Endangered Species Act
Section 7 Intra-Service Consultation

Biological/Conference Opinion for the Proposed Issuance of a Section 10(a)(1)(B) Incidental Take Permit to the Montana Department of Natural Resources and Conservation for their Forested Trust Lands Habitat Conservation Plan

December 2011
U.S. Fish
Montana Field Office
Fish and Wildlife Service
Helena, Montana

MONTANA DNRC HCP

BIOLOGICAL OPINION

PART I - INTRODUCTION

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PART I. INTRODUCTION TO THE BIOLOGICAL/CONFERENCE OPINION

A. INTRODUCTION

This document represents the U.S. Fish and Wildlife Service's (USFWS) biological/conference opinion) concerning proposed issuance of an incidental take permit (Permit) to Montana Department of Natural Resources (DNRC) for forest management activities on state forested trust lands in the Northwestern, Southwestern, and Central Land offices in western Montana, in accordance with section 7 of the Endangered Species Act of 1973, as amended (16 U.S.C. 1531 et seq.) (Act).

The proposed Federal action is to issue a Permit for the DNRC HCP that addresses forest management activities on state school trust lands in western Montana. The Permit would be issued pursuant to section 10(a)(1)(B) of the Act based on the DNRC Forested Trust Lands Habitat Conservation Plan (HCP), prepared by DNRC in support of its incidental take permit application. This Permit would authorize incidental take of the HCP covered species that are listed below. The permittee would be the Montana DNRC and the underlying activities covered under the DNRC HCP are specific to those identified in Section C as well as in Part II.A; Part III.A; and Part IV.A of this biological opinion. The incidental take that would be authorized by the Permit would also be specific to the set of activities covered under the DNRC HCP. The take which would be authorized by the Permit would be incidental take, which is take that is incidental to, and not the purpose of, the carrying out of an otherwise lawful activity (50 CFR 17.3). The term "take" means to harass, harm, pursue, hunt, shoot, wound, kill, trap, capture, or collect, or attempt to engage in such conduct (Act Section 3(18)). "Harass" in the definition of take in the Act means an intentional or negligent act or omission which creates the likelihood of injury to wildlife by annoying it to such an extent as to significantly disrupt normal behavioral patterns which include, but are not limited to, breeding, feeding, or sheltering. "Harm" in the definition of take in the Act means an act which actually kills or injures wildlife. Such act may include significant habitat modification or degradation where it actually kills or injures wildlife by significantly impairing essential behavioral patterns, including breeding, feeding, or sheltering (50 CFR 17.3). Therefore, incidental take may include harm or harassment so long as the harm or harassment is not the purpose of the activity, and the activity resulting in harm or harassment is an otherwise lawful activity. In other words, the activities addressed by the proposed Permit must be in compliance with Federal, State, and local laws.

Species Covered by this Biological Opinion

At issue are the effects of proposed permit issuance on three Federally listed species "covered" by the Permit, specifically the federally threatened bull trout (*Salvelinus confluentus*) Columbia River distinct population segment (DPS), Canada lynx (*Lynx canadensis*) (lynx) contiguous United States DPS, and grizzly bears (*Ursus arctos horribilis*) in the following recovery zones:

Northern Continental Divide Ecosystem (NCDE), Cabinet-Yaak Ecosystem (CYE), and Bitterroot Ecosystem (BE). As defined in the HCP, "covered species" are species that are addressed in the plan and for which incidental take authority would be granted under the proposed Permit. This intra-Service consultation also addresses the effects of proposed Permit issuance on designated critical habitat for the lynx and bull trout.

In addition to these species, DNRC is seeking assurances of permitted future take for two currently unlisted species: westslope cutthroat trout (*Oncorhynchus clarkii lewisi*) and Columbia redband trout (*Oncorhynchus mykiss gairdneri*). These two species would be included in the Permit. The Permit would become effective as to a particular species concurrently with its listing as threatened or endangered. In DNRC's HCP, these two species are treated as if they are proposed and are treated likewise by the USFWS for purposes of this biological opinion. Therefore, the USFWS will conference on these unlisted species in this biological opinion.

In addition to the covered species listed above, we have completed an intra-Service Section 7 consultation for listed species that are not covered by the proposed Permit but that may be affected by the forest management activities and grazing licenses described in the HCP (USFWS 2011a). These species include the federally threatened Ute ladies' tresses (*Spiranthes diluvialis*); water howellia (*Howellia aquatilis*); and Spalding's campion (*Silene spaldingii)*. An analysis of the effects of the proposed action on plants is included in a separate biological evaluation contained in the project record. Through the intra-Service consultation we have determined that implementation of the proposed HCP and issuance of the Permit may affect but is not likely to adversely affect Ute ladies' tresses; water howellia; and Spalding's campion, and these species are not further addressed in this biological opinion.

The DNRC HCP does not include bald eagles as a "covered" species in the proposed HCP. Therefore, the Bald Eagle Protection Act (BEPA) is in full force and DNRC is subject to compliance with the rules and regulations of the BEPA. We note that the Administrative Rules of Montana for Forest Management (ARMs 36.11.401 through 456) includes a series of protective measures to be applied to forest management activities conducted in bald eagle habitat.

Organization of this Biological Opinion

This biological opinion is comprised of four parts: Part I. Introduction; Part II. biological opinion for grizzly bears; Part III. biological opinion for Canada lynx and lynx critical habitat; and Part IV. biological opinion for bull trout and bull trout critical habitat, westslope cutthroat trout, and Columbia redband trout.

Part I provides the Consultation History; Description of the Proposed Action, including the components of the DNRC HCP, which is the basis for the issuance of the Permit; and Climate Change. Parts II, III, and IV contain all required elements of the biological opinion for each

covered species, respectively, i.e. Status of the Species, Environmental Baseline, Effects of the Action, Cumulative Effects, Conclusion, Incidental Take Statement, Reporting Requirements, and Conservation Recommendations, Reasonable and Prudent Measures and Terms and Conditions and Reinitiation Notice.

We include the discussion of current conditions and anticipated future conditions relative to climate change in the forests and aquatic ecosystems of western Montana in Part I.D of this biological opinion. For the covered species, climate change issues are discussed in the status of the species section of the biological opinion in each respective chapter.

The DNRC HCP appears as Appendix A of the Final EIS/HCP (2010); however, for convenience, the DNRC HCP portion of this combined document will be referred to separately when referencing only DNRC's conservation plan, whereas, other portions of the combined document will be referenced as the Final EIS/HCP 2010. In this biological opinion, the DNRC HCP refers to the DNRC HCP in Appendix A of the Final EIS/HCP (2010).

Information Considered in this Biological Opinion

This biological opinion is based primarily on the following:

1. The DNRC Forested Trust Lands Draft Environmental Impact Statement (EIS) and Draft HCP, USFWS and DNRC 2009; hereafter cited as Draft EIS/HCP (2009);

2. The DNRC Forested Trust Lands Final EIS and Final HCP (HCP), (USFWS and DNRC 2010); hereafter cited as "Final EIS/HCP (2010)"; the term DNRC HCP refers to the Final EIS/HCP 2010, Appendix A.

3. Species accounts for the 5 covered species prepared by DNRC 2005a,b,c,d,e (revised 2010);

4. Other information contained in USFWS files, including but not limited to: scientific literature, draft and final recovery plans, federal register notices, species status reviews, the HCP Handbook (USFWS and NMFS 1996), expert opinion, other biological opinions and HCPs, and published and unpublished data and reports

B. CONSULTATION HISTORY

The proposed action is the result of a decision by DNRC to apply for a Permit for forest management activities on state trust lands. Federal legislation was passed in 2001 to fund an HCP that addresses cold-water fish in Montana. A series of meetings between the USFWS and DNRC were held between 2000 and 2002 during which both parties agreed to work together to develop the HCP. A cooperative funding agreement was signed on July 11, 2000. In June 2001, DNRC decided to move forward in pursuing an HCP to address native fish as well as grizzly

bears and Canada lynx. On May 20, 2002, the Montana Board of Land Commissioners (Land Board) approved DNRC's pursuit of a Permit and development of a Habitat Conservation Plan. On April 28, 2003, the USFWS published a Notice of Intent to Prepare an Environmental Impact Statement in the *Federal Register*, initiating the National Environmental Policy Act (NEPA) process. At approximately the same time, DNRC and the USFWS decided to develop a combined draft EIS and HCP, which would satisfy the National Environmental Policy Act (NEPA), Montana Environmental Policy Act (MEPA), and Act requirements in a single document. The public was invited to four scoping meetings to help determine the scope of the draft EIS between April 28 and June 27, 2003; the scoping report was published in January 2004. Generally, scoping comments were directed towards the HCP and EIS process and elements that should be considered during preparation of the HCP and EIS. Most commenters concurred with the list of covered species and covered lands. Many parties requested the HCP cover additional activities including weed management, mining, and land sales and development. In response to concerns about land sales and development, the HCP included a transition lands strategy.

Technical planning for the HCP commenced in August 2003 at which time 12 species were proposed for coverage under the HCP and Permit. Both agencies collaborated on the development of the conservation strategies. However, after numerous project delays and cost overruns, the list of covered species was revised and the draft conservation strategies for five covered species were released for third party review by Montana Fish Wildlife and Parks in June 2005: grizzly bear, Canada lynx, bull trout, westslope cutthroat trout, and redband Columbia trout. A draft of the conservation strategies was released for public review and comment in October 2005. The public comment period for the draft conservation strategies ended on November 21, 2005. Based on comments received during the review period, the conservation strategies were then revised and finalized in May 2006.

Between May 2006 and April 2009, the remaining sections of the HCP were finalized and the EIS analysis was completed. On April 30, 2009, the USFWS received an application for a Permit and draft HCP from the DNRC. On June 26, 2009, the USFWS published a Notice of Availability for the DNRC Forested Trust Lands Draft EIS/HCP in the Federal Register, initiating a 105-day public comment period on the Draft EIS and HCP. The comment period for the Draft EIS/HCP ended October 9, 2009.

Between November 2009 and August 2010, the USFWS and DNRC addressed public comments on the Draft EIS/HCP and developed the Final EIS/HCP. On September 17, 2010, the USFWS published the Notice of Availability for the DNRC Forested Trust Lands Final EIS/HCP in the Federal Register. The 60-day review period for the Final EIS/HCP ended on November 16, 2010.

The intra-Service section 7 consultation/conference for issuance of a section 10(a)(1)(B) permit was initiated on April 30, 2009 with receipt of the DNRC incidental take permit application and draft HCP.

C. DESCRIPTION OF THE PROPOSED ACTION

The USFWS will decide whether to issue a Permit to DNRC for forest management activities on forested state trust lands in the western Montana. Issuance of the Permit would be based on the DNRC HCP, in the Final EIS/HCP (2010) and ROD (USFWS 2011b), prepared by the USFWS and DNRC in support of DNRC's permit application, and on meeting the Act Section 10 permit issuance criteria addressed in the USFWS's Statement of Finding (USFWS 2011c). The duration of the proposed permit period is 50 years.

USFWS proposes to provide long-term regulatory assurances to DNRC under the "No Surprises" rule codified at 50 CFR §§17.3, 17.22(b)(5) and (6), and 17.32(b)(5) and (6). On February 23, 1998, the USFWS and National Marine Fisheries Service (the Services) jointly published a final rule for the No Surprises Policy for Habitat Conservation Plans (HCPs) (63 FR 8859-8873). Under the final rule, the Services will only provide assurances to applicants for the species that are adequately covered in the HCP and specifically identified on the Permit. Therefore, all the covered species are addressed in this biological opinion as if they are either listed or proposed, including currently unlisted species. This biological opinion includes a conference opinion on the currently unlisted species, treating them as though they are proposed for listing, and these species will be on the Permit immediately, but only activated upon the effective date of the species being listed. Mitigation and minimization measures will be implemented immediately by DNRC, regardless of the current listing status of the individual species. At the time of listing of a new species that is on the Permit, the USFWS will review the effects analyses contained within this document, and update or revise the conclusions, as necessary. If the new analysis indicates that retaining a newly-listed species on the permit would result in a potential jeopardy situation for that species, the USFWS may delete that species from the Permit, but only after exhausting other remedies.

The DNRC HCP describes a comprehensive program to conserve the HCP covered species during ongoing forest management activities, which includes the issuance of grazing licenses on classified forest trust lands, within the HCP project area. The DNRC HCP includes three strategies addressing covered species and a "transition lands" strategy to address the addition or removal of lands from the HCP project area. The major components of the HCP are summarized below and include: the HCP project area, covered activities, conservation strategies, changed circumstances, and monitoring and adaptive management.

HCP Project Area

The covered lands are referred to as the HCP project area and consist of approximately 548,500 acres of trust lands in three DNRC land offices in western Montana: Northwest Land Office (NWLO), Southwestern Land Office (SWLO), and Central Land Office (CLO) (Figure I-1 and Table I-1). The HCP project area is comprised of blocked lands or scattered parcels. Blocked lands refer to large, mostly contiguous blocks of DNRC ownership specifically identified as the

Stillwater and Coal Creek State Forests (Stillwater Block) and the Swan River State Forest in the NWLO. Scattered parcels refer to all other HCP project area lands outside of blocked lands. The majority of scattered parcels in the HCP project area are less than or equal to one square mile in size (640 acres) and many are isolated parcels surrounded by a matrix of other ownerships, including private lands, private industrial forest lands, National Forest lands, Bureau of Land Management (BLM) lands, other state lands, and tribal lands.

Figure I-1. Location of the planning area and HCP project area.

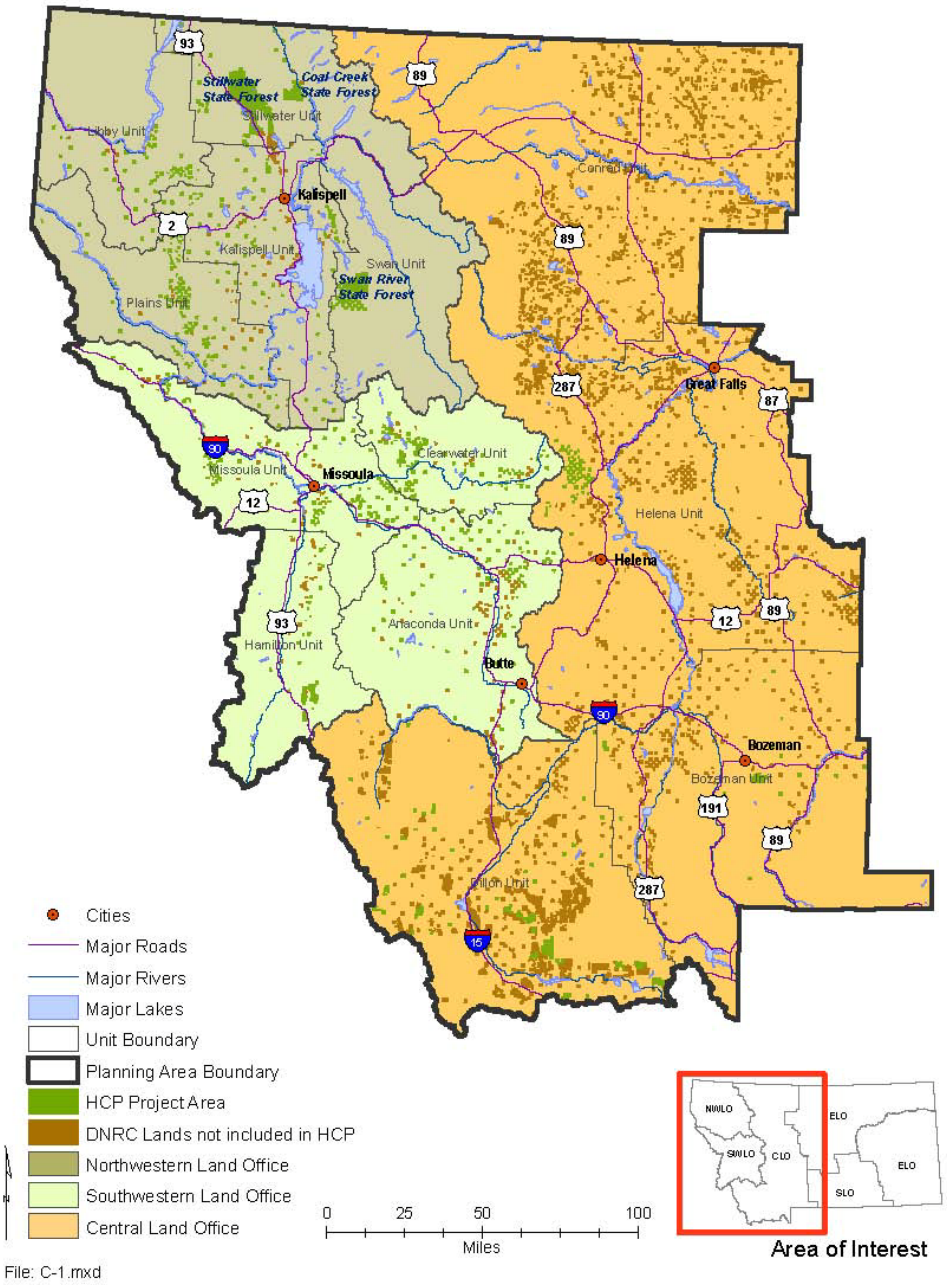


Table I-1. Acres of DNRC lands in the HCP project area by land office and land type (block scattered).

Land Office and Land Type	HCP Project Area (Acres)
NWLO	273,500
Scattered Parcels	143,100
Stillwater Block	90,700
Swan River State Forest	39,700
SWLO	
Scattered Parcels	161,800
CLO	
Scattered Parcels	113,200
Total	**548,500**

Source: Final EIS/HCP (2010), Appendix A, HCP Chapter 1, Table 1-3, page 1-14.
Rounded to the nearest 100 acres.

The HCP project area is where the DNRC HCP would be implemented and where incidental take of the covered species would be authorized. The Final EIS/HCP 2010 also describes a 39.4 million-acre "planning area," which encompasses the HCP project area and adjacent lands in the three DNRC land offices. The planning area includes state trust lands as well as U.S. Forest Service (USFS), National Park Service, state, tribal, and other public and privately owned lands, including Plum Creek Timber Company lands, and provides a basis for evaluating the effects of the DNRC HCP within a regional context (Figure I-2). The planning area is divided into 14 aquatic analysis units for the purposes of describing aquatic conditions in the affected area (Figure I-3).

Figure I-2. Land ownership in the planning area.

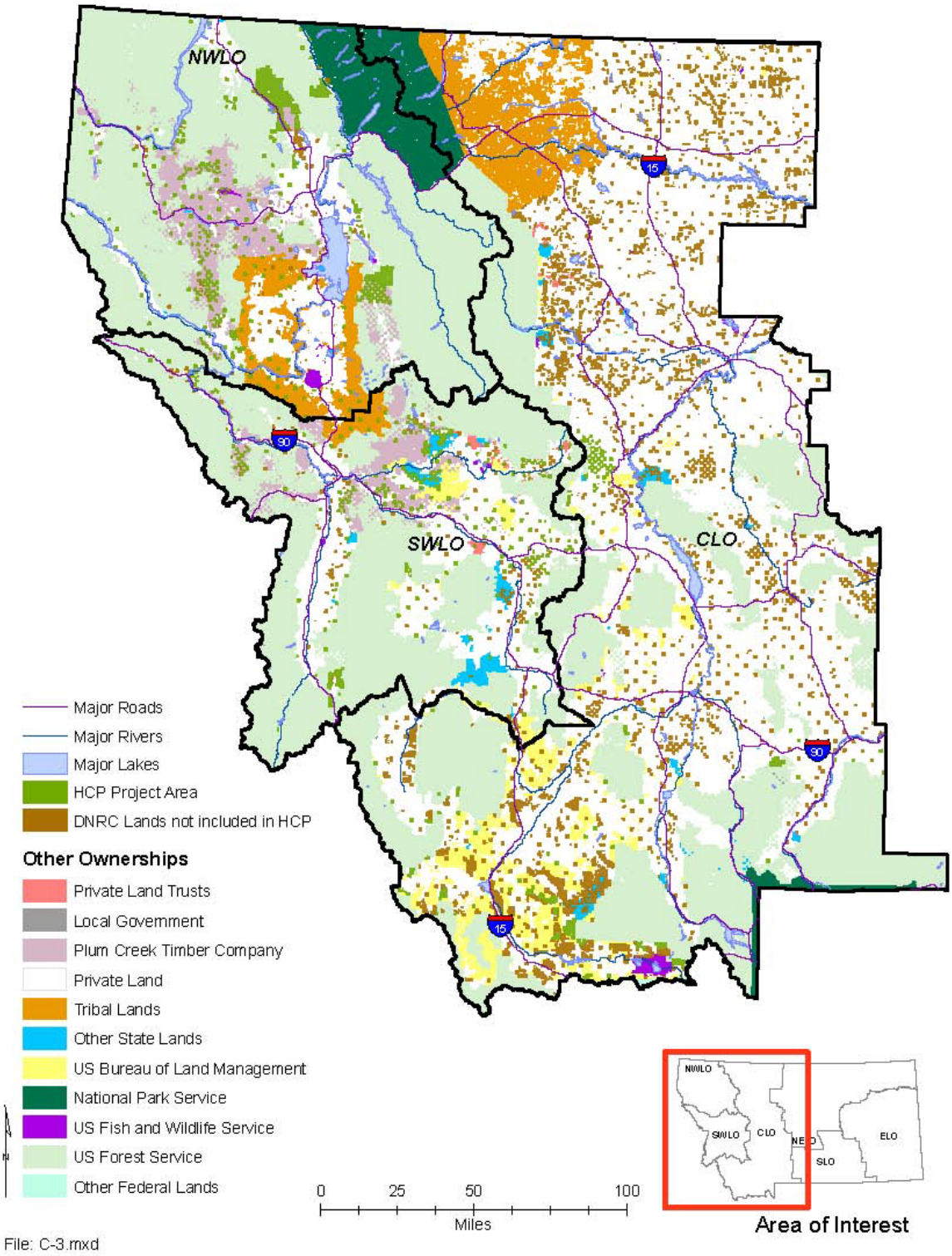
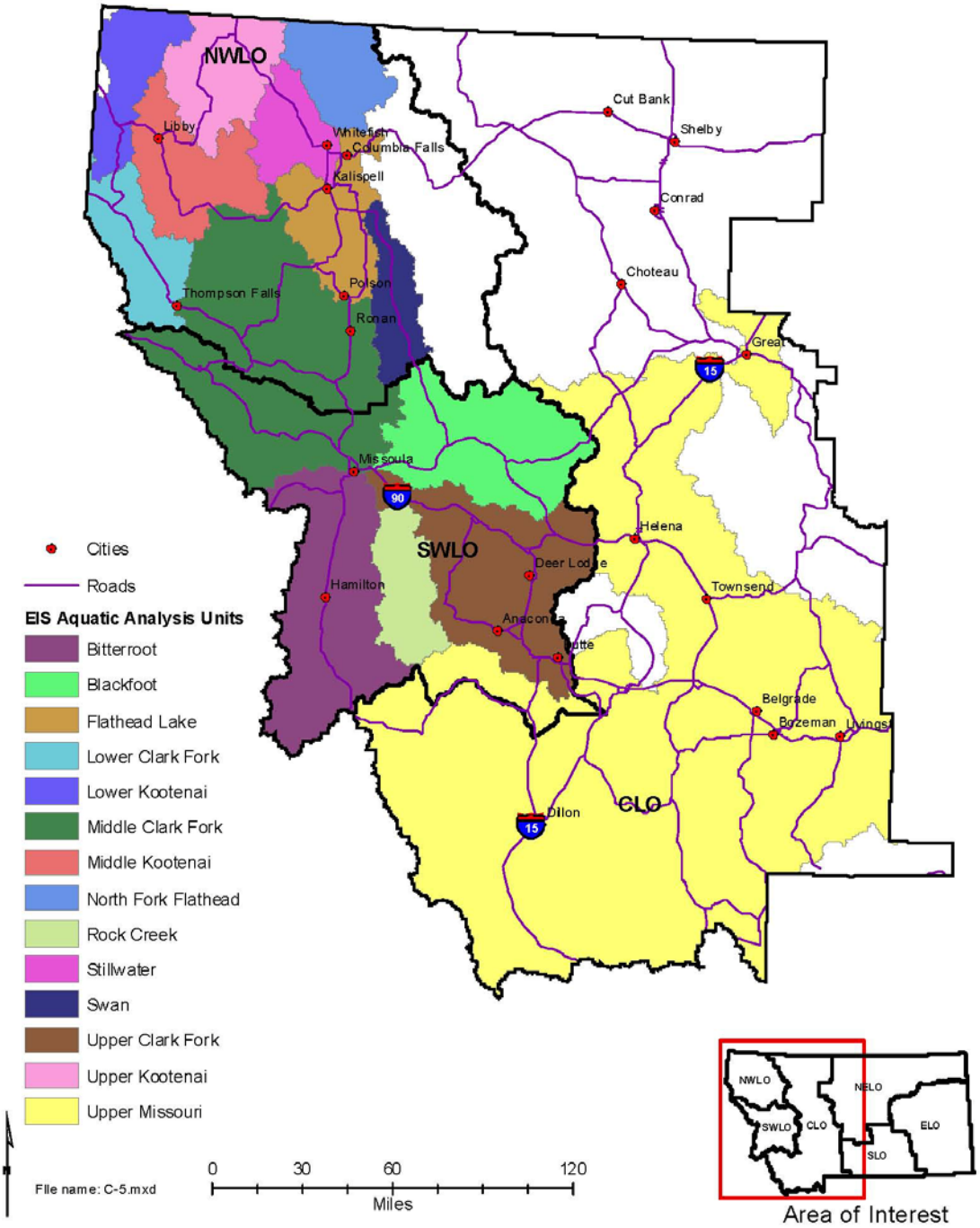


Figure I-3. Location of aquatic analysis units in the HCP project area and planning area.



Covered Activities

Forest management activities on state trust lands for which DNRC seeks coverage under the Permit consist of commercial forestry and associated activities, as well as road construction and maintenance and associated gravel quarrying, and grazing licenses. DNRC conducts its forest management activities in compliance with the Administrative Rules of Montana (ARMs) for Forest Management (36.11.401 though 456). All covered activities are described in detail in the DNRC HCP, Chapter 1.

Commercial Forestry

Commercial forestry includes timber treatments such as timber and salvage harvest and thinning including both ground and aerial operations. The DNRC is required by Montana Code Annotated (MCA) 77-5-221 through 223 to operate its forest management program under an annual sustainable yield (ASY). Montana law defines the ASY as:

"….the quantity of timber that can be harvested from forested state lands each year in accordance with all applicable state and federal laws, including but not limited to the laws pertaining to wildlife, recreation and maintenance of watersheds and in compliance with water quality standards that protect fisheries and aquatic life and that are adopted under the provisions of Title 75, Chapter 5, taking into account the ability of state forests to generate replacement tree growth" (MCA 77-5-221)."

DNRC believes the ASY represents the management level that is needed to maintain healthy and diverse forests and meet other important ecological goals and commitments. The harvest level and the associated income earned by the trust beneficiaries are also tempered by access and operability constraints as well as DNRC's environmental and legal commitments, which are specified in the State Forest Land Management Plan (SFLMP) and ARMs. Under the DNRC HCP, the ASY would be 57.6 million board feet.

DNRC's timber harvests or treatments are applied to emulate natural disturbance (primarily fire) acting on the forest. These timber harvests can be generally grouped into two categories of silvicultural treatments: regeneration treatments and intermediate treatments. Regeneration treatments aim to initiate or assist the development of a new age class in a stand, and can be accomplished by using even-aged methods or uneven-aged methods. Even-aged methods regenerate or maintain a stand with a single age class using such methods as clearcutting, seed tree (where 10 or fewer trees per acre remain after harvest), and shelterwood (where 11 to 30 trees per acre remain after harvest). Uneven-aged or selection methods regenerate or maintain a multi-aged stand by removing trees throughout the range of age and size classes present in a stand. Selection cutting can be done by removing single trees or small groups of trees within a stand.

Intermediate treatments are used to enhance the growth, quality, vigor, and composition of a stand after establishment and prior to final harvest. Two common intermediate treatments that generate revenue are commercial thinning (where about 100 or more merchantable trees per acre remain after harvest) and sanitation cutting. Sanitation cutting occurs in stands that contain commercial sized trees that have insect or disease problems. Sanitation cutting may occur at any time during a commercial stand's development. Selection and sanitation cutting is most commonly applied in riparian zones. Pre-commercial thinning is also implemented, however, it costs money to implement with no associated revenue, and occurs about 15 years after stand regeneration.

Timber harvest operations in even-aged and uneven-aged stands include felling trees, then moving (yarding) them to landing sites where they are limbed and bucked (trimmed). Methods of moving trees depend on terrain slope, road access, worker safety, and other factors. Tractor-based systems are most commonly employed by DNRC and are usually used on relatively flat slopes. Cable yarding systems are used on steeper slopes. Infrequently, DNRC incorporates log yarding with helicopters to access harvested timber in otherwise inaccessible terrain and/or areas in which road construction and maintenance are not feasible. Logs are loaded on trucks at the landings, then transported over federal, state, or private and public roads to mills where they are processed. In some cases, small logs or tree tops may be manufactured into wood chips on site and transported in chip vans to paper or pulp mills. From 1998 to 2005, the statewide annual amount of DNRC's harvest units logged using helicopter equipment ranged from approximately 160 to 320 acres (DNRC 2005b), which corresponds to a range of 2 to 4 percent of total harvest, respectively, based on an approximate statewide total harvest acreage of 8,000 acres per year. Over the past two years (2008 to July 2010), no DNRC timber sales included helicopter logging units.

Timber salvage harvests are conducted in accordance with MCA Section 77-5-207 Salvage Timber Program, which requires the timely salvage logging of dead and dying timber that is threatened by insects, disease, fire, or windthrow. This mandate requires DNRC to move forward in a timely manner after a disturbance event occurs, because the quality of wood in dead trees deteriorates quickly. Salvage projects are often implemented as emergency situations.

Associated Forestry Activities

Associated activities include slash disposal, prescribed burning, and site preparation as well as reforestation, inventory, and access to forestlands for weed control. DNRC often prepares sites for forest regeneration. Site preparation consists of clearing slash and competing vegetation and exposing adequate mineral soil for subsequent tree planting or natural regeneration. This is accomplished using a variety of techniques, such as tractors and excavators, tree planting hoes, and broadcast burns. On rare occasions, DNRC uses helicopters to accomplish forest management activities. Such activities could include weed control, prescribed burning ignition and control of prescribed burns, aerial seeding, and moving large pieces of equipment or

materials to remote and/or rugged locations. Such administrative activities rarely occur (an estimated 1 to 3 projects per year statewide) (R. Baty, DNRC, personal communication, 2010) and are of short duration (i.e., 1 to 2 days of operating time).

Slash disposal may include brush piling, pile burning, and broadcast burning. Pile burning is the most common type of slash disposal employed by DNRC. Many of the activities conducted under slash disposal also accomplish site preparation goals, such as slash piling and burning. Broadcast burning is a site preparation activity used to promote regeneration of tree seedlings and occurs in spring, fall, or early winter. DNRC uses broadcast burning, herbicides, and mechanical scarification to create conditions conducive to the establishment and growth of desired tree species. Note that only mechanical methods of site preparation, not herbicide use, are covered activities under this HCP. Monitoring activities and trips associated with application of herbicides are a covered activity. Most herbicide applications occur in the spring and fall. Prescribed fire is a stand treatment used to achieve a desirable stand condition to meet a management objective. DNRC rarely uses prescribed fire as a management tool.

DNRC regularly engages in reforestation activities, primarily by planting in burned areas or areas where regeneration harvest treatments have occurred, and by interplanting following partial harvests. Planting typically occurs between April and May, generally 1 to 2 years following harvest completion. Additional planting may occur several years later, if a site does not naturally regenerate. DNRC rarely plants riparian areas because these areas are generally not harvested intensely enough to require planting (i.e., the residual stand is fully stocked). Riparian planting may occur as part of a restoration activity such as decommissioning streamside roads and after a wildfire. DNRC reforestation is primarily limited to shade-intolerant species (ponderosa pine [*Pinus ponderosa*], western larch [*Larix occidentalis*], and western white pine [*Pinus monticola*]), often with seedlings selected from genetically superior seed sources.

DNRC also monitors reforestation activities. Surveys are generally conducted when the ground is free of snow, typically May through October.

Because noxious weed seed sources are typically already present within many project areas prior to project implementation, a primary objective for resource protection and control of noxious weed establishment and spread is to minimize the areal extent of ground disturbance within a project area. This is typically done through contract requirements such as skid trail network design prior to operations, skid trail spacing requirements, and selection of appropriate logging systems given the terrain. Other control measures include use of weed-free equipment and prompt revegetation of road rights-of-way and other disturbed areas with site-adapted species (including native species). In general, DNRC seeds all new road construction and reconstruction with site-adapted grass seed. Additionally, DNRC cooperates with local county weed control boards on management projects and revegetation plans for land-disturbing projects. Noxious weed treatments are implemented at the most appropriate time when considering the schedule of

project activities and the most effective treatment period, or as soon as possible after the completion of harvest activities.

Fertilization associated with forest management consists of occasional applications of small amounts of fertilizers to individual planted trees and application of fertilizer in conjunction with grass seeding on road cuts and fills. DNRC applies a few thousand doses of fertilizer annually on lands designated for tree planting. Fertilizer use is not a covered activity under this HCP; however, monitoring activities and trips associated with application of fertilizer are a covered activity.

DNRC's forest inventory program is responsible for collecting and analyzing forest resource inventory data across the state. Forest inventory field activities consist primarily of accessing inventory areas from forest road systems with motorized vehicles, conducting walk-through stand examinations, conducting cruise plots, and collecting other field data. Inventories are completed by both DNRC field staff and contracted employees. DNRC collects approximately 30,000 acres of data per year.

DNRC uses snowmobiles to access timber stands during winter. Access is primarily achieved on open, plowed roads with some additional use on packed routes on restricted roads. Snowmobiles are used primarily for sale preparation. DNRC staff typically operate machines for just a few minutes until they access the marking units and then walk considerable distances during the day to mark units. They do not drive snowmobiles in units to any appreciable degree. Sale preparation is typically accomplished through the course of one "summer-fall-winter" season, and typically does not require additional set-up time in a second winter. If a second winter is required, the activities would typically involve other stands and parcels distant from ones where work was completed the previous year.

Snowmobiles are also used to monitor some burning of slash piles in winter, sale administration in some cases, forest inventory, and wildlife monitoring. These activities would involve the use of a snowmobile for a day or two in a limited and dispersed manner across DNRC ownership (blocked and scattered).

Roads

Forest management road activities include construction, reconstruction, maintenance, use, and associated gravel quarrying for road surface materials, as well as installation, removal, and replacement of stream crossing structures. DNRC constructs new logging roads and upgrades existing roads to minimize impacts on the landscape. Roads are planned and located considering the terrain, soils, and timber type. DNRC considers many factors when designing road systems, including:

- existing and future management needs and opportunities

- logging system capabilities, including alternative yarding systems that do not require roads
- fisheries and wildlife habitat conservation
- coordination with adjacent land owners
- use of existing roads, unless use of such roads would cause or aggravate an erosion problem or threaten water quality and associated beneficial uses.
- opportunities to use temporary roads that are obliterated after the project is completed.

Many of the existing roads in the HCP project area are DNRC's typical road design and construction standard, which is a single lane with occasional turnouts. Many existing roads include a road surface width of 12 feet; however, roads constructed in the recent past and under the HCP would typically have a 14-foot road surface and grade less than 12 percent. Roads are typically constructed with native surfacing and are outsloped without a ditch, but may include a 3-foot drainage ditch where warranted. Excavated soil is used as part of the subgrade fill or disposed at a stable site. Culverts or bridges are typically placed at water crossings, but DNRC does use drive-through fords for low-volume or temporary haul roads in consultation with Montana Fish, Wildlife and Parks (MFWP) through the Montana Stream Protection Act 124 permit process. DNRC implements best management practices (BMPs) and erosion control measures during road construction and maintenance activities. Erosion control measures typically used by DNRC at stream crossings include filter fabric sediment traps, grass seeding, sediment control fence, and slash filter windrows as well as a site-specific water diversion plan.

Road inspections occur through several mechanisms. DNRC field staff are driving roads and making observations on a daily basis while conducting field work. However, detailed analysis of road conditions and maintenance needs typically occurs during project-level analysis and design for timber sales. During sale contract administration, DNRC foresters review road drainage function and stability when administering the requirements outlined in the timber sale contracts and BMPs. DNRC occasionally completes watershed or landscape level road assessments using contractors or teams of resource specialists. DNRC inspects and maintains roads to provide proper drainage function and subgrade stability. DNRC's road maintenance plans are intended to reduce the potential effects of roads and their use on streams and riparian habitat by the following: 1) minimize roads and close or stabilize roads based on short-term and long-term transportation needs in each watershed; 2) reduce sediment delivery from existing roads by identifying and correcting roads and associated drainage features that pose a potential risk; 3) complete routine maintenance to ensure roads meet minimum BMP standards; 4) prohibit road construction in the streamside management zone; 5) restrict sidecasting to prevent sediment from entering streams and riparian areas; and 6) minimize erosion at road sites by implementing BMPs. Also, DNRC surfaces some of its roads with gravel to improve the road standard and

reduce the potential for road-related erosion. Road construction activities do not generally occur when soils are saturated or when there is snowpack, because of the difficulty in obtaining adequate compaction of fill material necessary for road prism stability or proper bedding of culverts. Therefore, road construction, re-construction, decommissioning as well as maintenance activities are generally completed during drier seasons (June through October).

Gravel Quarrying

Fill material for road construction and road surface material is obtained as near the road site as feasible. This activity primarily consists of obtaining materials, or "borrow", within the road corridor itself. Sites used for borrow are typically disturbed for the duration of the road construction or maintenance project then reshaped to as near natural contours as possible.

Gravel may also be obtained from nearby gravel pits on DNRC lands. Medium pits (1 to 4.9 acres) receive intermediate levels of use and may be activated periodically to serve as sources for multiple road maintenance and/or construction projects in a given year or across multiple years. Medium pits may include excavating, crushing, sorting, and/or asphalt operations. Large pits are sources of gravel or rock that involve 5 to 40 acres of disturbed area. Typically, no more than 5 acres can be under operation and actively mined at any point in time. Large pits may be activated periodically or continuously to serve as sources for multiple road maintenance and/or construction projects in a given year or across multiple years. Large pits may include mining, crushing, sorting, and/or asphalt operations over 1 or more years. Large gravel pits are typically subject to rules, regulations, and permitting outlined in the Montana Opencut Mining Act (ARMs 17.24.201 through 225) administered by the Montana Department of Environmental Quality (MDEQ).

Grazing

Grazing activities covered by the DNRC HCP include grazing licenses issued on classified forest trust lands (versus grazing leases on classified grazing lands). Within the HCP project area, DNRC has 164,931 acres (391 parcels) of forested trust lands with grazing licenses. Grazing licenses are typically issued for a 10-year term and specify the carrying capacity of the parcel in animal unit months (the amount of forage required by an animal unit for one month) and the allowable season of use. Licenses may also contain stipulations for addressing problems or corrective action necessary to prevent or mitigate previous or existing impacts on riparian areas.

Most all grazing licenses allow grazing, at the longest, from May 1 to September 31, but may be as short as June 15 to September 1 for wet sites. Typically a whole parcel is designated for grazing unless a specific management plan has been developed for that parcel or riparian grazing exclosures have been constructed.

Of the total acres in the project area with grazing licenses (164,931 acres), approximately 75,560 acres (163 parcels) contain streams supporting bull trout, westslope cutthroat trout, or Columbia redband trout (Final EIS/HCP 2010: Tables 4.8-5 and 4.8-6). These 163 parcels contain

approximately 82 miles of stream supporting bull trout, 121 miles of stream supporting westslope cutthroat trout, and 4 miles of stream supporting Columbia redband trout (Final EIS/HCP, Chapter 4, page 4-189). The majority of these stream miles are open for grazing with the remaining within exclosures or terrain-limited areas. Approximately 9,000 acres of the HCP project area within grizzly bear recover zones hold grazing licenses and approximately 38,000 acres in grizzly bear non-recovery occupied habitat (NROH) in the HCP project area hold grazing licenses (Final EIS/HCP 2010:Table 4.9-3). Approximately 5,500 acres of total potential lynx habitat in five lynx management areas (LMAs) support grazing licenses (Table I-2).

Table I-2. Acres of total potential lynx habitat in DNRC lynx management areas (LMAs) supporting grazing licenses.

	DNRC LMAs					
	Stillwater East	Stillwater West	Coal Creek	Seeley	Garnet	**Total**
Potential Lynx Habitat	34,468	35,582	14,188	4,466	3,923	**92,627**
Potential Lynx Habitat in Grazing Licenses	622	732	778	1,770	1,649	**5,551**

Conservation Strategies

The DNRC HCP includes three strategies addressing covered species and a "transition lands" strategy to address the addition or removal of lands from the HCP project area.

The conservation commitments comprising the strategies for the covered species are described below for each species. See Parts II.A., III.A., and IV.A. for a more detailed description of the proposed action specific to grizzly bears, Canada lynx, and HCP fish species, respectively.

Grizzly Bear Conservation Strategy

Under the HCP, DNRC would extend conservation to grizzly bears by applying commitments across a greater geographic area within DNRC's forested trust lands than are applied now, and increasing the level of commitments based on the importance of that habitat for bears. The commitments include provisions to minimize the potential for human-bear conflicts as well as negative outcomes when conflicts do occur; to minimize disturbance and displacement of grizzly bears from suitable habitat and provide for seasonal habitat use and security; and to design timber sales and apply silvicultural prescriptions to maintain important habitat features, including den sites, avalanche chutes, lush riparian zones, and locations that produce high volumes of

forage. The grizzly bear conservation commitments are described in detail in DNRC HCP, Chapter 2, as well as Part II.A of this biological opinion.

Canada Lynx Conservation Strategy

The goal of the lynx conservation commitments is to support federal lynx conservation efforts by maintaining important habitat elements for lynx and their prey at both the landscape and site specific scale, particularly in key locations for resident populations. This is primarily achieved by maintaining specific amounts of suitable lynx habitat and foraging habitat and connectivity in the HCP project area and managing for vegetation structure and habitat elements important for lynx and their prey. The lynx conservation commitments are described in detail in DNRC HCP, Chapter 2, as well as Part III.A of this biological opinion.

Fish Species Conservation Strategy

For HCP fish species, the conservation strategy was developed to manage and maintain suitable stream temperature regimes, in-stream sedimentation levels, in-stream habitat complexity, and stream channel stability and channel form and function within the HCP project area as well as to improve connectivity among sub-populations of the covered species where appropriate on HCP project area lands. This is achieved through a suite of commitments addressing riparian timber harvest, sediment delivery reduction, connectivity, grazing, and cumulative watershed effects. The aquatic conservation commitments are described in detail in DNRC HCP, Chapter 2, as well as Part IV.A of this biological opinion.

Transition Lands Strategy

DNRC considers opportunities to sell, purchase, develop, or exchange state trust land parcels to diversify land holdings, maximize the rate of return to the trusts, improve public access to state trust lands, and consolidate state trust lands for more efficient management. In order to accomplish these objectives, DNRC must be able to maintain the flexibility to move lands into and out of the HCP project area over the 50-year Permit term. Lands identified for removal from or addition to the HCP project area due to proposed land use or ownership changes are termed "transition lands."

DNRC's decision to sell, exchange, or acquire trust land is influenced by market conditions, financial analysis and expected financial rates of return, as directed by the DNRC Land Banking Rules (ARM 36.25.801 through 817), and the management discretion of the Land Board. Generally, lands selected for sale, exchange, or acquisition are screened through a rigorous process outlined in the Land Banking Rules. According to ARM 36.25.803, DNRC may sell a parcel of trust land that is determined significant to threatened or endangered species only if the Land Board provides or approves compelling reasons for the sale. Additionally, according to ARM 36.25.904, DNRC prioritizes real estate development projects on trust lands in urban areas over rural areas and generally excludes projects that may potentially affect federally listed threatened and endangered species. DNRC's Real Estate Management Administrative Rules

limit the number of acres available for real estate uses to 30,000 acres statewide and to 1,500 acres in rural areas (ARM 36.25.911). DNRC recognizes that conservation can be a plausible use of trust land (ARM 36.25.910). DNRC has developed a systematic approach to allow outside entities to propose conservation use of lands identified for real estate projects. Following notice of real estate project proposals, DNRC allows entities 60 days in which to propose conservation use of those lands by issuing a letter of intent to DNRC. Any entity submitting a letter of intent during the 60-day period is granted an additional 45 days in which to apply to DNRC for a lease, license, easement, or other legal device to secure a conservation use. Those who complete and submit an application have 12 months to secure the conservation use. During that time, DNRC suspends all other actions not related to conservation use. If the applicant fails to submit a letter of intent or apply to the DNRC within the specified timeframes, DNRC may proceed with the original development project. DNRC is also required to conduct MEPA analysis for most real estate projects, except for those that are categorically excluded as outlined in ARM 36.25.918. All trust land sale, development, exchange, and conservation projects are required to comply with MEPA, while trust land acquisition is categorically excluded. Overall, the procedures and ARMs described above decrease the likelihood that parcels in the HCP would be sold (disposed) over the Permit term.

The DNRC HCP allows the removal of some lands from the original baseline HCP project area. Removal of lands is capped at five percent of the baseline acreage of the HCP project area for lands in the grizzly bear NCDE recovery zone, CYE recovery zone, CYE NROH, LMAs, and bull trout core areas (as defined in MBTRT 2000). In total, 10,880 acres could be removed from these habitat areas. For lands in these habitat areas that will not be subject to conservation measures similar to the HCP once they are removed from the covered lands, federal, state, or non-federal land management or conservation agencies or entities will have 60 days to submit a letter of intent and proposal to purchase the land outright or to lease, license, or explore other legal instruments for conservation purposes pursuant to existing state laws.

For all other HCP project area lands, the DNRC HCP allows the removal of 10 or 15 percent of the baseline acreage of the HCP project area over the 50-year Permit term. The cap will be 10 percent of the original baseline acres unless and until DNRC acquires large amounts of former industrial timber lands (e.g., through the Montana Working Forests Project) and adds at least 15,000 acres to the HCP project area. At that time, the cap will increase to 15 percent of the original baseline. The 10 percent cap will allow removal of up to 33,090 acres from 330,900 acres, and the 15 percent cap will allow removal of up to 49,640 acres from 330,900 acres in the HCP project area. The removal of lands is not limited to the original lands comprising the HCP project area, but may also apply to any lands subsequently added to the HCP project area at a later date.

Under the DNRC HCP, the USFWS may request and DNRC may add deed restrictions to lands removed from the HCP, as long as the value of the land is not reduced.

There are numerous recent and ongoing acquisitions by DNRC in western Montana, mostly the result of transfers of private industrial forest, primarily owned by Plum Creek, to public ownership. The majority of these lands provide habitat for the covered species, and it is likely that once acquired, DNRC would propose adding these lands to the HCP. Therefore, the transition lands strategy also outlines a process under which lands could be added to the HCP project area. When DNRC proposes to add lands to the HCP project area, it will provide relevant information to the USFWS for our approval to include these lands in the HCP project area and manage them under Permit conditions. Based on recent and ongoing acquisitions, DNRC is considering adding approximately 61,340 acres to the HCP project area. DNRC is likely to acquire numerous additional acres over the Permit term that it would consider for addition to the HCP and Permit.

Changed and Unforeseen Circumstances

Changed circumstances are changes in circumstances affecting a species or geographic area covered by a conservation plan that can reasonably be anticipated and planned for by plan developers and the USFWS (e.g., the listing of new species or a fire or other natural catastrophic event in areas prone to such events) (50 CFR 17.3). Under the DNRC HCP, changed circumstances include natural disturbance events, as well as administrative changes. Because changed circumstances have been anticipated, the DNRC HCP can accommodate a plan of action immediately after a changed circumstance is discovered. Under the DNRC HCP, DNRC could be required to provide additional mitigation in response to the changed circumstances identified in the HCP (Chapter 6). These circumstances apply for three types of natural disturbance events: forest fires, insect and disease outbreaks or wind events; floods; and landslides, which were identified by the USFWS and DNRC as most relevant to the DNRC HCP. The DNRC HCP, Chapter 6, outlines the steps that would be taken by both agencies in response to a changed circumstance. In brief, the DNRC HCP states that in the event of a changed circumstance, DNRC will develop a contingency plan with USFWS input and will apply the toolbox outlined in the HCP for the respective event and applicable species. DNRC will invite the USFWS to site visits and solicit input on appropriate mitigation during development of the plan. The plan must be completed and agreed upon by DNRC and the USFWS within the DNRC's project timeline. If this has not occurred, the matter will be resolved using the dispute resolution provisions (see Implementing Agreement, Final EIS/HCP 2010. Appendix F). The process to address administrative changed circumstances is specific to the administrative change and is described in DNRC HCP, Chapter 6.

Unforeseen circumstances are those that could not have been reasonably anticipated by DNRC or the USFWS at the time of the DNRC HCP's development. The DNRC HCP does not specify what management actions are required if unforeseen circumstances occur. If unforeseen circumstances occur, the USFWS can work with DNRC to develop mitigation measures to address impacts to HCP species. DNRC will not be responsible for additional mitigation consisting of additional commitments of land, water, or financial compensation or additional

restrictions on the use of land, water, or other natural resources with regard to the covered species.

Monitoring and Adaptive Management

DNRC's HCP includes provisions for implementation and effectiveness monitoring, as well as adaptive management. The specific implementation and effectiveness monitoring commitments for each species are described in detail in the DNRC HCP, Chapter 4.

Implementation Monitoring

Implementation monitoring consists of project-level checklists, office-level reviews, and field reviews. Practitioners will use an HCP Implementation Checklist to ensure the appropriate commitments are implemented for a proposed project. The DNRC Forest Management Bureau (FMB), responsible for implementing the HCP, will conduct office reviews of all timber sale packages to ensure the appropriate commitments were implemented. These reviews will also be used to determine if additional training is required and to ensure required communications with or approvals from Services were sought and documented. FMB staff will also conduct field reviews of at least two projects per year. These reviews will:

- verify that habitat-based commitments were appropriately applied on the ground,
- give both DNRC and the USFWS assurance that HCP commitments are understood and are being implemented properly at all levels,
- identify implementation challenges that need to be discussed at annual meetings, and
- identify needs for additional training in proper implementation of HCP commitments.

Effectiveness Monitoring

DNRC will conduct limited effectiveness monitoring for grizzly bears and lynx since the conservation strategies are based on best available science and are understood to be effective when implemented properly. Four biological objectives for grizzly bears, will be monitored for effectiveness as described in the HCP, Chapter 4: 1) minimizing displacement through access management including limiting new open roads (GB-NR1)[1] 2) limiting granting of easements 3) (GB-NR2), promoting safety for humans and bears (GB-PR1, PR2, and PR3), and 4) understanding bear habitat quality in managed forests.

Many of the conservation commitments for lynx require DNRC to track the availability of various types of lynx habitat in the HCP project area. Lynx habitat categories are defined based

[1] The HCP commitments are numbered and coded according to the HCP species they address and category of commitment under which they fall as described in Final HCP, Chapter 2 (e.g., GB-NR2 is the first commitment in nonrecovery occupied habitat in the grizzly bear strategy).

on the characteristics of timber stands as described in DNRC's SLI database. DNRC's ability to provide the required amounts of lynx habitat relies on the SLI database's ability to accurately characterize conditions on the ground. Therefore, to monitor the effectiveness of the strategy for achieving desired amounts of lynx habitat, DNRC will evaluate the accuracy for characterizing stand conditions as they actually exist on the ground for the queried stand. Additionally, DNRC will evaluate post-harvest stand conditions to determine prevalence of potential future dens sites (large logs, piles of small logs, root wads, etc.). The proposed monitoring methodologies to assess (1) the accuracy of the DNRC SLI, (2) habitat mapping protocols for describing lynx habitat, and (3) retention of potential den sites are contained in the Final EIS/HCP 2010, Appendix B, Document B-12 – Monitoring Methodologies to Assess Accuracy of DNRC Stand Level Inventory Data and Habitat Mapping Protocols for Describing Lynx Habitat.For the HCP aquatic species, each of the conservation strategies includes an effectiveness monitoring program as described in the HCP Chapter 4. If the effectiveness goals are not met, DNRC would implement a pre-negotiated response through adaptive management. The effectiveness monitoring commitments for the aquatic species are summarized in the Final/EIS HCP 2010. Chapter 4, Table 4-7 and described in detail in the subject chapter.

Timing of Monitoring

Monitoring activities occur during the regular field season: June through September, but individual monitoring activities may occur during any month of the year. Some monitoring, such as water quality monitoring that is associated with high flows during spring runoff occur from April through June, and might include snowmobile trips into remote areas during the early spring. DNRC also conducts snow surveys in the Stillwater State Forest using snowmobiles during the winter months. Wildlife monitoring activities may be conducted during any month of the year. Road inspections occur through several mechanisms. DNRC field staff are driving roads and making observations on a daily basis while completing field work. When new roads are constructed or old roads maintained through a timber sale project, inspections are conducted during contract administration. DNRC occasionally completes watershed or landscape level road assessments using contractors or teams of resource specialists, typically associated with a MEPA analysis. These assessments are completed during the normal field season.

Adaptive Management

Adaptive management is a process whereby conservation commitments and management actions may be changed based on the results obtained from effectiveness monitoring and/or research. This process results in a feedback loop that incorporates better understanding into everyday practices.

For this HCP, the adaptive management process will be used to address issues identified through effectiveness monitoring or results of research as mutually agreed upon by DNRC and USFWS. The adaptive management process for responding to issues raised through effectiveness monitoring is a collaborative approach based on the following steps:

1. DNRC conducts the effectiveness monitoring as required for the HCP.
2. DNRC provides annual updates and 5-year monitoring reports to the USFWS summarizing and evaluating the results of monitoring.
3. The USFWS reviews the updates and 5-year monitoring reports.
4. DNRC and the USFWS conduct an annual HCP review and 5-year meeting whereby the results and evaluation of the effectiveness monitoring are discussed. If the agencies find that the commitments are not effective at meeting the desired results, the management actions identified through adaptive management would be revised into HCP conservation commitments and implemented.

The adaptive management program for each species is described in the DNRC HCP, Chapter 4.

D. CLIMATE CHANGE

Many changes have been observed in global climate over the past century. The nature and causes of these changes have been comprehensively chronicled in a variety of recent reports, such as those by the Intergovernmental Panel on Climate Change (IPCC) (IPCC 2007) and the U.S. Global Change Research Program (http://www.globalchange.gov/). Climate change trends at the global, regional, and local scales are discussed thoroughly in the Final EIS/HCP (2010) which provides information pertinent to this biological opinion.

Federal agencies have acknowledged that climate is changing rapidly and have developed policies and strategic plans that address agency activities, land management, and fish and wildlife resources (USFWS 2010b; USGS 2010; USFS 2010; EPA 2010). Past and future trends in climate parameters, e.g. temperature and precipitation, have been determined through data collection and modeling. Climate changes are predictable phenomena over the long term though actual timing and intensity of such changes may vary on an annual basis. Therefore, the DNRC HCP addresses climate change as a changed circumstance as described in Chapter 6 because it is reasonably predicted to occur during the permit term and measures can be taken to address these changes through an adaptive management approach.

This biological opinion addresses the effects of climate change on the covered species and critical habitat in the respective species section. The current and anticipated future conditions relative to climate change at the regional and local level are described based on current literature. This discussion forms the basis of the subsequent discussion of effects of climate change on the covered species and critical habitat in the respective species status sections of this biological opinion.

Current Conditions

On the global scale, human activities have led to large increases in heat-trapping gases over the past century. Global warming of the past 50 years is due primarily to human-induced increases

in heat-trapping gases, causing increases in global average temperatures, and changes in ocean heat content, precipitation, atmospheric moisture, and Arctic sea ice (Karl et al. 2009). Analysis of various climate data for the Northern Hemisphere suggest that the rate of warming observed in the 20th century, as well as the magnitude of global temperatures from 1990 to 2004, is unprecedented in the past 2000 years (Moberg et al. 2005).

At the National level, over the past 50 years, the U.S. average temperature has risen more than 2°F, precipitation has increased an average of about 5 percent, extreme weather events, such as heat waves and regional droughts, have become more frequent and intense, and sea level has risen along most of the U.S. coast (Karl et al. 2009). In addition, cold-season storm tracks are shifting northward and Arctic sea ice is declining. Ecosystem processes are affected by climate and by the concentration of carbon dioxide in the atmosphere (Janetos et al. 2008). The diversity of living things (biodiversity) in ecosystems is itself an important resource that maintains the ability of these systems to provide the services upon which society depends. Many factors affect biodiversity including: climatic conditions; the influences of competitors, predators, parasites, and diseases; disturbances such as fire; and other physical factors. Human-induced climate change, in conjunction with other stresses, is exerting major influences on natural environments and biodiversity, and these influences are generally expected to grow with increased warming (Janetos et al. 2008).

Relative to this BO, notable effects to ecosystems as a result of climate change include effects to ecosystem processes such as those that control growth and decomposition (Ryan et al. 2008), large-scale shifts in the ranges of species and the timing of seasons and animal migration (Janetos et al. 2008), increases in fires, insect pests, disease pathogens, and invasive weed species, and reduction of habitats of some mountain species and coldwater fish, such as salmon and trout, in response to warming.

With respect to water resources, evidence is mounting that human-induced climate change is already altering many of the existing patterns of precipitation in the United States, including when, where, how much, and what kind of precipitation falls (Gutowski et al. 2008; Bates et al. 2008). A warmer climate increases evaporation of water from land and sea, and allows more moisture to be held in the atmosphere. For every 1°F rise in temperature, the water holding capacity of the atmosphere increases by about 4 percent (Hegerl et al. 2007). Increased air temperatures lead to higher water temperatures, which have already been detected in many streams, especially during low-flow periods. The availability of dissolved oxygen is reduced in lakes, reservoirs, and rivers because at higher temperatures the amount that can be dissolved in water is lower and respiration rates of living things are higher. Low oxygen stresses aquatic animals such as coldwater fish, and the insects and crustaceans on which they feed (Bates et al. 2008).

Effects to Regional Forested and Aquatic Ecosystems

In the western United States, both the frequency of large wildfires and the length of the fire season have increased substantially in recent decades, due primarily to earlier spring snowmelt and higher spring and summer temperatures (Westerling 2006). Changes in climate have contributed significantly to several major insect pest outbreaks in the United States and Canada over the past several decades. The mountain pine beetle has infested lodgepole pine in British Columbia. Over 33 million acres of forest have been affected, by far the largest such outbreak in recorded history. Another 1.5 million acres have been infested by pine beetle in Colorado (Karl et al. 2009). Drought and hot, dry weather have led to an increase in outbreaks of insects in the Columbia Basin, especially mountain pine beetle (ISAB 2007). Mountain pine beetles in the Sawtooth National Recreation Area, home to the headwaters of the Salmon River, which has historically been too cold for outbreaks, have been restricted to small thermally favorable areas, such as the west-facing side of a valley (Logan 2006a). Beginning in the mid 1990s, these small localized populations began to increase and merge, forming an outbreak from 1995—2003.

Animal and plant species that live in the mountains are among those particularly sensitive to rapid changes in climate. They include animal species such as the grizzly bear, bighorn sheep, pika, mountain goat, and wolverine (Karl et al. 2009). One reason mountain species are so vulnerable is that their suitable habitats are being compressed as climatic zones shift upward in elevation. Some species try to shift uphill with the changing climate, but may face constraints related to the availability of and competition from other species. In addition, as species move up the mountains, those near the top simply run out of habitat (Janetos et al. 2008).

Salmon and other coldwater fish species in the United States are at particular risk from warming. Rising temperatures in aquatic ecosystems causes precipitation to increasingly fall as rain rather than snow, causing flushing of stream substrates containing salmon eggs. Earlier melting of snow leaves rivers and streams warmer and shallower in summer and fall. Diseases and parasites tend to flourish in warmer water. Studies suggest that up to 40 percent of Northwest[2] salmon populations may be lost by 2050 (Battin et al. 2007).

The Northwest's rapidly growing population, as well as its forests, mountains, rivers, and coastlines, are already experiencing human-induced climate change and its impacts. Regionally averaged temperature rose about 1.5 °F over the past century (with some areas experiencing increases up to 4°F) and is projected to increase another 3 to 10°F during this century (Mote et al. 2008). Higher greenhouse gas emissions scenarios, projected by climate models, would result in warming in the upper end of the projected range. Increases in winter precipitation and decreases in summer precipitation are projected by many climate models (Hamlet et al. 2005),

[2] With respect to discussions of climate change, Karl et al (2009) identify the Northwest Region as including all of Washington, Oregon and Idaho, and western Montana in a north-south line near Helena, i.e. 112° longitude.

though these projections are less certain than those for temperature. Impacts related to changes in snowpack, streamflows, sea level, forests, and other important aspects of life in the Northwest are already underway, with more severe impacts expected over coming decades in response to continued and more rapid warming (Karl et al. 2009). Two notable changes are 1) increased insect outbreaks, wildfires, and changing species composition in forests posing challenges for ecosystems and the forest products industry, and 2) salmon and other coldwater species experiencing additional stresses as a result of rising water temperatures and declining summer streamflows (Karl et al. 2009).

Effects to Western Montana Forest and Aquatic Ecosystems

Even though there are few climate change studies specific to sub-regions, such as western Montana, there is some data available for the state. For instance, The Montana Climate Action Project (NCAT 2010) website reports that warmer springs are making snow melt sooner, and early snowmelt leaves rivers low by summer's end. Over the last century, the average temperature in Helena, Montana, has increased 1.3 °F, and precipitation has decreased by up to 20 percent in many parts of the state (NCAT 2010). In the absence of data for specific areas and/or sub-regions, climate change data and observations in the Region can be interpreted to apply to similar ecosystems that occur both in the Region and the sub-region of interest. Thus, similar to climate changes occurring at the Regional scale, it is assumed that western Montana forest, grassland, and aquatic ecosystems are experiencing increasing temperatures, decreasing precipitation, lower late-summer streamflows, seasonal weather pattern changes in timing and duration, and increased frequencies of wildfire and insect outbreaks.

Future Conditions

Although climate is impossible to accurately predict, the comparison of various climate models and extensive analysis has led to some generally accepted climate projections for the next 100 years. Two widely used future global scenarios project warming throughout all of North America, with most warming occurring during the Arctic winter and greater than average warming occurring throughout the U.S. and Canada. In North America, only Mexico shows an inconsistent level of warming. Modeling projects 34 to 42 °F warming from 1990 to 2100, which is 2–10 times greater than observed warming during the 20th century. Globally, warming is expected to produce sea level rise of .3 to 2.9 feet by 2100 (IPCC 2001a,b) compared to .3 to .7 feet recorded for the 20th century (IPCC 2001a).

At the National level, over the past 50 years, the U.S. average temperature has risen more than 2° F, over the past 50 years and is projected to rise more in the future. Precipitation has increased an average of about 5 percent over the past 50 years. The amount of rain falling in the heaviest downpours has increased approximately 20 percent on average in the past century. Extreme weather events, such as heat waves and regional droughts, have become more frequent and intense during the past 40-50 years. Sea level has risen along most of the U.S. coast over the last

50 years. Cold-season storm tracks are shifting northward and the strongest storms are likely to become stronger and more frequent. Arctic sea ice is declining and this is very likely to continue.

Effects to Regional Forest and Aquatic Ecosystems

Salathé et al. (2007) collected the output from 20 different global climate model simulations that were run as part of the IPCC's Fourth Assessment Report. The relevant precipitation and surface temperature fields for the Pacific Northwest region (here defined as the region between 124° and 111° west longitude, 42° and 49° north latitude, encompassing Washington, Oregon, Idaho, and western Montana) were extracted in order to generate a regional average time series. Their analysis shows the projected warming rate for the next century to be in the range of 32.1 – 33 °F/decade, with a 20-scenario average of 32.5 °F/decade. For comparison, the observed rate of warming in the 20th century was 32.1 °F/decade. Projected precipitation changes are relatively modest and unlikely to be distinguishable from natural variability until late in the 21st century. Most models project long-term trends with increases in winter precipitation and decreases in summer precipitation for the Pacific Northwest region.

Quantitative assessments of the impacts of climate change on hydrology and water resources have been reported by researchers to link the output from global climate models used by the IPCC to physically-based hydrologic models for the Columbia River Basin (e.g. Hamlet and Lettenmaier 1999; Payne et al. 2004; Hamlet 2006). These and related studies have consistently identified the following types of climate change impacts on the snow pack, stream flow, and water quality in the Columbia Basin:

- Warmer temperatures will result in more precipitation falling as rain rather than snow
- Snow pack will diminish, and the timing of stream flow will be altered
- Peak river flows will likely increase
- Water temperatures will continue to rise

The detailed responses to climate change of biological communities, such as sagebrush steppe or forest, and the wildlife they support, are uncertain because many causal factors are involved and much information on specific causal relationships is missing or imperfect. More research would improve prediction of change in biotic communities with climate change, but considerable uncertainty will remain. The predictions of biological communities under unprecedented climatic and landscape conditions, and under unprecedented rates of change in these conditions, must include uncertainty. The species composition and health of ecosystems is influenced not only by climate but also by interactions among species within communities, including interactions with non-native species that are new players in those communities and changes in interactions within

a community as some species become locally extirpated or extinct and different sets of species are present. Additionally, landscape pattern and many ecosystem processes will be altered as climate, species, and human population and land use simultaneously change (e.g., Aber et al. 2001, Schmitz et al. 2003). Thus, although we can describe the ongoing and expected changes in climate and predict direct responses of some species to them, and we can define the factors that will be important in determining ecological responses and outcomes, considerable uncertainty of the final resulting communities will remain.

Outbreaks of forest insects are occurring at unprecedented levels in western North America. Bark beetles are a striking example. Mountain pine beetles in the Sawtooth National Recreation Area, home to the headwaters of the Salmon River, which has historically been too cold for outbreaks, have been restricted to small thermally favorable areas, such as the west-facing side of a valley (Logan 2006b). Beginning in the mid 1990s, these small localized populations began to increase and merge, forming an outbreak from 1995—2003. Similarly, an outbreak of mountain pine beetle in British Columbia, Canada, is both far north of observed outbreaks and unprecedented in size (24.7 million acres affected by summer 2005) (Carroll et al. 2003).

Predicted climate shifts over the next century, combined with known climate tolerances of the dominant species of these forests, lead to the expectation that there will be dramatic changes in the character of Pacific Northwest forestland (Shafer et al. 2001, Hansen et al. 2001). Potential habitat for the subalpine species Engelmann spruce and mountain hemlock is expected to contract substantially in the western United States. In fact, alpine habitats, subalpine spruce-fir forests, and aspen are expected to be largely eliminated from the Western United States and displaced northward to Canada over the next century. The future distributions of some species, such as Douglas fir, are predicted to be considerably smaller in the region and also include areas significantly removed from the current distribution, which may pose problems for migration and range adjustments. In some areas, forest may expand, occupying sites currently supporting rangeland, as trees are increasingly favored by altered precipitation, enhanced water-use efficiency at elevated CO2 levels, and a lengthening of the growing season (Millar et al. 2006).

Effects to Montana Forest and Aquatic Ecosystems

Based on projections made by the IPCC, climate in Montana may change more over the next century. By 2100, temperatures in Montana could increase by 4°F in spring and summer and 5°F in fall and winter (NCAT 2010). Precipitation is estimated to increase by roughly 10 percent in all seasons except winter. The amount of precipitation on extreme wet or snowy days in winter is likely to increase, and the frequency of extreme hot days in summer would increase because of the general warming trend (NCAT 2010).

Water resources are affected by changes in precipitation as well as by temperature, humidity, wind, and sunshine. Changes in streamflow tend to magnify changes in precipitation. Water resources in drier climates tend to be more sensitive to climate changes. Because evaporation is

likely to increase with warmer climate, it could result in lower river flow and lower lake levels, particularly in the summer. If streamflow and lake levels drop, groundwater also could be reduced. In addition, more intense precipitation could increase flooding (NCAT 2010).

Western Montana drains into the Columbia River system. Winter snow accumulation and spring melt are key processes that affect the runoff of all rivers within the state. A warmer climate would lead to earlier spring snowmelt, resulting in higher streamflows in winter and spring and lower streamflows in summer and fall. Earlier spring snowmelt could reduce the performance of the reservoir system in western Montana, thus reducing summer and fall runoff, which is critical for power generation, fisheries protection, recreation, and other uses. Increased rainfall could mitigate some of these effects, but it also could lead to increased flooding (NCAT 2010).

Trees and forests are adapted to specific climate conditions, and as climate warms, forests will change. These changes could include changes in species, geographic range, and health and productivity. If conditions also become drier, the current range and density of forests could be reduced and replaced by grasslands and pasture. Even a warmer and wetter climate could lead to changes; trees that are better adapted to these conditions, would thrive. Under these conditions, forests could become denser (NCAT 2010). These changes could occur sooner, if accelerated by other stresses such as fire, pests, and diseases. Some of these stresses would themselves be worsened by a warmer and drier climate. With changes in climate, the extent of forested areas in Montana may change little or could decline by as much as 15 to 30 percent. The uncertainties depend on many factors, including whether soils become drier and, if so, how much drier. Hotter, drier weather could increase the frequency and intensity of wildfires, threatening both property and forests. Drier conditions could reduce the range and health of lodgepole pine and Douglas fir forests, and increase their susceptibility to fire. With increases in rainfall, however, these effects could be less severe. Grass and rangeland could expand into previously forested areas along the eastern slope of the Rocky Mountains and into some of the western valleys. Milder winters could increase the likelihood of insect outbreaks and of subsequent wildfires in the dead fuel left after such an outbreak. These changes would significantly affect the character of Montana forests and the activities that depend on them.

Ecosystems in Montana are diverse, ranging from grasslands and deserts to mountain shrublands, forests, meadows, and alpine tundra. They also include numerous wetlands and streams. Warming and changes in precipitation could affect alpine areas, causing tree lines to rise by roughly 350 feet for every degree Fahrenheit of warming. Mountain ecosystems such as those found in Glacier National Park could shift upslope, reducing habitat for many subalpine species. Alpine animals and species, many of which are unique to the region, could disappear from the highest elevations. Mountain glaciers such as those found in Glacier National Park are expected to shrink, possibly leading to higher stream temperatures and decreased runoff. This would adversely affect aquatic biota, including trout species. Changes in rainfall and snowfall also

could alter streamflows and wetlands, affecting wildlife and possibly accelerating the invasion of non-native plants into streamside habitats. Aquatic species that are sensitive to water temperature could be affected adversely by climate change (NCAT 2010).

Summary

Global, regional, and local climate change trends are expected to continue on a regular basis over the next century. While individual climate events are not necessarily predictable for any given year, the climate changes documented above clearly demonstrate that these changes and some repercussions will result. The issues associated with climate change for each species is addressed in the Status of the Species in the respective chapters of this biological opinion.

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MONTANA DNRC HCP

BIOLOGICAL OPINION

PART II – GRIZZLY BEARS

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A. DESCRIPTION OF PROPOSED ACTION SPECIFIC TO GRIZZLY BEARS

The Montana DNRC proposes to implement an HCP for the conservation of grizzly bears, Canada lynx, bull trout, westslope cutthroat trout, and Columbia redband trout within 548,500 acres of state forested trust lands. The DNRC manages lands in the project area under several programs. This BO addresses the forest management program and associated forestry activities that have the potential to affect the HCP covered species. This part of the biological opinion addresses effects on grizzly bears.

Background information on the proposed action, including the consultation history, is provided in Part I of this BO.

Proposed Project Area

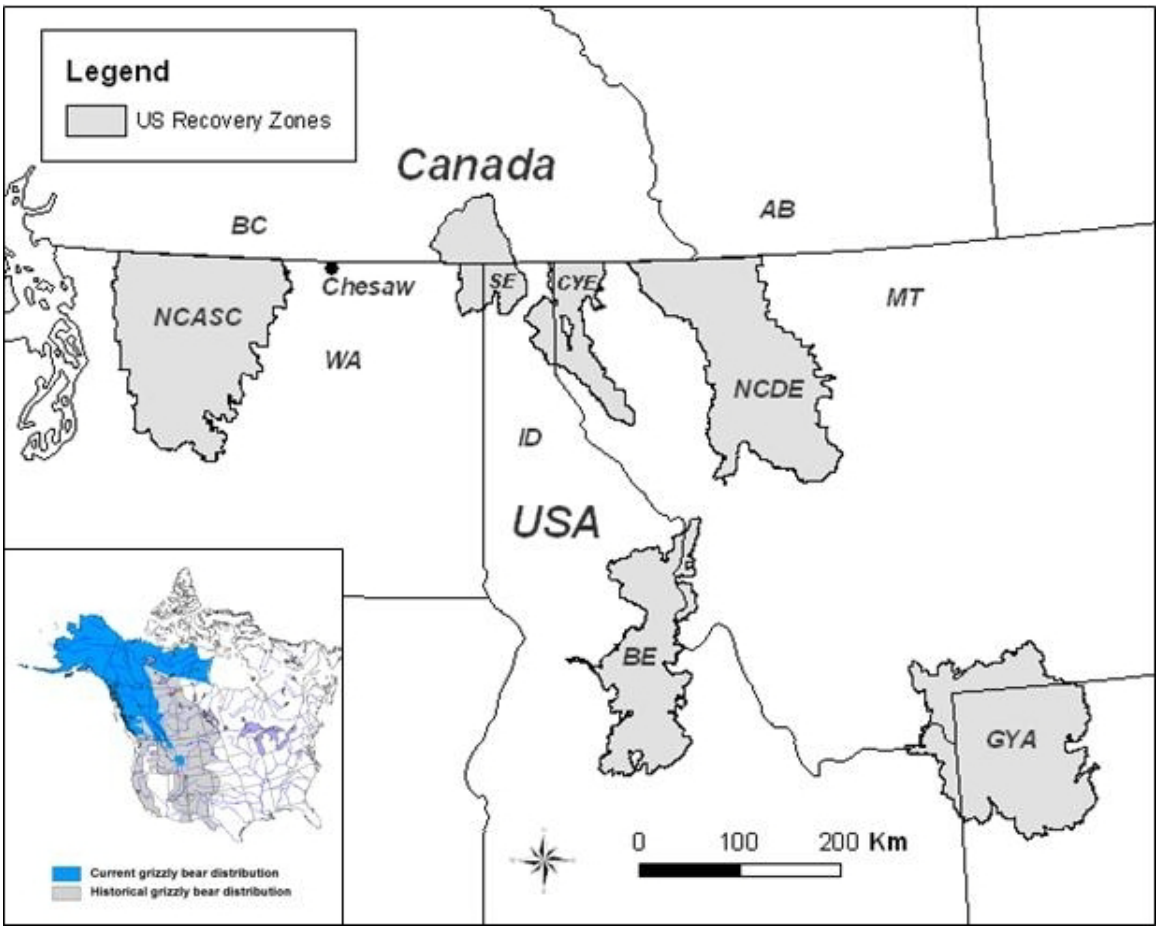
The proposed action would occur on the HCP project area, which is a subset of the total DNRC trust lands in western Montana. DNRC trust lands are managed through six land offices, which are further divided into "administrative units" (Final EIS/HCP 2010, Appendix D, Figure D-2). The HCP project area is comprised of both blocked lands and scattered parcels. Blocked lands refer to large, mostly contiguous blocks of DNRC ownership specifically identified as the Stillwater and Coal Creek State Forests (Stillwater Block) and the Swan River State Forest. Scattered parcels refer to all other HCP project area lands outside of blocked lands (Figure I-1 in Part I of this BO). The majority of scattered parcels in the HCP project area are less than or equal to one square mile in size (640 acres) and many are isolated parcels surrounded by a matrix of other ownerships, including private lands, private industrial forest lands, National Forest lands, Bureau of Land Management (BLM) lands, other state lands, and tribal lands.

The 1993 Grizzly Bear Recovery Plan (herein referred to as the 1993 Recovery Plan) prompted the identification of six grizzly bear recovery zones: the North Continental Divide Ecosystem (NCDE), the Cabinet-Yaak Ecosystem (CYE), the Greater Yellowstone Area (GYE), the Bitterroot Mountains Ecosystem (BE), the Selkirk Mountains Ecosystem (SE), and the North Cascades Ecosystem (Figure II-1). The recovery zones are defined as areas within which the population and habitat criteria for achievement of recovery will be measured (USFWS 1993). Grizzly bear "ecosystems" encompass not only the associated recovery zone, but also the greater area used by grizzly bears surrounding the recovery zone. These terms, "recovery zone' and "ecosystem," are often used interchangeably when discussing the status of grizzly bears in recovery zones. The HCP project area includes lands within the NCDE, CYE, GYE, and BE.

Covered Activities

The DNRC forest management activities that are addressed in the proposed HCP as covered activities are listed and analyzed in detail in the Final EIS/HCP 2010, Appendix A. These activities are also described in Part I.A of this BO.

Figure II-1. Current grizzly bear recovery ecosystems. Inset map illustrates historic (grey shade) and current grizzly bear distribution (dark blue). Adapted from Proctor et al. (in review).



HCP Conservation Commitments for Grizzly Bears

The DNRC HCP consists of three categories of conservation commitments for grizzly bears based on the importance of the lands to grizzly bears:

a. Program wide

b. Non-recovery occupied habitat, and

c. Recovery zones.

Because of the unique pattern of DNRC's land ownership, some of the conservation commitments apply to the entire HCP project area, whereas other measures are applicable only to parcels in specific locations in relation to grizzly bear recovery zones and NROH. Therefore, the grizzly bear conservation strategy is divided into the following categories to reflect this diverse ownership pattern and administrative boundaries important for conservation of grizzly bears:

Program-wide Commitments – Conservation commitments that apply to the entire HCP project area.

NROH Commitments – Conservation commitments that apply to all scattered parcels in the HCP project area within NROH (Wittinger 2002)—this includes portions of the Stillwater, Anaconda, Bozeman, Clearwater, Libby, Helena, Kalispell, Missoula, Plains, and Dillon Units, as well as scattered parcels and blocked lands in recovery zones within the HCP project area.

Recovery Zone Commitments – Conservation commitments that apply to the HCP project area within grizzly bear recovery zones, including only the NCDE and CYE at this time.

Stillwater Block Commitments – Conservation commitments specific to the blocked portions of the Stillwater and Coal Creek State Forests, hereafter referred to as the Stillwater Block.

Swan River State Forest Commitments – Conservation commitments specific to the Swan River State Forest.

Scattered Parcels in Recovery Zones Commitments – Conservation commitments specific to scattered parcels within grizzly bear recovery zones—this includes portions of the Stillwater, Clearwater, Libby, Helena, Kalispell, Missoula, and Plains Units.

CYE Commitments – Conservation commitments specific to the CYE recovery zone and NROH associated with the CYE recovery zone, which includes the Libby and Plains Units.

The list above starts by identifying the commitments that apply to the entire HCP project area and then progressively identifies higher levels of commitments that are applied to various areas as the likelihood of grizzly bear presence and the need for conservation increase. The progression culminates with the highest levels of DNRC conservation being placed on the HCP project area within the grizzly bear recovery zones, including the Stillwater Block, the Swan River State Forest, and numerous scattered parcels, including lands in the CYE (categories 3 through 7 above).

The commitments within each of these categories address the biological goals and objectives of the HCP, as follows:

- Promote safety for humans and grizzly bears in the HCP project area through vegetation management constraints, comprehensive sanitation policies, education, and livestock grazing measures.

- Minimize displacement of grizzly bears from suitable habitat and provide for seasonal habitat use and security through overall access management.

- Contribute to grizzly bear recovery where the conservation of seasonally important grizzly bear habitat would complement federal efforts.

- Promote grizzly bear habitat connectivity where the HCP project area occurs in important locations.

- Maintain important habitat features, including den sites, avalanche chutes, lush riparian zones, and locations that produce high volumes of forage.

- Increase DNRCs' understanding of grizzly bear habitat quality in managed forests through HCP monitoring and voluntary cooperation in research programs as funding and budgets allow.

The specific conservation commitments in the three land categories are summarized below. The commitments are listed by biological objective in Table II-1. For our analysis, we considered the complete description and rationale for the Commitments contained in the Final EIS/HCP 2010, Appendix A.

Program-wide Commitments

These commitments apply to all lands in the HCP project area. Three of the commitments are aimed at promoting safety for humans and grizzly bears (biological goal 1) and include provisions to: train employees on working in bear habitat (GB-PR1[1]); restrict firearms use (GB-PR2); and require proper food storage and sanitation (GB-PR3). Three commitments address the maintenance of important bear habitat features (biological goal 5) including: limiting open road construction in riparian zones and avalanche chutes (GB-PR4); protecting den sites (GB-PR5); and controlling noxious weeds at gravel pits (GB-PR7). Commitment GB-PR8 would reduce grizzly bear disturbance from helicopter use. The last commitment, to retain visual screening in riparian and wetland management zones (GB-PR6), would promote bear habitat connectivity (biological goal 4) as well as maintain this important habitat feature (biological goal 5).

Non-recovery Occupied Habitat Commitments

These commitments apply to all lands in the HCP project area that are in grizzly bear non-recovery occupied habitat (NROH) as well as recovery zone areas. Non-recovery occupied habitat is defined as the land area outside the boundaries of established grizzly bear recovery zones where one would reasonably expect to find grizzly bears occurring during any/most years, as defined by Wittinger (2002). The USFWS recognizes that this boundary may change over

[1]Commitments are numbered and coded according to the species they address and category of commitment under which they fall. For example GB refers to grizzly bears, PR refers to program-wide commitments; NR refers to non-recovery occupied habitat commitments; RZ refers to recovery zone commitments; ST refers to commitments applied in the Stillwater Block, SW refers to commitments applied in the Swan River State Forest; and SC applies to commitments applied on scattered parcels in recovery zones

time. However, it is DNRC's intent to apply these commitments within the NROH as specified by Wittinger (2002) for the term of the Permit. Five of the commitments would minimize displacement of grizzly bears from suitable habitat (biological goal 2) including: DNRC will restrict use on most new road construction, minimizing new open road construction (GB-NR1), discouraging easements that relinquish DNRC's ability to regulate use of the road (GB-NR2), limiting the number and size of gravel pits (GB-NR6), prohibiting commercial forestry (and limiting other low-intensity and motorized activities) during the spring period in spring habitat for grizzly bears (GB-NR3), and providing visual screening in clearcuts and seed tree harvests such that grizzly bears are no more than 600 feet from cover (GB-NR4). The sixth commitment would reduce conflicts from livestock operations by requiring a mitigation plan when small livestock are proposed for weed control on grazing licenses on forested lands (GB-NR5).

Table II-1. Biological objectives of the DNRC HCP for grizzly bears and commitments to be implemented to minimize/mitigate impacts on grizzly bears

Biological Objectives	Minimization and Mitigation Commitments
Promote safety of humans and grizzly bears	PR1 – Develop educational program (brochures and training). PR2 – Restrict firearm use by employees and contractors (and their employees). PR3 – Require proper food storage and sanitation for employees and contractors (and their employees). NR4 – Limit distance to cover to no greater than 600 feet for clearcut or seed tree harvest designs. NR5 – Develop minimization measures for small livestock grazing licenses. RZ2 – Retain visual screening on open roads and clearcut and seed tree units. RZ4 – Prohibit new small livestock grazing licenses. Do not initiate establishment of new grazing licenses. ST1, SW1 – Install interpretive signs about bear presence.
Minimize displacement of grizzly bears from suitable habitat, and provide security through access management	PR5 – Suspend activities near den sites. PR8 – Minimize impacts of helicopter use NR1 – **New roads will be managed as open only when needed for project** NR2, RZ6 – Discourage easements with private parties. Implement minimization measures in easement agreements. NR3, ST4, CY3 – Restrict management activities in the spring season. NR6, ST5, SW5, SC4 – Limit size, number, and period of operation of gravel pits. RZ3 – Maintain road closures. Examine all primary road closures annually, and repair within 1 year. RZ5 – Implement seasonal restrictions on activities in post-denning habitat. ST2, SW3, SC2 – Rest specified lands for 8 years following 4 years active management. ST3, SW4, SC3, CY1, CY2 – Allow one salvage harvest requiring 31 to 150 days per 8-year rest period. Various minimization measures apply.
	SW1 – Implement transportation plan. Apply spring restrictions on more activities to an additional 41 miles of existing road. All new roads would have restricted access and would be subject to spring restrictions. SC1, CY4 – Open road reduction program. ST1 – Implement transportation plan. All new roads (19.3 miles) would have restricted access, most of which (10.5 miles) would also be subject to spring restrictions.

Table II-1 Continued

Biological Objectives	Minimization and Mitigation Commitments
Contribute to recovery	Addressed through the geographic hierarchy of the commitments, whereby greater restrictions apply adjacent to other land ownerships actively managing for grizzly bears. SW2 – Collaborate with adjacent landowners.
Promote habitat connectivity	PR6 – Retain cover to provide visual screening in RMZs and WMZs. NR1 – Minimize construction of open roads. NR3, ST4, CY3 – Restrict management activities in the spring season. RZ2 – Retain visual screening on open roads and clearcut and seed tree units. SC1, CY4 – Implement open road reduction program. ST2, SW3, SC2 – Rest specified lands for 8 years following 4 years active management.
Maintain important habitat features	PR4 – Reduce road construction in RMZs, WMZs, and avalanche chutes. PR5 – Suspend activities near den sites. PR6 – Retain cover to provide visual screening in RMZs and WMZs. PR7 – Comply with biennial weed agreements with county weed boards at DNRC gravel pits. RZ1 – Consider habitat needs in designing timber sale layouts. ST2, SW3, SC2 – Restrict management in rested areas in winter above 6,300 feet elevation.
Monitor HCP and participate in research	Achieved through DNRC monitoring commitments outlined in Chapter 4, HCP; prioritize evaluation of blocked land transportation plans.

Recovery Zone Commitments

This set of commitments applies to all projects in the HCP project area within the occupied grizzly bear recovery zones identified in the 1993 Plan, specifically, the NCDE and CYE. Under the HCP, the only commitments that would apply in the Bitterroot Mountains recovery zone would be the program-wide commitments because at this time, this recovery zone is not considered occupied by grizzly bears (see Section B). If at a future date, we determine that the Bitterroot Mountains recovery zone is occupied by grizzly bears, DNRC would implement the recovery zone commitments through the Changed Circumstance Process as described in the Final HCP, Chapter 6. The GYE contains no project area lands in the recovery zone.

The commitments are divided into four categories based on DNRC's land ownership in recovery zones: commitments that apply to all recovery zones, commitments that apply to scattered parcels in recovery zones, commitments that apply to the Swan River State Forest, commitments that apply to the Stillwater Block (Stillwater and Coal Creek State Forests), and commitments that apply in the CYE.

<u>All Lands in Recovery Zones</u>
Four of the commitments would minimize displacement of grizzly bears from suitable habitat (biological goal 2) as well as increase grizzly bear security by: maintaining and inspecting road closures (GB-RZ3); restricting certain activities in post-denning habitat at certain times of the year (GB-RZ5); applying mitigation measures to easements in grizzly bear habitat (GB-RZ6); and retaining visual screening along open roads, clearcuts and seed tree harvest units (GB-RZ2). One of the commitments would maintain important habitat features (biological goal 5) by avoiding or minimizing impacts on these features when laying out timber sales (GB-RZ1).

Commitment GB-RZ4 would reduce livestock conflicts by prohibiting new small livestock grazing licenses (biological goal 1).

Scattered Parcels in Recovery Zones Commitments

The commitment requiring that all open roads be examined for possible closing or restriction on use (GB-SC1**)** would minimize displacement of grizzly bears (biological goal 2) and promote habitat connectivity (biological goal 3). The miles of open roads in recovery zones will not increase from baseline levels at the LMO scale. Commitments would minimize displacement of grizzly bears from suitable habitat (biological goal 2) by limiting the number, size, and location of gravel pits (GB-SC4). Lastly, commitment GB-SC2 would promote grizzly bear habitat security by requiring that lands be rested for a period of 8 years following 4 years of active management.

Stillwater Block Commitments

DNRC categorized the lands within the Stillwater Block into two distinct grizzly bear conservation management classes, A and B. Habitat maintenance and security are key considerations for Class A lands (biological goal 2). Conservation of Class A lands contributes to connectivity with adjacent federal lands, which helps ensure future opportunities for conservation and habitat function on DNRC lands and on federal lands where management for grizzly bear recovery is mandated (biological goal 3 and 4). Quiet areas for grizzly bears provided through the HCP and low levels of existing development on Class A lands contribute to DNRC's ability to provide for linkage (biological goal 4), "the area between larger blocks of habitat where animals can live at certain seasons, and where they can find security to successfully move between these larger habitat blocks" (Servheen et al. 2001). On Class A lands, these goals are achieved by implementing a transportation plan that identifies existing, proposed, and temporary roads for the permit term (GB-ST1); prohibiting new roads (GB-ST2); restricting access on roads (GB-ST1); and requiring 8 years of rest following 4 years of active management on each of the 4 subzones of Class A lands (GB-ST2). Class A lands are depicted in the Final EIS/HCP 2010, Appendix D, Figure D-4B.

Class B lands are lands adjacent to industrial private or federally managed timberlands and rural/residential property (highway corridors, industrial land with high development potential, large private development, railroad tracks, etc.). Class B lands are depicted in the Final EIS/HCP, Appendix D, Figure D-4B. Minimizing the potential for bear-human conflict (biological goal 1) and maintaining areas with limited disturbance during important seasons (biological goal 2) where opportunities exist, are the management priorities for these lands. Access restrictions for lands in this class promote linkage (biological goal 4), as defined by Servheen et al. (2001), during the applied periods of restriction.

These goals are achieved on Class B lands by implementing a transportation plan that identifies existing, proposed, and temporary roads for the permit term (GB-ST1). This transportation plan also identifies specific seasonal restrictions for roads on Class B lands and prohibits commercial forestry and motorized use on nearly 40 miles of road during the spring period on an annual basis (GB-ST4).

Additionally within the Stillwater Block, installation of bear presence signs (GB-ST1) would promote safety for humans and grizzly bears (biological goal 1), and limiting the number, size, and operation of gravel pits (GB-ST5) would minimize displacement of grizzly bears from suitable habitat (biological goal 2).

Swan River State Forest Commitments

DNRC is presently a signatory party to the Swan Valley Grizzly Bear Conservation Agreement (Swan Agreement), an existing multi-party conservation agreement for grizzly bears in the Swan Valley (USFWS et al. 1995). This agreement provides a conservation framework for grizzly bears for intermingled land ownership in the valley. Cooperators currently include DNRC, the Flathead National Forest, and the USFWS. The Nature Conservancy (TNC) now owns all former Plum Creek Timber Company (PCTC) lands that were part of the Swan Agreement. Although not a signatory party, TNC has agreed to follow the requirements of Swan Agreement, as had PCTC. Plum Creek no longer owns land within the Swan Agreement area. Under its HCP, DNRC would continue to manage its lands in the Swan River State Forest in accordance with the Swan Agreement. In the event that the current Swan Agreement is terminated, DNRC would adopt the HCP for the Swan River State Forest and would then be responsible for abiding by the complete set of conservation commitments identified in the HCP and summarized in the following paragraphs.

Habitat maintenance and security are key considerations for these lands (biological goal 2). Conservation of these lands contributes to connectivity with adjacent federal lands, which helps ensure future opportunities for conservation and habitat function on DNRC lands and on federal lands where management for grizzly bear recovery is mandated (biological goal 3 and 4). Quiet areas for grizzly bears provided through the HCP and low levels of existing development on these lands contribute to DNRC's ability to provide for linkage (biological goal 4) (Servheen et al. 2001).

These goals are achieved by implementing a transportation plan that identifies existing, proposed, and temporary roads for the permit term (GB-SW1). This transportation plan also identifies specific seasonal restrictions for roads. Within the Swan River State Forest, 5 subzones are delineated, each requiring 8 years of rest following 4 years of active management (GB-SW3). The 5 subzones are depicted in the Final DNRC HCP, Appendix B, Figure B-7.

Additionally, installation of bear presence signs (GB-SW1) would promote safety for humans and grizzly bears (biological goal 1) and limiting the number, size, and operation of gravel pits (GB-SW5) would minimized displacement of grizzly bears from suitable habitat (biological goal 2).

Cabinet-Yaak Ecosystem Commitments

The grizzly bear population within the CYE recovery zone is small, which raises the importance of conservation within that ecosystem at this time. In its grizzly bear conservation strategy, DNRC applied greater levels of mitigation in the CYE to address the need for greater conservation of this population.

Greater conservation is achieved in the CYE through commitments to avoid or minimize displacement of grizzly bears (biological goal 2) and promote habitat connectivity (biological goal 3). These commitments include: expediting the examination of all open roads for possible closing or restriction on use (GB-CY4); restricting helicopter use to avoid adverse effects (GB-CY5); 3) increasing the types of restrictions on DNRC activities during the spring period (GB-CY3); and reducing the number of allowable days for commercial activities on rested parcels (GB-CY1).

Transition Lands Commitments

The DNRC HCP includes a "Transition Lands" Conservation Strategy to address the addition and removal of lands from the HCP project area. This strategy is described in Part I.3.d of this BO. Briefly, the strategy caps the number of acres that can be removed from the HCP and Permit over the Permit term and describes various programs through which DNRC may apply conservation to lands that are ultimately removed from the HCP. A process for adding lands is also described.

HCP Monitoring and Adaptive Management Commitments

The monitoring and adaptive management program for grizzly bears is described in Final EIS/HCP 2010,Appendix A and summarized below.

Implementation Monitoring Commitments

Monitoring of the grizzly bear conservation strategy is focused on implementation monitoring, because the commitments are based on best available science and are expected to meet the biological goals when implemented properly. DNRC anticipates using a checklist to document implementation of the HCP commitments and then provide annual updates and 5-year reports on implementation of the grizzly bear conservation commitments as described in the Final EIS / HCP 2010, Vol. II. Appendix A.4, Table 4-2.

Effectiveness Monitoring Commitments

Limited "effectiveness monitoring" would occur under the HCP; however, DNRC will participate in cooperative bear research and monitoring programs as time and budgets allow. DNRC will prioritize participation in the evaluation of effectiveness of the Swan River State Forest and Stillwater Block transportation plans in mitigating risks to grizzly bears as cooperative study opportunities become available.

Additionally, DNRC will monitor the effectiveness of a limited number of commitments at meeting their biological goals. These include reporting instances of human-bear conflicts involving DNRC ownership, employees, or contractors and their employees and, depending on the nature of the incident, implementing adaptive management as described in the Final DNRC HCP (2010, Appendix A). In addition, if through monitoring and reporting, the DNRC and the USFWS determine that minimization of new open road construction in NROH has not occurred,

or that appropriate efforts are not being made to apply the commitments to limit the granting of new easements, adaptive management would be implemented.

Adaptive Management Commitments

For the commitments subject to effectiveness monitoring, the Final EIS/HCP 2010, Appendix describes a suite of measures that may be implemented if the commitments are deemed ineffective. Through the adaptive management process, DNRC and the USFWS will select an alternative strategy from those identified in the Final DNRC HCP to ensure the commitment is effective.

HCP Changed Circumstances Commitments

The primary changed circumstances of concern for grizzly bears are natural disturbance events such as a fire, insect or disease outbreak, or wind event. In response to a natural event such as these, DNRC typically conducts a salvage harvest, which is a covered activity under the HCP. Therefore, the conservation commitments apply to all salvage harvests. However, both parties recognize that management following large-scale fires, insect or disease outbreaks, or wind events could compromise the integrity of the rest/management strategy to provide grizzly bears secure and quiet areas free from management activities. Therefore, the triggers for changed circumstances for grizzly bears related to these events are focused on events that interrupt rested subzones and are described in the Final DNRC HCP, Chapter 6.

When a salvage harvest is planned in response to a natural disturbance that would affect grizzly bears, DNRC would follow the changed circumstance process outlined in the DNRC HCP (2010), Chapter 6 and develop project mitigation for conducting the salvage harvest. The "toolbox" of potential measures includes, but is not limited to:

- After the project is completed, re-starting the 8-year rest period during which time commercial forest management is limited to the winter period
- Adding extra time to the rest period once it re-starts (9 years instead of 8, for example)
- Implementing temporary road restrictions or closures that were not part of the original travel plan
- Requiring seasonal operation restrictions
- Making adjustments to operations in adjacent subzones. Re-scheduling adjacent operations.

Potential effects on grizzly bears or their habitats resulting from mass movements or floods are expected to be minimal and do not warrant additional mitigation measures beyond those identified in the conservation strategies. Therefore, no triggers or responses were developed for grizzly bears in the event of a mass movement or flood. Other changed circumstances applicable to grizzly bears include changes in listing status, recovery boundaries, or dissolution of existing

conservation agreements. In each of these circumstances, the DNRC HCP would likely remain in effect and serve to address any concerns arising from these changes in grizzly bear status and conservation efforts.

B. STATUS OF THE SPECIES

Listing History

In 1975, the U. S. Fish and Wildlife Service (USFWS) listed the grizzly bear as a threatened species in the contiguous United States (40 FR 31734-31736, July 28, 1975). The USFWS subsequently developed a grizzly bear recovery plan in 1982, and revised it in 1993, with the objective of sufficiently recovering populations so that the grizzly bear could be delisted (i.e., no longer classified as threatened or endangered) (USFWS 1993).

Since the original listing of the grizzly bear, the USFWS has initiated four 5-year reviews (46 FR 14652, February 27, 1981; 52 FR 25523, July 7, 1987; 56 FR 56882, November 6, 1991; and September 6, 2011). The USFWS completed a recovery plan with a 5-factor analysis in 1982 (USFWS 1982); this plan was revised in 1993 (USFWS 1993) and supplemented with additional chapters in later years (USFWS 1996; 1997; 2007a; 2007b). Since then, the USFWS has undertaken a number of actions to review the status of individual populations. On March 13, 1990, the USFWS received a petition requesting that the grizzly bear in the North Cascades Ecosystem be reclassified from threatened to endangered. We made a positive 90-day finding on the petition and initiated a status review of the North Cascades population (55 FR 32103, August 7, 1990). On January 28, 1991, we received a petition requesting that we reclassify the grizzly bear populations in the CYE, SE, and North Cascades ecosystems from “threatened” to “endangered.” Then, on February 4, 1991, we received a petition requesting that grizzly bear populations in the SE, CYE, GYE, and NCDE recovery zones be reclassified from threatened to endangered. In 1992, we made a positive finding on these 2 petitions regarding the CYE and SE and initiated a status review for these 2 ecosystems (57 FR 14372, April 20, 1992). This same finding found that there was not substantial information presented about the Yellowstone or NCDE recovery zones and that the request to uplist the North Cascades population was already being addressed through initiation of a status review in 1990 (55 FR 32103, August 7, 1990).

In July 1991, we released a 12-month finding that reclassification of the North Cascades population from threatened to endangered was warranted but precluded (56 FR 33892, July 24, 1991). In 1993, we published a 12-month finding that the grizzly bear population in the CYE was warranted for uplisting to endangered status while the population in the SE was not (58 FR 8250, February 12, 1993). This warranted status for the CYE, like the North Cascades, was determined to be precluded by higher priority actions. In 1998, we re-affirmed this position, publishing a notice that the North Cascades and CYE populations are warranted for endangered status, but precluded by higher priority actions (63 FR 30453, June 4, 1998). In 1999, after a Court remanded our finding regarding the Selkirk Ecosystem population back to the USFWS, we released a 12-month finding that both the CYE and SE populations were warranted for endangered status but precluded by higher priority actions (64 FR 26725, May 17, 1999). Since then, the North Cascades, SE, and CYE populations have remained warranted for reclassification from threatened to endangered status but precluded by higher priority actions (64 FR 57534,

October 25, 1999; 66 FR 54808, October 30, 2001; 67 FR 40657, June 13, 2002; 69 FR 24876, May 4, 2004; 70 FR 24870, May 11, 2005; 71 FR 53756, September 12, 2006; 72 FR 69034, December 6, 2007; 73 FR 75176, December 10, 2008; 74 FR 57804, November 9, 2009). Despite numerous studies of the BE, there were no verifiable sightings of grizzly bears in the last 60 years until an adult male grizzly bear was mistakenly killed by a black bear hunter in September 2007 in the BE. As the USFWS noted in a draft Environmental Impact Statement (EIS) released in July 1997, grizzly recovery in this ecosystem will require the reintroduction of grizzly bears from other areas. The USFWS proposed such reintroduction as its preferred alternative in the Draft EIS; the Final EIS was released in March 2000, with the USFWS's final decision following in 30 to 90 days. In June 2001 the USFWS proposed to withdraw the plan to reintroduce grizzly bears into the BE. Public comment was received and no final decision has been made. Based on the best scientific and commercial information available, the USFWS delisted the Yellowstone grizzly bear DPS, effective April 30, 2007. On September 21, 2009, a court order enjoined the USFWS from removing the Yellowstone DPS from the list of threatened species. The final rule designating the Yellowstone DPS and removing the Yellowstone grizzly bear DPS from the list of threatened species was vacated and remanded to the USFWS. Therefore, the YGBE grizzly bear is once again listed as threatened. The United States is appealing the court decision.

Species Description

Grizzly bears are large (averaging 400-600 lbs for males, and 250-350 lbs for females) and long-lived (up to 40 years old) (Storer and Tevis 1955), but usually no more than 15-25 years in the wild. Grizzly bears are omnivorous, opportunistic feeders that require caloric intake in excess of maintenance requirements, particularly in later summer and fall, in order build fat levels to survive denning.

Life History

Much of the following information is summarized from the 1993 Recovery Plan; more specific information can be obtained in that document. Because the listing of the grizzly bear in the lower 48 States pre-dated the critical habitat policy, we did not designate critical habitat for this species.

Home Range and Dispersal

Generally solitary, grizzly bears avoid one another, except during the mating season when male and female grizzly bears tolerate one another. Grizzly bears do not defend territories, but instead have home ranges they share with other grizzly bears, although social systems influence movements and interactions among resident grizzly bears. Strict territoriality among grizzly bears is not known, and intraspecific defense behavior generally tends to be limited to defense of limited food concentrations, defense of young, and surprise encounters (USFWS 1993:2). Adult male grizzly bears are known to kill juveniles, and adults also occasionally kill other adults. Females with cubs require spatial separation from aggressive males. This is particularly true in spring, when cubs-of-the-year are most prone to attack. Sows with cubs often select rugged and isolated habitats for this reason (Russell et al. 1979; Reynolds and Hechtel 1980; Banci 1991).

Data are insufficient to fully assess the effects of predation on younger grizzly bears by adult grizzly bears (USFWS 1993:5), particularly when considering potential indirect effects of various human activities that may displace a subadult bear into the home range of an aggressive adult bear. Home range sizes for adult female grizzlies vary from 50 to 150 square miles; an adult male can have a home range size as large as 600 square miles (Schwartz et al. 2003).

Grizzly bears display a behavior called natal philopatry in which dispersing young establish home ranges within or overlapping their mother's (Waser and Jones 1983; Schwartz et al. 2003). This type of movement makes dispersal across landscapes a slow process. Radio-telemetry and genetics data suggests females establish home ranges an average of 9.8 to 14.3 km (6.1 to 8.9 mi) away from the center of their mother's home range, whereas males generally disperse further, establishing home ranges roughly 29.9 to 42.0 km (18.6 to 26.0 mi) away from the center of their mother's (McLellan and Hovey 2001; Proctor et al. 2004a).

Den Site Selection

Grizzly bears in the contiguous United States spend 4 to 6 months in dens, typically beginning in October or November (Craighead and Craighead 1972; Nagy and Gunson 1990; Hellgren 1998). The grizzly bears hibernate for as long as 7 months. During this period, they do not eat, drink, urinate, or defecate. Over the course of the denning season, a bear may lose 30 percent of its body weight. All of this weight is stored as fat, which is acquired during the 2 to 4 months prior to entering dens. During the pre-denning period, grizzly bears increase their food intake dramatically and may gain as much as 3.64 pounds per day (Schwartz et al. 2003).

Den site characteristics are variable, but several researchers have described dens located at high elevations in remote areas with slopes greater than 30 degrees, soils that are deep, and aspects where snow accumulates (Pearson 1975; Servheen 1981; Zager and Jonkel 1983; Podruzny et al. 2002). Sloped sites are often selected because they facilitate easier digging and are generally stabilized by trees, boulders, or root systems of herbaceous vegetation. In addition to excavating dens, grizzly bears den in natural caves and hollows under the roots of trees. While individual den sites are rarely reported to be used for more than one winter, numerous researchers have observed that dens rarely occur singly, but are concentrated in areas that apparently possess appropriate environmental conditions (Craighead and Craighead 1972; Hamer et al. 1977).

Grizzly bears in the NCDE typically enter their dens in early to mid-November (Servheen and Klaver 1983; Aune and Kasworm 1989; Mace and Waller 1997). Grizzly bears on the east side of the NCDE entered their dens on a mean date of November 6 (Aune and Kasworm 1989); while grizzly bears on the west side exhibited a mean date of November 4 in the Swan Mountains (Mace and Waller 1997) and the third week of November in the Mission Mountains (Servheen and Klaver 1983). In the CYE, den entry ranged from third week of October to the last week of December with 82 percent of grizzly bears entering dens between the first week of November and the second week of December (Kasworm et al. 2009).

The literature on disturbance and impacts to grizzly grizzly bears during denning (or immediately before or after denning) suggests that the greatest risk involves females with young cubs that have recently emerged from den sites (Mace and Waller 1997; Reinhart and Tyers

1999; Graves and Reams 2001). Cubs are still vulnerable at this age, and it has often been noted that these family groups will remain near dens for some time before heading for lower-elevation areas with better forage. Grizzly bears generally appear to tolerate motorized activities occurring more than 1 kilometer (0.6 mile) from the den (Linnell et al. 2000). There is some indication that close encounters with dens can cause physiological stress (Reynolds et al. 1986) or, in some cases, den abandonment (Swenson et al. 1997). Den abandonment, in turn, increases the likelihood of cub mortality. Mace and Waller (1997) suggested a denning period of October 8 through May 26, to ensure that females with cubs at den sites prior to entry and post-entry would not be disturbed by forest management activities. The NCDE Access Management Technical Group[2], herein referred to as the NCDE Access Group, (2002) identifies the denning period as November 1 through April 1.

Recruitment (Breeding, or Reproduction)

Mating occurs from May through July, and cubs are born inside the den in late January or early February. Cubs remain with their mother for 2 to 3 years (Foresman 2001). Grizzly bears have one of the lowest reproductive rates among terrestrial mammals. The age at which females produce their first litter varies from 3 to 8 years, with litter size varying from one to four cubs. Grizzly bear females cease breeding successfully some time in their mid to late 20s (Schwartz et al. 2003).

Habitat Requirements

Grizzly bears are habitat generalists. Key habitat requirements include the availability of food, security (from humans and other grizzly bears), and den sites (Archibald et al. 1987; Harting 1987; Heinrich et al. 1995; Mace et al. 1996, 1999; Linnell et al. 2000) (Table II-2). While biologists agree that preferred habitats of grizzly bears are early seral, fire-successional types, the proximity of security cover is also an important variable that has been shown to influence the use of foraging habitat. Given equal foraging opportunities, under cover and in the open, McLellan (1992) suggested that grizzly bears would prefer to feed under cover.

The NCDE subcommittee meets biannually to coordinate grizzly bear recovery efforts throughout the ecosystem. At various times, additional subcommittees within the NCDE are formed to address issues as they arise, hence the formation of the Access Management Technical Group.

Table II-2. Grizzly bear key habitat requirements.

Habitat Requirement	Key Habitats
Spring foraging[1]	Low-elevation mesic vegetation
Summer, autumn foraging[1]	Moderate- to high-elevation mesic vegetation
Security cover and isolation from humans[2,3]	Cover provided by vegetation and topographic breaks; absence or low density of roads and trails
Denning habitat[4]	Remote, high-elevation areas with slopes greater than 30 degrees; friable, deep soils; and snow accumulations

Sources: [1]. Mace et al. (1996); Mace et al. (1999); McLellan and Hovey (2001); Nielson et al. (2002); Waller and Mace (1997). [2]. Archibald et al. (1987); Kasworm and Manley (1990); Mace et al. (1996); Mace et al. (1999); Mattson et al. (1987); McLellan and Shackleton (1988, 1989); Wielgus et al. (2002). [3]. Mace and Waller (1997); White et al. (1999); Graves (2002). [4]. Pearson (1975); Servheen (1981); Zager and Jonkel (1983); Podruzny et al. (2002).

Food Habits and Seasonal Use of Habitats

Grizzly bears are opportunistic omnivores with high diet variability among individuals, seasons, and years (72 FR 14866-14938; Mattson et al. 1991a,b; Schwartz et al. 2003; LeFranc et al. 1987; Felicetti et al. 2003; Felicetti et al. 2004). The grizzly bears are selective in their seasonal use of various kinds of forage and, therefore, move across the landscape as they follow the growth and abundance of preferred forage items (Blanchard 1983; Mace et al. 1996; Waller and Mace 1997; McLellan and Hovey 2001).

Grizzly bears display great diet plasticity and switch food habits according to which foods area available. Mattson et al. (1991a) hypothesized that grizzly bears are always sampling new foods in small quantities so that they have alternative options in years when preferred foods are scarce. In the Greater Yellowstone Area (GYE), Blanchard and Knight (1991) noted that, "After 10 years of food habits data collection, new feeding strategies continued to appear annually in this population." Mattson (1997) found that grizzlies in the GYE "…used ungulates the most during years when they used pine seeds the least." Similarly, Felicetti et al. (2003) documented that in years of poor pine nut production, "72 percent of GYE grizzly bears make minimal use of pine nuts while consuming more ungulate meat...".

Grizzly bears are selective in their seasonal use of various kinds of forage and, therefore, move across the landscape as they follow the phenological development and abundance of their preferred forage items. As a result, the productivity of grizzly bear populations is likely more strongly influenced by the availability of high quality food resources than by density-dependent regulating factors (DNRC 2005, updated 2010). It has also been observed that grizzly bears of all ages will congregate readily at plentiful food sources and form a social hierarchy unique to that grouping of grizzly bears (USFWS 1993:2).

With the exception of a few forest vegetation types, such as horsetail associations, the majority of vegetative food items preferred by grizzly bears occur in early seral communities where forest cover is absent or relatively sparse (Hamer and Herrero 1983). Foraging areas that are consistently described in the literature as favored by grizzly bears include avalanche chutes (Zager et al. 1980; Mace et al. 1996; Waller and Mace 1997; Ramcharita and McLellan 2000; McLellan and Hovey 2001), fire-mediated shrub fields (Almack 1985, 1986; Hamer and Herrero 1987a,b; McLellan and Hovey 2001), and riparian areas (Servheen 1983; McLellan and Hovey 2001). Avalanche chutes may be used at any time of year, but seem to attract grizzly bears particularly in the spring. These areas are usually quite wet (due to deep snows that melt later than in other areas), and they contain both valuable forage species and a tangle of vegetation that provides visual screening. Fire-mediated shrub fields often contain soft-mast (e.g., berry) producing shrub species, an important food source for foraging grizzly bears in mid-summer and early fall. Riparian areas are primarily used in spring and early summer when habitats at higher elevations are still covered with snow or plant growth is otherwise delayed.

When grizzly bears emerge from their dens in the spring, their fat stores have been severely depleted; therefore, foraging to rebuild energy reserves is their primary focus. It is important that grizzly bears have adequate spring foraging opportunities close to their dens, especially when cubs have been born, to build up fat stores quickly. In their study of radio-collared female grizzly bears, Mace et al. (1999) found that the upper elevation limit observed for habitat use in spring was 4,900 feet. Waller and Mace (1997) defined the spring period as the period from den exit to July 15 based on apparent changes in food habitats and behavior. The NCDE Access Group (2002) identifies the spring period as April 1 through June 30. The Selkirk/Cabinet-Yaak Grizzly Bear Subcommittee Interim Access "rule set" (S/CYE Subcommittee, 12/01/1998) identifies the spring period as April 1 through June 15.

Secure Habitat - Security cover is an important variable that influences grizzly bear use of foraging habitats. In addition to foraging habitat, security cover and isolation from humans and human-associated activities are necessary habitat components for grizzly bears (Archibald et al. 1987; Mattson et al. 1987; McLellan and Shackleton 1988, 1989; Kasworm and Manley 1990; Mace et al. 1996, 1999). Human activities can result in direct mortality of grizzly bears, as well as indirect negative effects by displacing grizzly bears to less suitable habitats (Mace and Waller 1998; McLellan et al. 1999; Benn and Herrero 2002; Wakkinen and Kasworm 2004; Schwartz et al. 2006). Secure habitat is important to the survival and reproductive success of grizzly bears, especially adult female grizzly bears (Mattson et al. 1987; IGBC 1994; Schwartz et al. 2010).

Grizzly bear habitat security is primarily achieved by managing motorized access which — (1) minimizes human interaction and reduces potential grizzly bear mortality risk; (2) minimizes displacement from important habitat; (3) minimizes habituation to humans; and (4) provides habitat where energetic requirements can be met with limited disturbance from humans (Mattson et al. 1987; McLellan and Shackleton 1988; McLellan 1989; Mace and Manley 1993; Mace et al. 1996; Mattson et al. 1996, Wakkinen and Kasworm 1997). Secure habitat for grizzly bears (also

referred to as core areas) is specifically defined by the Interagency Grizzly Bear Committee[3] (IGBC) (1998) as areas that are at least 0.3 mile from any open road or motorized trail and that receive no motorized use of roads or trails during the period they are considered secure habitat (typically at least 10 years). Such lands should also encompass areas of seasonal importance for grizzly bears throughout the year. Based on the research to date, the IGBC recommended that each recovery zone develop specific criteria for route densities and secure habitat based on female grizzly bears monitored in the recovery zone, other research results, and social or other management considerations.

Analysis in the South Fork Study area of the NCDE (Mace and Manley 1993; Mace et al. 1996) indicated the importance of unroaded habitat, especially for females with cubs. Mace and Manley (1993) reported adult females used habitat further than 0.5 mile from roads or trails more than expected; 21 percent of the composite home range had no trails or roads and 46 percent was unroaded (greater than 0.5 mile from a road); approximately 68 percent of the adult female composite home range was secure habitat.

Based on grizzly bear habitat use data from the Yellowstone ecosystem, Mattson (1993) recommended that micro-scale security areas in that region be an absolute minimum of 6 kilometers (3.6 miles) in diameter or 28 square kilometers (10 square miles) and should be secure for a minimum period of 5, or preferably 10, years.

In the Selkirk/Cabinet-Yaak ecosystems, Wakkinen and Kasworm (1997) found that six female grizzly bears had an average of 55 percent core habitat in their home ranges, with some grizzly bears in the Yaak having as little as 44.1 percent core. No minimum core size was determined, but the authors suggest that if a minimum occurs it would likely be between 2 and 8 square miles.

While security cover is necessary primarily to allow grizzly bears to avoid contact with humans, the cover is sometimes necessary for grizzly bears to avoid contact with other grizzly bears. Strict territoriality among grizzly bears is not known, and intraspecific defense behavior generally tends to be limited to defense of limited food concentrations, defense of young, and surprise encounters (USFWS 1993:2). Adult male grizzly bears are known to kill juveniles, and adults also occasionally kill other adults. Females with cubs require spatial separation from aggressive males. This is particularly true in spring, when cubs-of-the-year are most prone to attack. Data are insufficient to fully assess the effects of predation on younger grizzly bears by adult grizzly bears (USFWS 1993:5), particularly when considering potential indirect effects of various human activities that may displace a subadult bear into the home range of an aggressive adult bear. Sows with cubs often select rugged and isolated habitats for this reason (Russell et al. 1979; Reynolds and Hechtel 1980; Banci 1991). Shrub and tree cover, as well as topographic

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3 The IGBC was created in 1983 to coordinate and implement management efforts across multiple Federal lands and different States within the various recovery zones. Its objective was to modify land management practices on Federal lands that supported grizzly bear populations to provide security and maintain or improve habitat conditions for the grizzly bear.

landscape features, are commonly used as security from humans or other grizzly bears (McLellan and Hovey 2001; Wielgus et al. 2002), and dispersing subadult grizzly bears may be forced to choose poor home ranges that may be equally dangerous to their survival (USFWS 1993:5).

There are no broadly accepted USFWS or IGBC standards related to grizzly bear hiding cover. Cover is a habitat consideration addressed through a variety of standards and guidelines based on land management objectives of the landowner and location of their lands on the landscape.

Habitat Linkage

An important habitat component for wildlife is the presence of habitat linkage. Servheen et al. (2001) define habitat linkages as "the area between larger blocks of habitat where animals can live at certain seasons where they can find the security they need to successfully move between these larger blocks of habitat." The importance of maintaining habitat linkage is an issue recognized by federal, state, and county governments; conservation organizations; and many others (Servheen et al. 2001). It is an issue encompassing not only wildlife conservation but also human safety and economics, since vehicle-wildlife collisions on highways result in many human fatalities and injuries each year and cost millions of dollars in property damage (Servheen et al. 2001). The main factors generally considered to affect the quality of linkage zones are major highways, railroads, road density, human site development, availability of hiding cover, and the presence of riparian areas (Servheen et al. 2001; 2003; USFS 2005).

Habitat linkage and connectivity are important components of grizzly bear habitat (Servheen et al. 2001, 2003; USFWS 1993). Maintaining linkage and connectivity between small, isolated grizzly bear populations can benefit grizzly bears in several ways, including (1) allowing immigrant grizzlies to bolster a resident population in an area that has been affected by catastrophic events or negative environmental conditions, and (2) preserving genetic diversity by reducing negative effects from inbreeding. Task 37 in the 1993 Recovery Plan called for the evaluation of linkage potential between grizzly bear recovery zones.

Additional information on the relevance of habitat linkage and connectivity is discussed below in Section B.

<u>Grizzly Bear Dispersal, Movements, and Genetic Health</u>

Because grizzly bears live at relatively low population densities and are vulnerable to excessive human-caused mortality, human-caused fragmentation of historically contiguous populations into isolated "remnant" populations is a management reality on the current ecological landscape (Forman and Alexander 1996; Proctor et al. in review; Lindenmayer and Fischer 2006). It is a widely accepted tenet in conservation biology that extinction risk of isolated populations is reduced even through minimal levels of connectivity (Soule 1987). At greatest risk of extinction are small isolated populations with less than 100 individuals. Such populations are more susceptible to extinction through demographic processes such as human-caused mortality, natural mortality, and lower population growth rates as well as environmental processes such as poor food years, climate change, and habitat loss. While the SE and CYE grizzly bear populations contain less than 100 individuals each, they are not entirely isolated from Canadian

populations. Small populations benefit greatly from both demographic rescue (i.e., the immigration of female grizzly bears) and to a lesser degree genetic rescue (i.e., immigration of male grizzly bears). Although reconnection of these isolated populations is challenging (Forman and Alexander 1996; Lindenmayer and Fischer 2006), metapopulation theory directs that connectivity is the best long-term conservation practice to increase the resiliency, redundancy, representation, and overall probability of persistence of remaining grizzly bear populations in the lower 48 States (Boyce 2000).

Proctor et al. (in review) compiled and analyzed all known genetic and movement data for grizzly bears in 10 different study areas. They assessed the current state of genetic fragmentation within and between these study areas and used genetic assignment testing and movement data from radio-collared animals to compile what is known about current levels of male and female movement.

Samples from coastal British Columbia and the Selkirk Mountains south of Canadian Highways 3 and 3A (i.e., the SE) have unique genetic material that is dissimilar to other grizzly bear populations in southern Canada and the northern U.S. In the Selkirks, this difference is most likely due to genetic drift acting on a small isolated population over several generations because of anthropogenic pressures (Proctor et al. in review).

Although there are differences in heterozygosity values among study areas and recovery zones, there have been no detectable consequences on grizzly bear morphology, physiology, ecology, or biology related to these differences in genetic diversity as evidenced by normal litter size, little evidence of disease, an equal sex ratio, and physical characteristics such as body size and weight (Wakkinen and Kasworm 2004; Schwartz et al. 2006a; Kasworm et al. 2008; Mace and Chilton 2009).

It is important to note that these genetic differences are not the result of natural selection in varying environments or indicative of historical conditions. Instead, they are artifacts of human pressures (Proctor et al. in review). High mortality risk when grizzly bears move between secure blocks of habitat and very low population sizes resulting from past range contraction and mortality have resulted in genetic fragmentation. Each of these fragmented populations may possess genetic material missing from other populations. Maintenance of this genetic material is important to the long-term ability of this region's grizzly bears to respond to environmental changes.

Because grizzly bears have low reproductive rates (Nowak and Paradiso 1983; Schwartz et al. 2003), long generational times (i.e., 10 years), and are slow to disperse across landscapes (McLellan and Hovey 2001), there can be a lag time between fragmentation and resulting changes in genetic diversity. The genetic data collected by Proctor et al. (in review) reflect fragmentation occurring on the landscape in the recent past (i.e., last 30-60 years) and <u>may not reflect current, improved levels of connectivity and recent movement of grizzly bears between areas</u>. In other words, current grizzly bear populations may not be as isolated as the genetic data of this study suggest. Therefore, it is useful to supplement these genetic data with movement data to get a complete picture of current population connectivity.

Proctor et al. (in review) examined grizzly bear movements between ecosystems that displayed varying levels of genetic separation. These movement data were collected from 1985-2007 and represent a more recent picture of fragmentation than genetic data.

In general, Proctor et al. (in review) found males move more frequently and over longer distances than females. This result is expected based on what we know about female home range size and the dispersal process. Females usually establish smaller home ranges than males that overlap with their mother's (Waser and Jones 1983; LeFranc et al. 1987; Schwartz et al.2003). In doing so, they generally disperse over much shorter distances than male grizzly bears (McLellan and Hovey 2001; Proctor *et al.* 2004a). The majority of migrants that moved from one study area to another were males (26) but a few females (4) were also observed moving between genetically fragmented populations (Proctor et al. in review).

Connectivity must be examined in a genetic (requires males only) and demographic (requires females) framework. While male movements can enhance genetic diversity and reduce genetic fragmentation (Miller and Waits 2003; Proctor et al. 2005), female movements are necessary to enhance a small population's growth rate (Proctor et al. in review). This concept is relevant to grizzly bear recovery in the NCASC, SE, CYE, and BE recovery zones, all of which contain small populations (if any) that are demographically and genetically isolated to varying degrees.

Proctor et al. (in review) documented increasing genetic and demographic fragmentation across Canada Highway 3. If allowed to continue, this fragmentation could lead to a loss of connectivity between U.S. and Canadian grizzlies. Canada Highway 3 is at least a partial barrier to population connectivity by minimizing female crossings (Proctor et al. 2005; Proctor et al. in review). Maintaining and increasing movements by females (i.e., demographic rescue) from Canadian populations into the small populations (North Cascades, SE, and CYE) is critical to the long-term conservation of these populations. Recovery could be accomplished via natural movements or translocating animals.

Another aspect of connectivity Proctor et al. (in review) examined was known habitat use by grizzly bears in intervening habitats between USFWS-identified recovery zones. This habitat use is relevant to understanding how and where grizzly bears in different ecosystems may be linked in the near future. Proctor et al. (in review) found 4 males and 1 female using habitat between the Selkirk and Purcell Mountains, although there was no evidence indicating any migration between these 2 mountain ranges.

Mace et al. (2011, unpubl rept.) documented the distribution of grizzly bears in and adjacent to the NCDE recovery zone based on a compilation of telemetry data, mortality data, and DNA detections and found that both male and female grizzly bears are occupying habitat between the NCDE and CYE.

We have documented one female grizzly bear with a cub that regularly uses habitat between the NCDE and CYE. She and her offspring spend most of their summer in the Salish Mountains of Montana less than 2 miles east of the edge of the CYE while denning within the boundaries of the NCDE recovery zone (Kasworm et al. 2008). In fact, there have been several different

grizzly bears with cubs documented using habitat west of Highway 93, since 2002 (USFWS, unpubl. data 2011).

Currently, it is not possible to tell if movements we are observing reflect an increase in bear movements or an increase in detection effort and technology (e.g., GPS collars; genetic techniques) (Proctor et al. in review). These promising detections of grizzly bear movements should be tempered by the idea that detected movement does not mean migrants are breeding successfully. If there is no successful reproduction, then there is no genetic or demographic rescue occurring. There seems to be high mortality risk associated with migrant grizzly bears (Proctor 2003, Proctor et al. in review). However, these data are helpful when considering how to most effectively manage and conserve the remaining grizzly bear populations in the lower 48 States. For example, these data emphasize the importance of maintaining demographic connectivity with Canadian populations and the small populations of the North Cascades, SE, and CYE, while highlighting the importance of recovering these small populations so that they can provide genetic and demographic rescue for the Bitterroot Ecosystem. Of relevance, the NCDE appears to be well connected to Canadian populations genetically and its large population size means female movements from Canada into the NCDE are not absolutely required for demographic health to be maintained, although such female movements are beneficial. Similarly, the Greater Yellowstone Area has a large enough population size that demographic rescue is not required. Instead, 1-2 male migrants every 10 years (i.e., genetic rescue) are adequate to maintain current levels of genetic diversity in the GYE (Miller and Waits 2003).

Status and Distribution

Recovery zones are defined as the area in each grizzly bear ecosystem within which the population and habitat criteria for achievement of recovery will be measured (USFWS 1993). Each recovery zone includes an area large enough and of sufficient habitat quality to support a recovered grizzly bear population. Grizzly bears will move and reside permanently in areas outside recovery zones. The 1993 grizzly bear plan stated "Bears can and are expected to exist outside recovery zone lines in many areas. However, only the area within the recovery zone will be managed primarily for grizzly habitat."

There are approximately 1,500 grizzly bears in the lower 48 States in five recovery zones: 765 in the NCDE; 600 in the GYE; 45 in the CYE; 30 in the SE; and 10 to 20 in the North Cascades. The population in the GYE is increasing at 4 to 7 percent annually. The population in the NCDE is increasing by approximately 3 percent annually. The best available data indicate the CYE population is declining due to unsustainable levels of mortality. The SE grizzly bear population is slowly increasing at a rate of 1.9 percent annually (Wakkinen and Kasworm 2004). The population size and trend for the recovery zones is summarized in Table II-3. The USFWS is in the process of updating the demographic recovery criteria in the 1993 Recovery Plan as there are new science and techniques available. This task has been completed for the GYE grizzly bear population (USFWS 2007a) but not for the other grizzly bear recovery zones.

Table II-3. Estimated grizzly bear population size and population growth rate by recovery zone in 2009-2010.

Recovery Zone	Estimated Population Size	Trend (% change annually)
Greater Yellowstone Area	596[a]	+ 4-7% [b]
Northern Continental Divide	765[c]	+ 3 %[g]
Cabinet-Yaak	>/=42[d]	– 3.8% [e]
Selkirk	80[f]	+ 1.9% [g]
North Cascades	< 20	Unknown
Bitterroot	0	n/a

[a]. Interagency Grizzly Bear Study Team 2009 Annual Report; [b] Harris et al. 2006; [c] Kendall et al. 2009; [d] Kasworm et al. 2010; [e] Kasworm unpubl. rept. 2010; [f] Proctor et al. in review; Wakkinen 2010; [g] Wakkinen and Kasworm 2004, g Mace and Roberts 2011.

Following is a description of the six recovery zones and the status of the grizzly bear in each.

Northern Continental Divide Ecosystem

The NCDE is contained entirely within the state of Montana. It is approximately 45 miles from the BE and 15 miles from the CYE. Of the 5,717,399 acres within the NCDE recovery zone, 78 percent (4,443,035 acres) are Federally owned, 4 percent (231,545 acres) are State owned, 7 percent (390,403 acres) are Tribally owned, and 10 percent (585,461 acres) are privately owned (Table II-4). An additional 1 percent is either water (66,953 acres) or owned by city/county government (1 acre). Federal ownership is primarily divided among Glacier National Park (17 percent) and the Flathead National Forest (40 percent) with the Lewis and Clark, Helena, Lolo, and Kootenai National Forests managing most of the remaining Federal Lands (20 percent) within the NCDE. Thirty percent (1,728,509 acres) of all lands inside the NCDE are designated Wilderness Areas.

Table II-4. Grizzly Bear Recovery Zone Acreages by Landowner.

	Recovery Zone Acreages				
	Total	**Federal**	**Tribal**	**State**	**Private**
NCDE	5,717,399	4,443,035 (78%)	390,403 (7%)	231,545 (4%)	585,461 (10%)
CYE	1,669,760	1,502,784 (90%)	0	83,488 (5%)	83,488 (5%)
BE	16,686,720	16,686,720 (100%)	0	0	0
GYE	5,888,000	5,764,352 (97.9%)		123,648 (2%)	
N.Cascades	6,204,159	5,459,656 (88%)	0	372,250 (6%)	372,250 (6%)
Selkirk[1]	746,505	597,204 (80%)	0	111,976 (15%)	37,325 (5%)

[1]. This recovery zone is comprised of 1,408,500 acres of which 53% (746,505 acres) is in the U.S and remainder of which is in Canada. The values presented are for land ownership in the U.S.

Kendall et al. (2009) estimated there are 765 grizzly bears in the NCDE (Table II-3). The study also found that the occupied range of the grizzly bears now extends 2.6 million acres beyond the NCDE recovery zone boundary identified in the 1993 Recovery Plan. The NCDE population of grizzly bears is contiguous with grizzly bears in Canada (Proctor et al. in review). Kendall et al. (2009) provide an accurate estimate of how many animals there were in 2004, the year of sampling, but do not address population trend (i.e., is the population increasing, decreasing, or stable). In 2004, the NCDE subcommittee and Montana Fish Wildlife and Parks (MFWP) initiated an ecosystem-wide research project to determine the population trend of the entire NCDE. Since 2004, the team has captured and monitored 109 female grizzly bears in the U.S. and Canada for trend monitoring. Based on data collected between 2004 and 2009, it is estimated that the NCDE population grew at a mean annual rate of approximately 3 percent (Mace and Roberts 2011).

Grizzly bears are well distributed throughout the NCDE recovery zone and someone would expect to encounter a grizzly bear there. Between 1999 and 2004, 22 of 23 bear management units (BMUs) were occupied by females with young (Dood et al. 2006). Between 2004 and 2010, Mace and Roberts (2011) report that all 23 BMUs were occupied by adult females and 21 BMUs were occupied by females with dependent young. The role and relationship of BMUs to recovery are explained below in Section B.

The demographic recovery criteria for the NCDE are currently under revision. Based on conflicts and mortalities, we know that grizzly bear range has expanded outside of the recovery zone boundaries to the east and to a lesser degree to the west and south. A male grizzly bear was documented approximately 80 miles east of the recovery zone boundary in 2009, and both males and females are becoming increasingly common in river bottoms between the recovery zone boundaries and Interstate 15 to the east. There have been 3 different grizzly bears with cubs documented west of Highway 93 since 2002 and 3 male grizzly bears documented south of Interstate 90 since 2002. The USFWS considers the NCDE population of grizzly bears to be nearing recovered levels.

Cabinet-Yaak Ecosystem

The CYE (approximately 2,609 square miles) is located primarily in northwestern Montana with small portions in northern Idaho. Land ownership in the CYE is approximately 90 percent Federal, 5 percent State, and 5 percent private lands. The Kootenai National Forest manages approximately 72 percent of lands within the CYE recovery zone, with the Idaho Panhandle and Lolo National Forests administering the remaining Federal lands within the recovery zone. State and private lands comprise just 10 percent of the CYE. The predominant private land owners in the recovery zone include PCTC and Stimson Timber Company.

The relative distribution of grizzly bears across this ownership pattern is unknown, but is believed to be proportionate to land ownership (i.e., approximately 90 percent of the grizzly bear population lives on the 90 percent of public land within this recovery zone). In Canada, the portion of British Columbia directly north of the Cabinet-Yaak recovery zone is largely Crown land (public) with the exception of the Moyie and Kootenay River valleys. Within the CYE recovery zone, 5.6 percent (94,272 acres) is designated Wilderness Area.

The CYE was estimated to contain at least 42 grizzly bears during 2004-2009 (Kasworm et al. 2010). The Cabinet Mountains lie south of the Yaak River drainage and contain about 60 percent of the recovery zone. During 2004-2009, there were approximately 16 individuals in the Cabinet Mountains and 26 individuals in the Yaak portion of the recovery zone (Kasworm et al. 2010). This population estimate of 42 grizzly bears is similar to our 1999 estimate of 30-40 in the CYE (64 FR 26725, May 17, 1999).

High rates of known mortality from 1999 to 2009 (3.36 mortalities per year) suggest the population has most likely been decreasing (Kasworm et al. 2010; Wakkinen pers. comm. January 2011 *in* USFS 2011 BA supplement). However, improved subadult female and adult female survivorship resulted in an improved trend than recent estimates (e.g. 2004), although still declining.

Kasworm et al. (2010, pg. 29) reported the most recent CYE grizzly bear population trend estimate: Approximately 90 percent of the data used in population trend calculations came from grizzly bears monitored in the Yaak River portion of this population and the result is most indicative of that portion of the recovery area. The sample sizes available to Kasworm et al. to calculate population trend were small and small samples sizes yield wide confidence intervals around any calculated trend estimate (λ). The probability that the population was declining was 78 percent.

Sample size allowed calculation of point estimates for cumulative annual rate of change beginning in 1998. Finite rates of increase calculated for the period 1983-1998 suggested an increasing population (Wakkinen and Kasworm 2004). Adult and subadult female survival rates declined in 2006. Human caused mortality has accounted for much of this decline and appears to be largely responsible for the decline in the rate of increase.

During 2009, adult female survival and subadult female survival had increased and resulted in an improving population trend estimate since 2006, although trend is still declining. Improving survival by reducing human-caused mortality is crucial for recovery of this population, as is augmentation of the population and ensuring connectivity with Canada (Proctor et al 2004) and between the Cabinet Mountains and the Yaak River portions of the ecosystem.

The 1993 CYE demographic criteria are: (1) six females with cubs over a running 6-year average both inside the recovery zone and within a 10 mile area immediately surrounding the recovery zone, excluding Canada; (2) 18 of 22 BMUs occupied by females with young from a running 6-year sum of verified sightings and evidence; and (3) known human-caused mortality not to exceed 4 percent of the population estimate based on the most recent 3-year sum of females with cubs. Furthermore, no more than 1.2 percent of total human-caused mortality shall be females. These mortality limits cannot be exceeded during any 2 consecutive years for recovery to be achieved. Presently, grizzly bear numbers are so small in this ecosystem that the goal for mortality is zero human-caused mortalities.

In the CYE, none of the 1993 demographic recovery criteria have been met (Kasworm et al. 2010). The population goal of 6 females with cubs has not been met. The 6-year running average was 2.0 females with cubs. The distribution criterion has not been met with only 11 of

22 BMUs occupied by females with young. Demographic criteria for zero mortality have also not been met. The running 6-year average (2004-2009) of total human caused mortality was 1.2 animals/year including 0.7 females each year.

In 2010, Wayne Kasworm, USFWS grizzly bear researcher, prepared an unpublished synopsis regarding factors affecting the CYE grizzly bear population:

> "In two 2004 peer-reviewed journal papers we analyzed and described the needs for recovery in the Cabinet-Yaak recovery area (Proctor et al 2004, Wakkinen and Kasworm 2004). The three things directly related to grizzly bear population that we determined need to be done to achieve recovery were: 1) limit mortality (particularly females), 2) augment the Cabinet Mountains population with young female grizzly bears (but may now need to consider males for genetic purposes), and 3) enhance or maintain linkage areas for grizzly bears to move naturally between the Yaak River drainage and the Cabinet Mountains and between recovery areas (this would eliminate the need for augmentation in the longer term).
>
> Known human-caused mortality in the CYE averaged about one animal per year from 1982-1998. During 1999-2002, known mortality jumped substantially within both natural and human causes. Human-caused mortality increased to an average of five animals per year.
>
> Some of this increase in human-caused mortality may have been related to poor berry production from 1998 to 2003. There appears to be a strong relationship between poor huckleberry production and total mortality in this area. During 2003-2009, human-caused mortality has remained at elevated levels, but natural mortality has declined. Average mortality has dropped to slightly more than two animals per year during this period.
>
> Since 1999, there appears to have been an increase in the numbers of grizzly bears killed on private lands in the CYE recovery area. To further quantify this issue, I calculated the mortality rates for all radio collared grizzly bears based on location of death (1.0 - survival rate = mortality rate). Mortality on private lands in the U.S. has become the largest source of human-caused mortality in the CYE.
>
> Grizzly bears are now being killed by humans at disproportionately higher numbers on private lands than on public lands: the CYE is about 90 percent public land, yet human-caused mortality on public land is only about 14 percent of the trend mortality."

Because of the small population size in the Cabinet Mountains, we believe that this population would not persist unless intensive management steps are taken. From 1990-1994, and again from 2002 – 2011, MFWP has released a few grizzly bears annually, mostly females, into the Cabinet Mountains (Kasworm et. al 2010). MFWP expects to continue this program,

Bitterroot Mountains Ecosystem

The Bitterroot Mountains ecosystem is the largest contiguous block of Federally designated Wilderness Area in the lower 48 States. The Experimental Population Area is approximately 16,686,720 acres including approximately 4,000,000 acres of designated Wilderness Area.

Habitat conditions in the BE were described in detail in the Final Environmental Impact Statement for Grizzly Bear Recovery in the Bitterroot Ecosystem (USFWS 2000).

The BE recovery zone is not currently occupied by grizzly bears (USFWS 1996; 65 FR 69624, November 17, 2000; USFWS 2000; 72 FR 14865-14938, March 29, 2007 p.14869). In September 2007, a male grizzly bear was mistakenly shot by a black bear hunter in the northern Bitterroot Mountains of Idaho. Based on the bear's genetic signature, it evidently came from the Selkirk Mountain ecosystem. This grizzly bear mortality was within the Bitterroot Nonessential Experimental Population Area (USFWS 2000). The Final EIS for grizzly bear reintroduction defined a population as, "…at least two different female grizzly bears with young or one female seen with different litters in two different years in an area…greater than 10 miles from the nearest non-experimental grizzly bear population recovery zone boundary" (USFWS 2000). At this point, we do not consider the BE to be occupied by a population of grizzly bears.

To assess the presence of grizzlies in the BE where recent observations of grizzly bears were reported, we systematically surveyed the northern Bitterroot Mountain (between Highway 12 in Idaho and Highway 200 in Montana) during 2008 and 2009 using barbed wire DNA hair corrals and cameras. These surveys can establish presence of species but cannot be used to establish absence. Sites were constructed according to the methods of Woods et al. (1999). Heat-and-motion-triggered cameras were placed at as many sites as possible to document the reproductive status of grizzly bears (e.g. to determine if cubs are present) and to serve as a supplemental sampling method in case animals did not leave a hair sample. The hair samples from 2009 are being analyzed by the genetics lab but we know that there were no grizzly bear hair samples from 2008. While we did not document any grizzlies in the study area, our sampling methods do not allow us to conclusively determine they are absent from the area. In the CYE, a small, low-density population with a population of 15 individuals over an area roughly half the size of our Bitterroot study area, we generally document 1 or 2 grizzly bears annually using the same methods. Our failure to document grizzly bears in the BE area indicates that if grizzly bears are regularly occupying the BE, there are very few individuals and they exist at very low densities.

Greater Yellowstone Ecosystem

The Greater Yellowstone Ecosystem (GYE) in northwest Wyoming, eastern Idaho, and southwest Montana (9,200 sq mi) has nearly 600 grizzly bears (Haroldson 2009). It is approximately 240 miles from the Bitterroot Ecosystem and at least 75 miles from the grizzly bear population in the NCDE. In 2008, the total population size for the GYE population was estimated at 596, with a 95 percent confidence interval between 535 and 656 in 2008 (Haroldson 2009). The GYE population is increasing in size approximately 4-7 percent annually (Haroldson 2009; Harris et al. 2006). For more details regarding GYE demographic features, please refer to the Yellowstone Final Rule (72 FR 14866, March 29, 2007), the latest Interagency Grizzly Bear Study Team Annual Reports (online at http://nrmsc.usgs.gov/products/IGBST), and Schwartz et al. (2006) (*Temporal, spatial, and environmental influences on the demographics of grizzly bears in the Greater Yellowstone Ecosystem* - Wildlife Monographs).

North Cascades Ecosystem

The North Cascades ecosystem is one of the largest contiguous blocks of Federal land in the lower 48 States. The recovery zone is approximately 6,204,159 acres in north-central Washington State and is composed of about 88 percent Federal lands; 6 percent managed by State agencies; and 6 percent are private lands (USFWS 1997) (Table II-3). Of the federal lands, approximately 11 percent (60,022 acres) is managed by North Cascades National Park, 28 percent (1,528,704 acres) by the Mount Baker-Snoqualmie National Forest, and 47 percent (2,566,038 acres) by the Wenatchee and Okanogan National Forests. About 43 percent of the recovery zone is designated Wilderness Area (10,842 sq km; 4,186 sq mi) and another 15 percent (3,806 sq km; 1,470 sq mi) is managed as Wilderness although it is not Congressionally designated. It is estimated to contain less than 20 grizzly bears (Almack et al. 1993). The nearest population of grizzly bears is immediately north in Canada with an estimated 23 individuals but populations to the east and west of the Cascades in Canada are considered extirpated (North Cascades Grizzly Bear Recovery Team 2004).

Selkirk Mountains Ecosystem

The Selkirk Mountains recovery zone (SE) is located primarily in northern Idaho but includes portions of Washington and Canada also. It encompasses (over 2,200 square miles (1,408,500 acres) of the Selkirk Mountains of northeastern Washington, northern Idaho, and southern British Columbia. Approximately 47 percent of the recovery zone is in British Columbia with the remainder in the U.S. In the U.S. portion of the SE, land ownership is approximately 80 percent Federal, 15 percent State, and 5 percent private lands. Within the SE, 3 percent (39,976 acres) is designated Wilderness Area.

Proctor et al. (in review) compiled data from multiple sources and conducted DNA-based population surveys (Proctor et al. 2007) to estimate a population size of 88 grizzly bears in the SE, with 30 in the U.S. and 58 in Canada (Proctor et al. in review). The estimate for the U.S. portion of the SE is based on expert opinion (Wakkinen 2010). The Idaho Department of Fish and Game is currently working on a population estimate for the U.S. portion of the SE that will present a more scientifically rigorous estimate. In 2004, it was estimated that the population of grizzly bears in the SE was slowly increasing at a rate of 1.9 percent annually (95 percent confidence interval = 0.922-1.098) (Table II-3) (Wakkinen and Kasworm 2004). As in the CYE, Wakkinen and Kasworm (2004) found that subadult female survival had the largest influence on overall population trend.

For the SE, the 1993 demographic criteria are: (1) six females with cubs over a running 6-year average both inside the recovery zone and within a 10 mile area immediately surrounding the recovery zone, *including* Canada; (2) 7 of 10 BMUs on the U.S. side occupied by females with young from a running 6-year sum of verified sightings and evidence; and (3) known human-caused mortality not to exceed 4 percent of the population estimate based on the most recent 3-year sum of females with cubs. Furthermore, no more than 30 percent of this 4 percent mortality limit shall be females. These mortality limits cannot be exceeded during any 2 consecutive years for recovery to be achieved. Presently, grizzly bear numbers are so small in this ecosystem that the mortality goal is zero human-caused mortalities.

In the SE, none of the 1993 demographic recovery criteria have been met. Data was derived from Wakkinen et al. (2009), and Wakkinen (2010) who noted: "*that the ability to monitor the population has declined due to funding limitations and the reduction in trapping and radio collaring activities"* in the recovery area. The population goal of 6 females with cubs has not been met. In 2008, the 6-year running average was 0.5 females with cubs (Wakkinen et al. 2009). In 2009 the 6-year running average dropped to 0.3 females with cubs (Wakkinen 2010) but there were no observations of family groups in the BMUs in 2009 due in part to the lack of radio-collared grizzly bears in the U.S. portion of the recovery zone. The distribution criterion has not been met with only 4 of 10 BMUs occupied by females with young (Wakkinen et al. 2009). Demographic criteria for zero mortality have also not been met. The running 6-year average of total human caused mortality was 1.8 animals/year including 0.7 females each year (Wakkinen et al. 2009; Wakkinen 2010, USFS 2010b, 2011 supplement).

Factors Affecting the Status of Grizzly Bears

Status of Factors Affecting Grizzly Bears at the Time of Listing

When grizzly bears in the lower 48 States were listed under the Act in 1975, the vast reduction in range, increase in trail and road construction, increase in recreation, livestock use of National Forest lands, unsustainable human-caused mortality, lack of data regarding populations, and isolation were identified as factors affecting their conservation status (40 FR 31734, July 28, 1975). To date, all of these threats have been addressed to varying degrees in different areas.

The IGBC was created in 1983 to coordinate and implement management efforts across multiple Federal land managers and different States within the various recovery zones. Its objective was to modify land management practices on Federal lands that supported grizzly bear populations to provide security and maintain or improve habitat conditions for the grizzly bear. The IGBC issued habitat management guidelines (IGBC 1986) for federally-managed grizzly bear habitat and the interagency management of grizzly bears.

Since 1975, and the 1986 IGBC Guidelines, habitat protection measures have focused primarily on providing relatively secure, functional habitat for grizzly bears across large ecosystems (primarily Federal lands). In the NCDE, GYE and CYE, multi-agency, State and local governments and non-government group efforts have been moved forward, often in a coordinated and cooperative fashion. The intent was to provide grizzly bears with adequate amounts of freely available habitat to meet their life history needs, and to minimize the opportunity for human-caused mortality. New information and science regarding grizzly bear biology, current status, and threats has become available over the years since listing. This research and information has been valuable in addressing the impacts and management of roads, trails, and recreation and livestock management. It has also indicated the need for public information and assistance programs, along with attractant storage, to limit human-caused mortality of grizzly bears.

Current Factors Affecting Grizzly Bears

Human-caused mortality remains an important concern for the recovery of grizzly bears. Unregulated residential development in and around grizzly bear recovery zones is a major source of direct mortality from bear/human encounters, food conditioning, and habituation of bears to humans (Mattson et al. 1987) as is development in lower elevation habitat, which results in habitat loss and/or brings grizzly bears into proximity with people. The sale of private lands that were traditionally commercial forest lands to other private owners for real estate development has led to an increase in private residential development in grizzly bear habitats. As human population densities increase, the frequency of encounters between humans and grizzly bears also increases, which can result in more human-caused grizzly bear mortalities due to a perceived or real threat to human life or property (Mattson et al. 1996). This occurs because human population growth results in corresponding increases in both the number of people recreating in grizzly bear habitat and human site developments.

Humans are directly or indirectly responsible for 88 percent of grizzly bear deaths in the lower 48 States outside of the GYE. Within the GYE, human-caused mortalities accounted for 73 percent of known mortalities from 1973-2002 (see p. 14920 of Yellowstone Final Rule, Appendix A).

Despite these mortalities, GYE and NCDE populations are large, stable to increasing with evidence of range expansion. The SE population appears to be increasing slowly (Wakkinen and Kasworm 2004). In contrast, the CYE population is most likely declining(Wakkinen and Kasworm 2004; Kasworm et al. 2010). Due to small population sizes, inherently low growth rates of grizzly bear populations, and potential fragmentation with Canadian populations, the increase in human-caused mortality over the current decade in both the CYE and SE indicates that human-caused mortality is a threat to grizzly bears in both of these ecosystems.

Climate Change

As discussed in Part I.D of this BO, climate changes have been characterized at the global, national, regional and local level and are expected to continue into the future (Karl et al. 2009; USFWS and DNRC 2010). We assume, for purposes of this BO, the climate changes characterized in Part I.D of this BO will continue through the 50-year permit term. Thus, climate change will likely affect grizzly bear habitat throughout the 50-year period of the HCP and Permit.

Climate change trends in western Montana and the Pacific Northwest region will be important to grizzly bears with respect to how these trends may affect denning behavior, foraging habitat availability, and fire-regimes.

As described in Part I.D of this BO, predicted decreases in snowpack levels may shorten the denning season as foods are available later in the fall and earlier in the spring. Spring and fall encounters between grizzly bears and hunters and/or recreationists would, therefore, likely increase, escalating the mortality risk to grizzly bears during these times.

An additional effect of climate change could be changes in the availability of and distribution of foraging areas due to increasing temperatures and seasonal changes in precipitation. The extent and rate to which plant species and communities would be affected is difficult to predict. Changes in vegetative distributions may also influence other mammal distributions, including prey species like ungulates.

As extensively described in this BO, (Section B), grizzly bears are opportunistic feeders and will consume almost any available food. Because grizzly bears are such successful omnivores, climate-induced vegetative changes may not have detectable, negative effects on grizzly bear populations in the lower 48 States.

An indirect effect of climate change may be an increase in wildfires that may result in reductions in forest cover and some types of foraging habitat, while potentially creating other types of foraging habitat, e.g. shrub, berry, and grassland forage areas. Increasing insect outbreaks may result in more decadence and die-outs of whitebark pine stands, thus, reducing a potential food source for grizzly bears in recovery zones where it represents a key food source to grizzly bears (i.e., the Greater Yellowstone Area.

In summary, grizzly bears are habitat generalists and opportunistic omnivores, able to find resources in a wide variety of habitat conditions. It is difficult to predict how this large, wide-ranging species would respond to environmental changes associated with climate change. At this time, the scope and scale of such changes are unknown, and the effects (positive or negative) on grizzly bears would likely be variable across the landscape.

Analysis of the Species Likely to be Affected

Grizzly bears are a wide-ranging species requiring large, interconnected areas of suitable habitat. State lands in Montana occur in three grizzly bear recovery zones (GYE, NCDE and the CYE), as well as in areas outside recovery zones into which grizzly bears have expanded over that past decade or so. Grizzly bears on State lands in Montana may be affected by forest management activities that contribute to high road densities and subsequent decreases in secure habitat. Forest management activities may also affect important habitat elements used by grizzly bears for denning and foraging, or that increase habitat fragmentation. Additionally, forest management activities may contribute to displacement of grizzly bears from suitable habitat or increase the risk of human/bear encounters that result in mortality of grizzly bears. This BO evaluates the proposed action with respect to the forest management activities that affect grizzly bears.

C. ENVIRONMENTAL BASELINE

This section contains an analysis of the effects of past and ongoing human and natural factors leading to the current status of the species, its habitat (including designated critical habitat, if applicable), and ecosystem, within the "action area" (USFWS and NMFS 1998).

The "environmental baseline" includes:

- the past and present impacts of all Federal, State, or private actions and other human activities in an "action area,"
- the anticipated impacts of all proposed Federal projects in an "action area" that have already undergone formal or early section 7 consultation,
- and the impact of State or private actions that are contemporaneous with the consultation in process.

Action Area

The "action area" includes all areas to be affected directly or indirectly by the Federal action (in this case, approval of the DNRC HCP permit) and not merely the immediate area involved in the action [50 CFR §402.02]. However, the action area does not necessarily include all areas potentially frequented by far-ranging, or migrant species (USFWS and NMFS 1998, pp 4-15 to 4-19).

For the purposes of this BO, the action area encompasses the DNRC HCP project area as well as those BMUs (CYE) or BMU subunits (NCDE) that overlap or are adjacent to the HCP project area. In other words, the HCP commitments are applied on the DNRC HCP project area, but may have effects on adjacent lands in overlapping BMUs and BMU subunits. We note that there are additional DNRC trust lands in western Montana that are not included in this HCP. This HCP only covers forest management activities. The excluded trust lands are either 1) managed for purposes other than commercial forestry (i.e., grazing, real estate, etc.) or 2) are forested trust lands that DNRC chose not to include in the HCP as discussed in the Final HCP, Chapter 1.

As discussed in Section A, the portions of the HCP project area occur on blocked lands: the Stillwater and Coal Creek State Forests, referred to as the Stillwater Block, and the Swan River State Forest in NCDE. Additionally, scattered parcels of HCP lands occur within and outside the recovery zones in NROH in the CYE and NCDE ecosystems, and the GYE has NROH as well. Many parcels are less than or equal to one square mile in size (640 acres) and are isolated parcels surrounded by a matrix of other ownerships, including private lands, private industrial forest lands, National Forest lands, BLM lands, other state lands, and tribal lands.

Status and Distribution of Grizzly Bear within the Action Area

This section is a subset of the preceding status and distribution discussion in Section B. The purpose of the BO is to analyze the effects within the action area (USFWS and NMFS 1998). The action area does not encompass the entire range of the grizzly bear. The action area is a subset of lands occupied by grizzly bears and includes some DNRC lands and Federal BMUs or BMU subunits in the CYE and NCDE as well as NROH in the NCDE, CYE, and GYE. DNRC has only 182 acres in the BE. The BE is not currently occupied by grizzly bears and so the proposed action will not affect grizzly bears in this area. Thus the BE will not be further analyzed in this BO. However, habitat conditions in the BE are at times presented in the tables developed to support the remainder of this analysis. The North Cascades ecosystem and the

Selkirk Mountains ecosystem are not affected by the proposed DNRC HCP and their status is not further discussed in this BO.

The status and distribution of grizzly bears in the recovery zones within the action area, as previously described above in Section B, is relevant to the environmental baseline discussion. This section describes the relationship of the action area to these recovery zones.

Northern Continental Divide Ecosystem

The NCDE lies entirely within western Montana. As shown in Table II-5, the action area includes 1,042,658 acres representing 18 percent of the lands in the NCDE recovery zone. The DNRC HCP project area includes 147,845 acres (130,374 acres of blocked lands and 17,466 acres of scattered parcels) in the NCDE recovery zone and 72,875 acres of NROH (Table II-6). In total, the HCP project area supports 2.6 percent of the NCDE recovery zone and 3 percent of associated NROH (Table II-5).

Cabinet-Yaak Ecosystem

The majority of the CYE lies within western Montana, with an additional 19 percent in Idaho. As shown in Table II-5, the action area includes 714,172 acres representing 4 percent of the lands in the CYE recovery zone. The DNRC HCP project area portion of the action area includes 6,174 acres in the CYE recovery zone and 12,122 acres in the NROH (Table II-6). In total, the HCP project area supports less than 1 percent of the CYE recovery zone and 1.4 percent of associated NROH (Table II-5). All lands in the CYE occur as scattered parcels (Table II-6)

Greater Yellowstone Area

The majority of the GYE lies within Wyoming with additional lands in Idaho and the action area. DNRC owns 40 acres in the GYE recovery zone, of which none are included in the HCP project area. The DNRC HCP project area portion of the action area includes 27,714 acres of NROH associated with the GYE, representing 1.5 percent of the lands in GYE NROH in Montana (Table II-6). All lands in the GYE occur as scattered parcels (Table II-6).

Table II-5. Relationship of the DNRC HCP action area and project area to all lands in grizzly gear recovery zones and associated NROH in western Montana.

	All lands in western Montana		All DNRC lands in western Montana		All lands in the action Area		HCP project area portion of the action area	
	Recovery Zone	NROH	Recovery Zone (% of Recovery Zone)	NROH(% of NROH)	Recovery Zone (% of Recovery Zone)	NROH (% of NROH)	Recovery Zone (% of Recovery Zone)	NROH (% of NROH)
NCDE	**5,711,299**	**2,459,088**	**204,139 (3.6)**	**160,640 (6.5)**	**1,042,658 (18)**	**72,875 (3)**	**147,845 (2.6)**	**72,875 (3)**
CYE[1]	**16,558,862**	**873,230**	**6,855 (0.5)**	**12,246 (1.4)**	**714,172 (4)**	**12,122 (1.4)**	**6,174 (0.5)**	**12,122 (1.4)**
BE[1]	**30,212,002**	**0**	**341 (<0.1)**	**0**	**0**	**0**	**182 (<0.1)**	**0**
GYE[1]	**58,997,892**	**2,406,568**	**40 (<0.1)**	**81,588 (4.3)**	**0**	**27,714 (1.5)**	**0**	**27,714 (1.5)**
Total	**162,881,742**	**5,738,886**	**211,374 (2.5)**	**254,475 (4.9)**	**1,756,832**	**112,711 (2.2)**	**154,201 (1.8)**	**112,711 (2.2)**

Note: Totals may not add up due to rounding.

[1]. Includes some acreage outside of Montana: 88 percent of the BE recovery zone occurs within Idaho; 19 percent of the CYE recovery zone occurs within Idaho; 71 percent of the GYE recovery zone occurs within Wyoming; and 7 percent of the GYE recovery zone occurs within Idaho.

Table II-6. Acres in the DNRC HCP action area by recovery zone and NROH and DNRC ownership type (blocked lands or scattered parcels).

	Acreage in the Action Area		
		DNRC HCP Project Area	
Location in the Action Area	**Non-DNRC HCP Project Area Lands**	**Blocked Lands**	**Scattered Parcels**
NCDE Recovery Zone			
Bunker BMU			
Goat Creek subunit	27,602	5,894	
Lion Creek subunit	29,047	3,067	
So Fork Lost Soup subunit	29,883	18,324	
Mission Range BMU			
Piper Creek subunit	30,992	177	
Porcupine Woodward subunit	37,666	12,238	
Crane Mtn subunit	36,692		85
Dearborn Elk Creek BMU			
Falls Creek subunit	84,931		639
Hungry Horse BMU			
Peters Ridge subunit	25,109		742
Lower North Fork Flathead BMU			
Cedar Teakettle subunit	31,704		492
Lower Big Creek subunit	30,343		82
Werner Creek subunit	28,607	383	
Monture Landers Fork BMU			
Alice Creek subunit	70,175		1,194
Arrastra Mountain subunit	69,256		1,696
Red Mountain subunit	76,674		1,888
Murphy Lake BMU			
Krinklehorn subunit	47,487	326	
Rattlesnake BMU			
Rattlesnake subunit	26,016		14
South Fork Jocko subunit	49,187		3,097
Sullivan BMU			
Noisy Red Owl subunit	37,096		5,137
Stillwater River BMU			
Lazy Creek subunit	34,559	14,367	

Table II-6. Continued

Location in the Action Area	Acreage in the Action Area		
		DNRC HCP Project Area	
	Non-DNRC HCP Project Area Lands	Blocked Lands	Scattered Parcels
Stryker subunit	40,860	32,923	5
Upper Whitefish subunit	32,201	27,035	
Upper North Fork Flathead BMU			
Coal & South Coal subunit	25,249	413	
Hay Creek subunit	33,658	1,807	
State Coal Cyclone subunit	31,366	13,420	
Ketchikan subunit	23,911		1,097
Lower Whale subunit	19,020		1,100
Red Meadow Moose subunit	33,367		198
NCDE Recovery Zone Subtotal	**1,042,658**	**130,374**	**17,466**
NCDE NROH			**72,875**
CYE Recovery Zone			
Callahan BMU	43,455		663
Cedar BMU	56,814		12
Newton BMU	95,938		266
Snowshoe BMU	65,230		1,278
Spar BMU	71,473		642
Bull BMU	81,719		311
Mount Headley BMU	152,394		1,998
Vermilion BMU	90,583		272
Wanless BMU	56,566		733
CYE Recovery Zone Subtotals	**714,172**		**6,174**
CYE NROH			**12,122**
BE Recovery Zone			**182**
GYE NROH			**27,714**
All Other HCP Lands			**281,588**
Subtotals	**1,756,832**	**130,374**	**418,121**
Action Area Total Acreage			**2,305,027**

Factors Affecting the Grizzly Bear Environment in the Action Area

As shown in Table II-5, the action area is comprised primarily of Federal lands and DNRC lands. A few incidental parcels of other landownership may be encompassed in some of the affected BMUs including private lands, other state lands, or industrial forested lands.

The following sections describe the factors affecting grizzly bears within the recovery zones with DNRC HCP lands, the NCDE and CYE. Note that this discussion involves recovery zones in general, which are not wholly part of the action area. However, the discussion frames factors that affect grizzly bears within the recovery zones that use DNRC lands and affected BMUs or subunits in the action area. As described in the Grizzly Bear Recovery Plan, recovery zones delineate the habitat and space needed to recover grizzly bear populations (USFWS 1993). Thus federal and State agencies have applied concentrated efforts to conserve grizzly bear habitat within recovery zones (IGBC 1986). In general, human-caused mortality and managing motorized human access have been and continue to be key factors in managing grizzly bears and their habitat. In the NCDE and CYE, access management in recovery zones has been largely addressed through National Forest and BLM management, detailed below for the NCDE and CYE.

In response to the formation of the IGBC and grizzly bear listing, National Forest and National Park plans have incorporated the Guidelines developed by the IGBC to manage grizzly bear habitat in the lower 48 States (IGBC1986) (see discussion in Section B). The Guidelines are applied within BMUs or BMU subunits on Federal Lands. The National Forests and National Parks delineated bear management units (BMUs) within each recovery zone to aid in managing habitat and monitoring population trends. In the NCDE (and GYE), BMUs were further subdivided into subunits. The BMUs are analysis areas that approximate the lifetime size of a female's home range, while BMU subunits are analysis areas that approximate the annual home range size of adult females within each respective ecosystem. In the CYE, BMUs were not divided into subunits and approximate the annual home range size of adult females (from 50 to over 150 square miles). The BMUs and subunits were identified to provide enough quality habitat and to ensure that grizzly bears were well distributed across the recovery zone (USFWS 1993).

In 1998, an interagency task force examined motorized access management and produced recommendations to standardize definitions and methods (IGBC 1998). This report recommended three parameters to include as components of access management: 1) open motorized route density (OMRD); 2) total motorized route density (TMRD); and 3) secure habitat. OMRD includes roads and trails that are open to wheeled motorized use without restriction. TMRD includes roads and trails open to motorized wheeled access and those with restrictions. Secure habitat contains no open motorized routes or any roads that receive administrative use and is expressed as a percentage of the analysis area that meets this definition (e.g., 75 percent of a BMU subunit may be considered secure habitat). The IGBC recommended that each recovery zone develop specific criteria for route densities and secure habitat based on female grizzly bears monitored in the recovery zone, other research results, and social or other management considerations.

Road density objectives for the NCDE and CYE are discussed in more detail in Section D. Access Management on Forested Trust Lands, Analysis of Road Densities. No HCP covered lands occur within the GYE recovery zone.

Factors Affecting Grizzly Bears in the NCDE

Access Management

The 1993 Recovery Plan identifies access management as an important tool for conserving grizzly bears and their habitat. The USFWS believes that the NCDE recovery zone access management direction contributes to and promotes grizzly bear recovery. All national forests in the NCDE have some form of access management program in place.

For the Flathead National Forest, the primary federal landowner in the action area, the status of access management for the BMU subunits in the action area is summarized in Appendix A, Tables A-1 and A-2. The Flathead National Forest encompasses all or portions of 11 BMUs and has 70 subunits. Of these 70 subunits, 16 occur primarily within wilderness. These 16 subunits are not subject to land management actions such as timber harvest and road construction and therefore are not subject to Amendment A19, which established road density objectives for the remaining 54 subunits. Of these 54 subunits, 40 are predominantly national forest, in that they are comprised of at least 75 percent national forest lands, and the numeric A19 road density objectives apply (described in Section D). As of July 2011, 24 of these subunits met all three A19 access objectives or amended objectives (U.S. Forest Service 2011b, U.S. Forest Service 2011 *in litt.*). The remaining 14 subunits are subject to the A19 objectives of no net increase of OMAD and TMAD and no net decrease in core (secure habitat). The Lolo and Helena National Forests manage less of the recovery zone. Both Forests have access management strategies similar to A19 on the Flathead National Forest.

The Lolo National Forest adopted a grizzly bear strategy and received an amended incidental take statement for its Forest Plan in 1996 that included the NCDE Access Committee recommendations and the Flathead A19 road density goals (U.S. Forest Service 1996; U.S. Fish and Wildlife Service 1996) for subunits within the NCDE recovery zone. Six of the seven subunits in two BMUs on the Lolo National Forest meet A19 access objectives and the sixth meets amended objectives.

The Helena National Forest manages one BMU of the NCDE with three subunits. Of these three subunits, two have greater than 75 percent Helena National Forest ownership and one has less than 75 percent Helena National Forest ownership. None of the subunits meet all three recommended access guidelines. However, road densities are low moderate to low, ranging from 9 to 23 percent OMAD and 20 to 23 percent TMAD. Core is moderate to high, ranging from 61 to 72 percent.

Human-caused Mortality

Recent data (USFWS 2010a) indicates that the majority of human-caused mortalities in the NCDE from 1999 through 2009 were management removals of nuisance or habituated grizzly bears and illegal killings. The grizzly bear population has been increasing from 2004 to 2009, despite the level of human-caused mortality. However, the federal agencies and MFWP continue efforts to minimize human-caused mortalities. The majority of these mortalities occurred on private lands, demonstrating a higher incidence of grizzly bear mortality associated with areas on and in proximity to private lands and associated development, than on federal or State lands.

A major factor in grizzly bear recovery in the NCDE is attractant-related human-caused grizzly bear mortality. Towns and settlements are common in low elevations and major valley bottoms within and adjacent to the recovery zone. Human generated food sources such as bird feeders, garbage, pet and livestock foods, human foods, gardens, and orchards present powerful attractants for grizzly bears. Grizzly bears attracted to these human-generated food sources may become habituated and food conditioned. Such bears often become a threat to human safety and property and are killed illegally or removed through agency nuisance grizzly bear control actions. The MFWP employs grizzly bear specialists that work with the public, primarily to inform residents as to how to live in grizzly bear habitat without conflicts with bears. The bear specialists also handle nuisance grizzly bear reports, and trap offending bears. These grizzly bears are typically habituated to seeking out human-related foods and garbage and pose serious threats to human safety, and often are destroyed. The MFWP manages black bear and big game hunting in the state. Among other measures to reduce defense of life and mistaken identity kills of grizzly bears, MFWP requires a mandatory black bear and grizzly bear identification training for all black bear hunters in the state. The Forest Service also enforces a food-storage order throughout the NCDE, and has various information programs regarding recreating safely in grizzly bear habitat.

Attractant- related grizzly bear deaths are among the leading causes of grizzly bear mortality in the NCDE (USFWS *in litt*. 2010). Data collected between 2000 and 2010 demonstrate management removal of habituated grizzly bears related to human food, garbage, pet and bird feed, and livestock, , resulted in approximately 32 percent of total grizzly bear mortality within the NCDE recovery zone (Ibid.).

Habitat Loss, Linkage Zones and Checkerboard Landownership.
As explained in various sections of this BO, Plum Creek Timber Company, Inc. recently transferred substantial ownership of lands in the NCDE, primary in the Swan Valley, to The Nature Conservancy. This acquisition will benefit grizzly bears, as these previously commercial timber properties will eventually be transferred to federal or State ownership, which will have conservation strategies for grizzly bear habitat.

Linkage zones, or zones of habitat connectivity within or between populations of animals, foster the genetic and demographic health of the species and a number of efforts to identify and conserve linkage areas are underway. The NCDE encompasses a span of mountain ranges on the Helena, Lewis and Clark, Lolo and Flathead National Forests, and Glacier National Park and is contiguous with grizzly bear habitat in Canada, including Banff National Park. To the west of the NCDE is the Cabinet/Yaak Ecosystem, and to the southwest is the Bitterroot recovery zone. A mix of National Forest, private and state lands, corporate timber lands and highways occur between the recovery areas within the action area. However, grizzly bears are living in these areas; observations are documented each year, primarily by Montana Fish, Wildlife and Parks and Forest Service. These areas typically have higher road densities, human settlements and other associated activity. These factors represent risks for grizzly bears attempting to reside in or move through the area. However, it is apparent that some grizzly bears are able to adapt to and survive in these less than optimal conditions.

Factors Affecting Grizzly Bears in the CYE

Proctor et al. (2004) indicated that augmentation of the population, reduction in human-caused mortality, and ensuring connectivity with and within Canada were needed to ensure persistence of the CYE grizzly bear population. In 2006, the USFWS grizzly bear recovery coordinator identified these and three more measures as conservation needs for this ecosystem: completion of a final access management strategies for important lands and food storage order for federal lands, increased public outreach, and address the needs of grizzly bears outside the recovery zone. He also added enhanced connectivity between the Yaak and Cabinet Mountains portions of the CYE (C. Servheen, USFWS, personal communication. October 1, 2006).

Access Management

Road density conditions have been steadily improving in the CYE since 1987. Recently, the Kootenai and Idaho Panhandle National Forests amended their Forest Plans with final access management strategies that promote survival and recovery of grizzly bear populations. The status of access management for the BMUs in the action area (i.e. on the Kootenai National Forest) are summarized in Appendix A, Table A-3. Thus, the conservation need for access management on federal lands has been addressed.

Human-caused Mortality

In the entire CYE since 1982, there have been a total of 56 known human-caused grizzly bear mortalities, on all ownerships (including Canada) (USFWS 2004; USFS 2010b; 2011 supplement). Of the total mortalities, about 23 (41 percent) are known or suspected to involve people shooting grizzly bears. Some mortalities are still under investigation; at least six human-caused are undeterminable. Of these shooter- related mortalities, fourteen (61 percent) were non-malicious (mistaken identities, self-defense, and legal hunting in BC); but nine (39 percent) were deemed poaching. Of these, all nine occurred on National Forest lands and included two poaching cases, three mistaken identity cases, and four self-defense cases.

Attraction of grizzly bears to improperly stored food and garbage is identified as one of the principal causes of grizzly bear mortality (Kasworm et al. 2010), especially on private lands in the CYE. Since 1999, there appears to have been an increase in the numbers of bears killed on private lands in the CYE recovery area. Mortality on private lands in the U.S. has become the largest source of human-caused mortality in the CYE.

Grizzly bears are now being killed by humans at disproportionately higher numbers on private lands than on public lands: the CYE is about 90 percent public land, yet human-caused mortality on public land is only about 14 percent of the trend mortality. As in the NCDE, the MFWP employs grizzly bear specialists that work with the public, primarily to inform residents as to how to live in grizzly bear habitat without conflicts with bears. Among other measures to reduce self-defense and mistaken identity kills of grizzly bears, MFWP requires a mandatory black bear and grizzly bear identification training for all black bear hunters in the state.

The National Forests in the CYE are currently implementing sanitation programs. In 2002, pursuant to guidance from the IGBC, the Kootenai and Idaho Panhandle National Forests convened an Information and Education Workgroup to develop a comprehensive sanitation

program, including a food storage order on public land to help reduce bear habituation to humans and to minimize the potential for bear/human conflicts. These programs are near full implementation and will include, among other things, public education, and a food storage orders on national forest system lands within and around the recovery zone. The Kootenai signed their food storage order on June 3, 2011; the Idaho Panhandle reportedly will soon sign theirs (SCYE Grizzly Bear Subcommittee meeting notes, June 9, 2011), and the Lolo signed a Forest-wide order in spring 2011 (*Ibid.*).

Habitat Loss

Land acquisition and exchange has placed additional areas within this recovery zone in the public domain and may benefit the long term conservation of the species. There have been 2 major land exchanges in particular that have been beneficial to grizzly bear habitat within the CYE. In 1997 the Kootenai National Forest completed a land exchange in which 33 square miles of land owned by Plum Creek Timber Company were placed in public ownership. Almost all of this land was within the CYE grizzly bear recovery zone and is now under Forest Service management.

Factors Affecting the Grizzly Bear Environment on DNRC Trust Lands in the Action Area

DNRC manages grizzly bear habitat on trust lands through Forest Management ARMs 36.11.431 through 434, which apply within the grizzly bear recovery zones. In the HCP project area, these lands include the Stillwater Block, the Swan River State Forest, and scattered parcels in grizzly bear recovery zones.

In the Swan River State Forest, DNRC is a signatory party to the Swan Valley Grizzly Bear Conservation Agreement (Swan Agreement), an existing multi-party conservation agreement for grizzly bears in the Swan Valley (USFWS et al. 1995). The Swan Agreement provides a conservation framework for grizzly bears for intermingled land ownership in the valley. Cooperators currently include DNRC, the Flathead National Forest, and the USFWS.

The Nature Conservancy is a non-signatory cooperator on the Swan Agreement for lands it recently acquired from PCTC. The primary objectives of the agreement are to promote habitat connectivity between the Swan and Mission Mountains and to reduce mortality to bears. Provisions include caps on open road densities, timber harvest mitigations, coordinated scheduling of operations, and requirements for retention of hiding cover.

Current management and availability of important habitat for bears on DNRC trust lands is described below.

Access Management

DNRC ARM 36.11.421 requires that forest managers plan transportation systems for the minimum number of road miles needed.

Total and open road densities (TRD and ORD, respectively) based on a moving windows analysis on DNRC blocked lands in the HCP project area under current practices are shown in

Table II-7 by BMU subunit. We note that the USFS uses the acronyms OMRD and TMRD because their density calculations include motorized trails, whereas DNRC has virtually no administratively designated motorized trails, and so expresses densities as TRD and ORD.

As seen in Table II-7, the proportion of DNRC lands with TRDs exceeding two miles per square mile and ORDs exceeding one mile per square mile is highly variable for all subunits in which it owns lands. The ARMs address potential effects of high road densities that affect grizzly bears in the Stillwater Block through commitments for: 1) no net increase in ORDs in BMU subunits that exceed the road density objectives for the affected National Forest, 2) implementation of the Stillwater Core (described below under Secure Habitat), 3) considering seasonal closures of roads, and 4) maintaining road closure devices. Effects of road densities in the Swan River State Forest are addressed through coordinated management such that areas are rested for three years after 3 years of management, ORDs are maintained below 1 mile per square mile on at least 33 percent of BMU subunits, road closure devices are maintained, and seasonal road closures are implemented.

Table II-7. Baseline condition of total road densities, open road densities, and secure habitat on the HCP portion of the action area.

	Percent BMU Subunit in HCP project area portion of the action area	Proportion of DNRC Lands with TRD[1] exceeding 2mi/sq mi	Proportion of DNRC Lands with ORD[1] exceeding 1mi/sq mi	Proportion of DNRC Lands Providing Secure Habitat
Stillwater Block		**53**	**42**	**43**
Lower North Fork Flathead BMU		**5**	**6**	**80**
Werner Creek Subunit	1.3	5	6	80
Murphy Lake BMU		**0**	**4**	**93**
Krinklehorn Subunit	0.7	0	4	93
Stillwater River BMU		**56**	**43**	**42**
Lazy Creek Subunit	41.6	80	72	16
Stryker Subunit	80.6	38	38	49
Upper Whitefish Subunit	84.0	64	35	48
Upper North Fork Flathead BMU		**45**	**34**	**43**
Coal and South Coal Subunit	1.6	0.1	0.0	99
Hay Creek Subunit	5.4	55	3	29
State Coal Cyclone Subunit	42.8	45	40	43
Swan River State Forest		**77**	**36**	**21**
Bunker Creek BMU		**72**	**36**	**23**
Goat Creek Subunit	21.4	92	46	10
Lion Creek Subunit	10.6	98	46	5
South Fork Lost Soup Subunit	61.3	60	31	30
Mission Range BMU		**88**	**37**	**16**
Piper Creek Subunit	0.6	23	2	66
Porcupine Woodward Subunit	32.5	89	37	15

1. TRD and ORD estimated through moving windows analysis.

Source: Final EIS/HCP, Chapter 4, Tables 4.9-11, 4.9-13, and 4.9-15 (USFWS and DNRC 2010). TRD, ORD, and secure habitat values rounded for the purposes of this BO.

Road densities on scattered parcels calculated using a linear road density calculation are displayed in Table II-8. For scattered parcels in recovery zones it is evident that linear open road density generally exceed one mile per square mile and linear total road densities exceed two miles per square mile and that conditions are worse on NROH parcels than those in recovery zones. Table II-9 provides additional data on the number of scattered parcels within each road density class for the HCP project area by recovery zone and NROH for the NCDE and CYE. From the data in Table II-9, it can be discerned that 34 out of 60 parcels in the NCDE exceed two miles per square mile, linear TRD, and just 21 out of 60 parcels exceed one mile per square mile linear ORD. In the CYE, 12 and 11 out of 21 parcels have linear TRDs and ORDs greater than 2 mile per square miles and 1 mile per square miles, respectively. Effects of high ORDs on scattered parcels are minimized in the ARMs through a commitment for no net increase in ORD for parcels at 1 mile per square mile.

Table II-8. Linear open and total road density by DNRC Land Office on scattered parcels for recovery zones and NROH in the HCP project area portion of the action area under baseline conditions. .

	ORD		**TRD**	
Land Office	**Recovery Zones**	**NROH**	**Recovery Zones**	**NROH**
Northwestern	1.4	2.1	2.8	3.8
Southwestern	1.8	0.8	2.3	2.9
Central	0.2	1.4	0.2	1.5

Source: Final EIS/HCP, Chapter 4, Table 4.9-12 and 4.9-14 (USFWS and DNRC 2010)

Table II-9. Number of parcels and associated acreage by linear total and linear open road density class for DNRC scattered parcels in the action area in recovery zones and NROH.

		Total Roads				Open Roads			
		Recovery Zone		NROH		Recovery Zone		NROH	
Land Offices and Unit Offices by Recovery Zone	Density Class mi/mi^2	Parcel Count	Acres	Parcel Count	Acres	Parcel Count	Acres	Parcel Count	Acres
NCDE									
NWLO-Kalispell Unit	0-0.99	8	1,049	8	1,943	13	3,005	10	2,729
	1.0-1.99	2	904	2	665	5	1,954	2	665
	>2.0	16	5,126	9	3,357	8	2,119	7	2,571
NWLO-Plains Unit[b]	0-0.99	N/A	N/A	3	942	N/A	N/A	4	1,583
	1.0-1.99	N/A	N/A	1	582	N/A	N/A	1	582
	>2.0	N/A	N/A	2	1,282	N/A	N/A	1	641
NWLO-Stillwater Unit	0-0.99	6	748	5	587	8	1,845	15	5,927
	1.0-1.99	1	646	4	1,412	1	646	11	4,977
	>2.0	5	1,100	37	14,873	3	2	20	5,969
SWLO-Anaconda Unit[b]	0-0.99	N/A	N/A	3	1,670	N/A	N/A	5	2,949
	1.0-1.99	N/A	N/A	2	1,140	N/A	N/A	2	1,140
	>2.0	N/A	N/A	3	1,900	N/A	N/A	1	620
SWLO-Clearwater Unit	0-0.99	4	1,556	33	12,566	6	2,276	64	26,026
	1.0-1.99	0	0	4	1,536	0	0	8	3,554
	>2.0	11	3,226	52	21,888	9	2,505	17	6,410
SWLO-Missoula Unit	0-0.99	2	657	3	648	2	657	3	648
	1.0-1.99	2	627	0	0	3	1,183	0	0
	>2.0	2	1,195	0	0	1	638	0	0
CLO-Helena Unit [b]	0-0.99	1	639	13	4,117	1	639	15	4,960
	1.0-1.99	0	0	1	241	0	0	2	890
	>2.0	0	0	4	1,573	0	0	1	80
CYE									
NWLO-Libby Unit	0-0.99	3	1,283	3	234	4	1,922	9	1,951
	1.0-1.99	2	905	5	1,953	1	266	7	2,891
	>2.0	2	673	20	7,678	2	673	12	5,023
NWLO-Plains Unit	0-0.99	6	524	6	757	6	524	6	757
	1.0-1.99	2	908	0	0	2	908	0	0
	>2.0	6	1,882	6	1,500	6	1,882	6	1,500

Note: Roads classified as proposed, abandoned, or reclaimed were not included in density calculations.

[a] All lands on this unit occur outside of the HCP project area.

[b] N/A = not applicable. There is no such land area in the given unit.

Source: DNRC 2008a

Secure Habitat

Secure habitat for grizzly bears (core areas) is specifically defined by the IGBC (1998) as areas that are at least 0.3 mile from any open road or motorized trail and that receive no motorized use of roads or trails during the period they are considered secure habitat (typically at least 10 years). Such lands should also encompass areas of seasonal importance for bears throughout the year.

Under current practices, a key element of grizzly bear habitat management in the Stillwater Block is the management of secure habitat for grizzly bears. DNRC refers to these areas as "security core areas" and defines it in its ARMs as areas typically greater than 2,500 acres that during the non-denning period (1) are free of motorized access; (2) consider the geographic distribution of seasonal habitats important for grizzly bears; (3) remain in place for long periods, preferably 10 years; and (4) are at least 0.3 mile from the nearest access route that can be used by a motorized vehicle (ARM 36.11.403). Within the Stillwater Block, the security core area is referred to as the Stillwater Core. The Stillwater Core consists of approximately 39,600 acres and on these lands, commercial forest activities are limited to the denning season. The availability of secure habitat on DNRC lands in the Stillwater Block by BMU subunit is shown in Table II-7.

There are no specific commitments in the Swan Agreement to manage secure habitat for bears by the cooperators with the exception of the USFS, which manages core areas through Forest Plan Amendment 19 (USFS 1995a). Rather, the other cooperators in the Swan Agreement minimize disturbance and displacement of bears generated by human activities by providing quiet areas on their lands, whereby lands are rested, i.e., free from commercial activity after a period of active management. Within these quiet areas, low-intensity, administrative activities may occur, but public access is restricted. The Swan Agreement allows 3 years of management followed by 3 years of rest, although all parties currently institute 6 years of rest. The Swan Agreement contains provisions for some activities in rested subunits, for example limited post and pole harvest, bough harvest, and salvage harvest. The availability of secure habitat on DNRC lands in the Swan River State Forest by BMU subunit is shown in Table II-7.

Under current practices, measures to provide secure habitat and quiet areas are not applied on scattered parcels.

Spring Habitat

Spring habitat is defined as low-elevation sites or other sites that maintain less snow during the spring period (e.g., avalanche chutes, riparian areas, wet meadows, swamps), which are particularly important for offsetting bears' nutritional stress following hibernation. On the Stillwater Block, spring habitat is modeled using habitat value functions following Mace et al. (1999) and occurs in areas associated with roads possessing restricted status during the spring period. Spring habitat on the Swan River State Forest includes all areas below 5,200 feet in elevation. Spring habitat on DNRC scattered parcels refers to lands below 4,900 feet in elevation.

Availability of spring habitat was described in the Draft and Final EIS analysis for western Montana but was not determined specific to the grizzly bear action area. However, the availability of spring habitat in western Montana provides a reasonable representation of spring habitat in the action area because the action area is a subset of western Montana, which supports a similar proportion of land ownership and habitat types as the action area. As shown in Table II-10, spring habitat is widely available on blocked lands and scattered parcels throughout western Montana and the HCP project area. Spring habitat in the HCP project area accounts for approximately 3 percent of the spring habitat in the recovery zones and NROH in western Montana. More than 80 percent of the spring habitat in the HCP project area occurs on blocked lands (Stillwater and Swan River State Forest) in the NCDE.

DNRC defines the spring period as:

- April 1 through June 15 for non-spring habitat and April 1 through June 30 for areas within spring habitat for the Stillwater Block.

- April 1 through June 15 for lands within the Swan River State Forest and DNRC scattered parcels in recovery zones and NROH.

These dates are consistent with the current Forest Plan direction in the CYE (Section B). The dates are also consistent with those proposed by the NCDE Access Group (2002) for the Stillwater Block, but differ by 15 days in the Swan River State Forest. These dates were selected to balance DNRC operational needs with the security needs of bears. The June 15 date is consistent with current practices associated with the Swan Agreement, and it provides protective restrictions for the period immediately following the emergence of bears from dens, when they are nutritionally stressed following hibernation. In *Response to Peer Review of the A19 and Proposed Approach to Managing Access in Grizzly Bear Habitat*, prepared by the NCDE Access Group (USFWS 2001:11), the authors acknowledge that the June 30 date used in that approach was an attempt to accommodate social concerns, but they felt justified in modifying the date to June 30 (from July 15 as described in the literature) for two reasons. First, the most urgent concerns related to displacement from good habitat due to snow, mortality risk during black bear season, and vulnerability during the grizzly bear breeding season were all reduced or gone by the end of June. Second, the team acknowledged that there is no dramatic shift in elevational use by bears after mid-June. By this time, 80 percent of bear locations were at elevations above those used to describe spring habitat (4,900 to 5,200 feet).

Table II-10. Acreage of grizzly bear spring habitat in recovery zones and NROH in western Montana and the HCP project area portion of the action area by land office and administrative unit.

	Spring Habitat in Western Montana		Spring Habitat in the HCP Project Area	
Recovery Zone, Land Office, Unit	**Recovery Zone**	**NROH**	**Recovery Zone**	**NROH**
Northern Continental Divide Ecosystem	**1,580424**	**2,954,124**	**91,273**	**49,928**
NWLO Kalispell Unit	107,640	207,760	6,580	4,512
NWLO Plains Unit	N/A[1]	25,191	N/A[1]	N/A[1]
NWLO Stillwater Block	48,649	53	48,571	48
NWLO Stillwater Unit	467,628	338,817	2,467	16,822
NWLO Swan River State Forest	31,871	N/A[1]	31,738	N/A[1]
NWLO Swan Unit	506,351	N/A[1]	N/A[1]	N/A[1]
SWLO Anaconda Unit	N/A[1]	8,126	0	0
SWLO Clearwater Unit	32,205	363,038	1,821	28,306
SWLO Missoula Unit	4,564	1,569	92	149
CLO Conrad Unit	310,793	596,481	N/A[1]	N/A[1]
CLO Helena Unit	70,723	160,089	4	91
Cabinet-Yaak Ecosystem	**816,411**	**699,336**	**5,843**	**12,036**
Libby Unit NWLO	566,262	449,752	2,832	9,779
Bitterroot Ecosystem	250,149	249,584	3,011	2,257
Bitterroot Ecosystem	**31,177**		**181**	
Hamilton Unit SWLO	5,344	N/A[1]	N/A[1]	N/A[1]
Missoula Unit SWLO	25,833	N/A[1]	181	N/A[1]
Greater Yellowstone Ecosystem		**29,857**		
Bozeman Unit CLO	N/A[1]	29,857	N/A[1]	0
Dillon Unit CLO	N/A[1]	0	N/A[1]	0
Total	**2,428,010**	**2,430,316**	**97,296**	**63,772**

[1] N/A = not applicable. Where N/A is listed in the table, there is no such land area in the given unit.
Source: Final EIS/HCP, Chapter 4, Table 4.9-5 (USFWS and DNRC 2010).

Under current practices, DNRC does not limit forest management activities (including road use) in spring habitat. Wildlife biologists may apply restrictions at the project level to protect spring habitat but there is explicit direction for which activities should be limited or how. On the Swan River State Forest, seasonal restrictions identified in the Swan Agreement limit most activities in spring habitat within linkage zones.

General Hiding Cover

There are no broadly accepted IGBC standards related to grizzly bear cover. DNRC defines grizzly bear hiding cover as vegetation or topography that hides 90 percent of a grizzly bear from view at the distance of 200 feet (DNRC 2008a).

Availability of hiding cover specific to the action area was not determined due to the complexity of the analysis. Table II-11 shows existing forested hiding cover on DNRC lands in the HCP project area both inside and outside the recovery zones.

Under current practices, DNRC maintains hiding cover in certain areas, where practicable. In the Stillwater Block and the Swan River State Forest and on scattered parcels in grizzly bear recovery zones, visual screening is provided, where available, along all riparian management zone and wetland management zones. DNRC is also required to provide visual screening adjacent to open roads in recovery zones to the extent practicable. Within the Swan River State Forest and the Stillwater Block, DNRC retains no less than 40 percent of the trust lands in any BMU subunit in hiding cover. As evidenced in Table II-11, these provisions have resulted in 60 percent of the HCP project area providing hiding cover for bears.

Table II-11. Acres of grizzly bear hiding cover in the HCP project area by land office for recovery zones and all lands outside recovery zones under baseline conditions and at year 50 under the HCP.

DNRC Land Office	Acres of Hiding Cover[1]	
Status of Hiding Cover in and out of Recovery Zones	**Baseline Condition**	**Year 50 – HCP**
CLO Total	**30,409**	**35,320**
CLO in Recovery Zones	231	252
CLO outside Recovery Zones	30,178	35,068
NWLO Total	**186,464**	**185,553**
NWLO Total in Recovery Zones	103,247	104,043
NWLO Total outside Recovery Zones	83,217	81,510
Stillwater Block in Recovery Zones (includes blocked and scattered parcels)	61,745	61,605
Stillwater Block outside Recovery Zones (includes scattered parcels)	11,015	11,065
Swan River State Forest in Recovery Zones (blocked lands)	31,121	32,371
Other NWLO Units in Recovery Zones (Kalispell, Libby, Plains)	10,381	10,067
Other NWLO Units outside Recovery Zones (Kalispell, Libby, Plains)	72,202	70,445
SWLO Total	**61,695**	**60,677**
SWLO in Recovery Zones	4,000	3,917
SWLO outside Recovery Zones	57,695	56,760
TOTAL in Recovery Zones (% of recovery zone acres)	107,478 (69.7)	108,211 (70.2)
TOTAL outside Recovery Zones	171,090	173,338
GRAND TOTAL	**278,568**	**281,549**
Estimated Percent Cover in the Project Area[2]	62.4	63.1

[1] Cover estimates in this table represent acreages of coniferous stands that are likely to provide screening characteristics that will hide grizzly bears. However, due to model limitations, no patch size, patch shape, or other spatial aspects can be presumed from these values.

[2] Percent cover determined from 446,095 acres of manageable timer in the project area.

Source: Final EIS/HCP, Chapter 4, Table 4.9-17 (USFWS and DNRC 2010).

Denning and Post-denning Habitat

DNRC defines denning and post-denning habitat as areas with slopes greater than 45 percent at elevations greater than 6,300 feet (Mace and Waller 1997:41). Methods for identifying this habitat in western Montana are described in DNRC (2008). Of 1.8 million acres of denning and post-denning habitat in recovery zones and NROH in western Montana, less than 1.0 percent

occur in the HCP project area portion of the action area (Table II-12). The HCP project area portion of the action area contains 5,863 acres of post-denning habitat within recovery zones (mostly in the Stillwater Block in the NCDE) and 3,073 acres in NROH (mostly within the GYE).

Under current practices, DNRC defines the denning period as November 16 through March 31 and provides den site protection on a case-by-case basis program-wide. These dates differ from those proposed by the NCDE Access Group (2002): December 1 through March 31. DNRC's November 16 date means rested subzones can be entered two weeks earlier for commercial harvest than allowed on Federal lands. These two weeks are necessary for DNRC to conduct the activities necessary to sustain a viable, income generating forestry operation on trust lands.

DNRC does not have post-denning restrictions on scattered parcels under current practices. By default, post-denning habitat is protected in the Stillwater Block since commercial forest activities are only allowed during the denning season (meaning they must end by March 31. Under the Swan Agreement, salvage harvest is only allowed in inactive subunits for 30 days each between June 15 and September 1 each year, which avoids the potential to disturb bears during den entry and emergence in inactive subunits.

Table II-12. Acreage of grizzly bear denning and post-denning habitat within western Montana and the HCP project area for recovery zones and non-recovery occupied habitat.

	Denning and Post-denning Habitat in western Montana (all ownerships)[1]		**Denning and Post-denning Habitat in the HCP project area portion of the action area**	
Recovery Zone (Scattered or Blocked Status)	**Recovery Zone**	**NROH**	**Recovery Zone**	**NROH**
NCDE	**957,626**	**31,176**	**5,863**	**812**
Stillwater Block	NA[2]	NA	4,498	NA
Swan River State Forest	NA	NA	1,266	NA
Scattered Parcels	NA	NA	98	812
CYE – scattered	**32,919**	**254**	**0**	**0**
BE – scattered	**146,719**	**0**	**0**	**0**
GYE – scattered	**249,433**	**430,271**	**0**	**2,261**
Total	**1,386,697**	**461,702**	**5,863**	**3,073**

Note: Totals may not add up due to rounding.
[1] For columns where acreages portrayed are for "all ownerships," the designation of scattered versus blocked lands is not applicable.
[2] N/A = not applicable. Where N/A is listed in the table, there is no such land area in the given unit.
Source: Final EIS/HCP, Chapter 4, Table 4.9-7 (USFWS and DNRC 2010).

Habitat Linkage

The Draft and Final EIS evaluated linkage in western Montana using methods developed by DNRC (2008) that are similar to those used by Servheen et al. (2001). The DNRC (2008) methods incorporate measures of road density, secure areas, developed sites, and grizzly bear hiding cover to identify and map areas with the greatest potential linkage value. The results of this analysis are displayed on Figures D-18A, B, and C in the Final EIS/HCP 2010, Appendix D and disclose the relationship of the HCP project area to areas estimated by DNRC to have importance for linkage.

More than 6 million acres of potential linkage for grizzly bears are estimated to occur in western Montana (Table II-13). Approximately 123,513 acres (2 percent) lie within the HCP project area; the majority of the potential linkage habitat occurs in the NWLO (Tables II-13).

Under current practices, DNRC implements spring restrictions for specific linkage zones in the Swan River State Forest that apply under the Swan Agreement. For all other forested trust lands, DNRC ARMs incorporate measures that are generally supportive of maintaining linkage for a diversity of species but are not tied to specific linkage zones defined by DNRC or others. For example, Servheen et al. (2001) identified a large, important linkage zone along Highway 93 that is adjacent to the southwest boundary of the Stillwater Block. There are no specific commitments applicable to that identified linkage zone; however, projects on all the bordering trust lands would be required to meet cover, security, and road density commitments established in the Forest Management ARMs for supporting effective linkage in that area.

Table II-13. Acreage of potential habitat linkage (DNRC model) within western Montana, by land ownership.

	Habitat Linkage within Western Montana	
Ownership	**Acres**	**Percent of Total[1,2]**
U.S. Forest Service	1,746,661	27.7
Bureau of Land Management	153,578	2.4
National Park Service	153,224	2.4
Other Federal	34,997	0.6
DNRC (non-HCP)	318,141	5.0
HCP Project Area	123,513	**2.0**
NWLO	71,650	**1.1**
SWLO	43,859	**0.7**
CLO	8,004	**0.1**
Other State (Non-DNRC)	151,388	2.4
Private Industrial Forest	136,540	2.2
Other Private	3,158,783	50.2
Other Land Ownership	436,320	6.9
Total	**6,289,632**	**100**

[1] Numbers may not sum to total due to rounding. [2] These values were adjusted to take into account results based on outputs from the Servheen et al. (2003) effort and the Swan Agreement (USFWS et al. 1995).
Source: Final EIS/HCP, Chapter 4, Table 4.9-9 (USFWS and DNRC 2010).

Risk Factors Related to DNRC Activities Affecting Grizzly Bears and Their Environment in the Action Area

In many instances, DNRC has adopted the IGBC Guidelines or attempted to address risk factors for bears through other measures incorporated into its ARMs. Two major factors are affecting grizzly bear recovery: (1) habitat loss and degradation and (2) direct bear-human conflicts, especially those resulting in grizzly bear mortality (USFWS 1993).

Habitat loss and degradation can occur on private or public land and is manifested by a) direct habitat conversion to development (mostly on private lands), and b) construction of roads (which can lead to bear avoidance of habitat and/or disturbance and a decrease in secure habitat). Poor forestry practices can also degrade habitat by affecting regeneration of forested cover and/or forage for bears. Poor forestry practices were of greater concern in the past but modern prescriptions are mostly compatible with perpetuating grizzly habitat. The DNRC HCP incorporates modern forestry practices.

As mentioned earlier, direct grizzly bear-human conflicts continue to occur in several ways and as a result of several causes (see Section C). In general, the overwhelming majority of adult grizzly bear deaths are caused by people (Mace and Waller 1998; McLellan et al. 1999; Benn and Herrero 2002; Wakkinen and Kasworm 2004). Direct grizzly bear- human conflict has not been an issue on DNRC lands in the past.

Some DNRC activities may contribute to risk factors for bears including: 1) construction of roads, which contribute to a decrease in secure habitat, increased risk of human bear conflicts, and displacement of bears from important seasonal habitats, 2) forestry practices that affect important habitat features for bears or reduce hiding cover, screening, and habitat linkage effectiveness, 3) disturbance or displacement of bears from habitats or as a result of forestry-related, mechanized activities, 4) livestock licenses on forested trust lands, 5) direct bear-human confrontations due to staff and contractors in the field, and 6) disposal of lands to private development.

This BO focuses on activities that are addressed directly or indirectly in the HCP as part of DNRC's conservation commitments. These include:

- Disturbance and Displacement Associated with Road Densities and Secure Habitat on Forested Lands
- Forestry Practices that Affect Grizzly Bear Habitat
- Disturbance and Displacement Resulting from Forestry-Related Mechanized Activities
- Livestock Operations on Forested Trust Lands
- Human-Bear Conflicts on Forested Trust Lands
- Land Disposals and Acquisitions

D. EFFECTS OF THE ACTION ON GRIZZLY BEARS

The effects of the action include the direct, indirect, interrelated and interdependent effects of the proposed HCP on grizzly bears within the action area. As described above, bears can be affected in a number of ways by the forest management activities considered for coverage under the HCP. The effects of the HCP for each of the primary factors for grizzly bears are addressed below. Each subsection is introduced by a bullet statement summarizing a potential effect and cause. Some bullet statements describe potential effects that span categories; for example, reduced visual screening is a habitat modification that results in an increased risk of bear-human conflicts. Next described are the indicators used to measure the effects of the proposed action on grizzly bears. And, finally is an analysis and description of the effects of the proposed HCP on grizzly bears.

Factors to be Considered

DNRC's ability to mitigate potential risk factors for grizzly bears varies with its land base. Under the HCP, DNRC has applied greater conservation emphasis in grizzly bear recovery zones, particularly in the NCDE where DNRC owns larger areas of land ("blocked" lands) and has greater control over the actions on those lands. Additionally, under the HCP, DNRC has applied more restrictive measures in the CYE where the grizzly bear population trend is declining. Conservation efforts on DNRC lands in recovery zones are often enhanced by their proximity to federal lands where active recovery efforts are ongoing. DNRC's scattered parcels also have a role in meeting the HCP biological goals and objectives; however, DNRC's measures on these lands may at times provide limited benefit to bears due to actions (e.g. timber harvest, roading, subdivision, fragmentation of habitat, and other development) by adjacent landowners (corporate and private timber companies, residential and business land owners).

The following analysis pertains to the effects of the proposed HCP on grizzly bears. The following sections analyze the effects of the measures contained in the proposed action (DNRC HCP) on grizzly bears for the risk factors identified above in Section C.

Analysis for Effects of the Action

This BO evaluates the effects of proposed actions and elements that are addressed directly or indirectly in the HCP as part of DNRC's conservation commitments. These include: 1) construction and maintenance of roads in grizzly bear habitat, which can contribute to a decrease in secure habitat, increased risk of human-bear conflicts, and displacement of bears from important seasonal habitats, 2) forestry practices that can affect important habitat features for bears or reduce hiding cover, screening, and habitat linkage effectiveness, 3) disturbance or displacement of bears from habitats as a result of mechanized activities, 4) livestock grazing licenses on forested trust lands, 5) direct bear-human confrontations due to staff and contractors in the field, and 6) disposal of lands to private development. We used the complete information related to the conservation commitments found in Final EIS/HCP 2010, Appendix A, and so incorporate by reference.

Effects of Access Management on Forested Trust Lands

Roads can affect grizzly bears both directly and indirectly in terms of disturbance, displacement, habituation, and increased risk of human-caused mortality. The following section analyzes road densities and secure habitat under the HCP. Additional measures to reduce displacement and human-bear conflicts are discussed in subsequent sections of this analysis.

Road Densities

Road density is a measure commonly used to assess the effects of roads on grizzly bears. It is important to note that the effects of total and open road density on grizzly bears are difficult to predict for several reasons. The effects of any roads or roaded habitat on grizzly bears varies due to (1) the amount of use by people that actually occurs on road systems, (2) locations of roads (e.g. spring habitat, fall habitat) (3) locations where grizzly bears may occur at any given time, (4) variations in how individual grizzly bears may respond to roads and humans, and (5) variations in how individual people may respond to grizzly bears in habitats near roads.

The preferred method of road density calculation, recommended by the IGBC where applicable, is a GIS-based 'moving windows' analysis (IGBC 1998; USFS 1995b). This method considers the spatial location of roads in relation to one another. For wide-ranging species, this method is preferred for assessing impacts at large scales (USFS 1995b). For grizzly bears, the appropriate scale of assessment is approximately fifty square miles to over a hundred square miles, which approximates the size of adult female grizzly bears' home ranges in an ecosystem or in a particular portion of the ecosystem. Average annual home range sizes may vary significantly between ecosystems, and in some cases within ecosystems, therefore analysis unit (e.g. BMU and BMU subunits) size varies as well. Moving windows analysis requires input of adequate open and restricted road layers, an adequate motorized trail layer, and a defined analysis area. This methodology provides land managers with the ability to create density contour maps for visually assessing effects and understanding *where* the greatest road densities occur within an analysis unit, such as a subunit. In this way, moving windows analysis provides more than just a simple density estimate over a given area (USFS 1995b).

The results of the moving windows roads analysis for grizzly bears are typically summarized as the proportion of a BMU or BMU subunit in two defined density classes (e.g., less than 1 mile per square mile of open road, more than 2 miles per square mile of total roads), and areas greater than 0.3 miles from open roads, or 'core'. Secure habitat is also expressed as the proportion of a BMU or BMU subunit meeting the definition of secure habitat (core area).

In the NCDE, a moving windows method was used to establish road density objectives for federal lands that were based on ecosystem-specific grizzly bear research (Mace and Manley 1993). The research provided information with which to establish benchmarks (i.e. proportions or percent of BMU or subunit) for each density class and core. In a similar fashion, CYE grizzly bear research (Wakkinen and Kasworm 1997) was used in the CYE to establish federal road management standards.

The DNRC access management strategy is based in part on IGBC Taskforce (1998) recommendations for federal land management, as it considers both open and total road densities, as well as secure areas (i.e. core). The DNRC employed a 'moving windows' analysis to estimate open and total road densities and secure habitat on its blocked lands in the Stillwater Block and Swan River State Forest. In these areas, DNRC manages large, contiguous blocks of land and can control the types of activities that occur on those lands. Road density on these blocked lands is analyzed at the BMU subunit scale. However, DNRC has not adopted the IGBC recommendation for federal lands to manage at research-based benchmark levels for road density and secure habitat (IGBC 1998).

The appropriate scale to use a moving windows analysis is at the BMU or BMU subunit scale, which generally approximate the average size of a female grizzly bear home range within an ecosystem or region of an ecosystem. Employed at larger scales, there is risk of obscuring the effects of roads in some areas of the unit due to too large an analysis area; large scale analyses may dilute the significance of high road densities in smaller areas of an actual grizzly bear home range that lie within or overlapping the larger analysis area. At smaller scales, the effects of road densities as a percent of the analysis unit are also more difficult to ascertain, as grizzly bears use relatively large home ranges; smaller scale analyses do not account for lands that would lie outside the analysis area, but within a grizzly bear's home range. Further, as mentioned, it is more difficult to manage limits on road densities at smaller scales, because any particular road and buffer would impact proportionately more of the analysis unit.

DNRC used the moving windows analysis method used by the USFS to measure open road densities for the HCP analysis. DNRC examined changes in its road densities measured as TRD/ORD on its lands and then examined how its TRD/ORD affected subunit level TMRD/OMRD. We note that the USFS uses the acronyms OMRD and TMRD because their density calculations include motorized trails, whereas DNRC has virtually no administratively designated motorized trails, and so expresses densities as TRD and ORD. Hence, in the following analysis we use TRD/ORD to refer to road densities on DNRC lands and TMRD/OMRD to refer to road densities at the BMU or subunit scale. However, due to limitations on data accuracy on DNRC lands and neighboring ownerships, and scale limitations they applied the method only to HCP blocked lands within subunits. This analysis is conservative in that the HCP blocked parcels are smaller than subunits and thus the influence of roads would be overemphasized by the open road density value, more so as parcel size decreases.

For scattered parcels throughout the action area, an alternative method of assessing road density is proposed. A simple linear calculation was used and is expressed as miles of road per square mile of land area (mile/square mile). This method was employed for scattered parcels for this analysis because road data for scattered parcels and particularly for adjacent private lands is limited. Many scattered parcels (about 70 percent) are less than or equal to one square mile in size (640 acres) surrounded by a matrix of other ownerships, including national forest lands, private industrial forest lands, and private lands. The application of a moving windows analysis for road effects on grizzly bears would not be appropriate at these small scales. Results calculated through a linear road density method are not comparable to those calculated through moving windows analysis. However, anticipated changes in linear road density on trust lands

under the HCP can serve as a consistent metric for evaluating road-related effects on grizzly bears in scattered parcels.

The methods used by DNRC to estimate future miles of road on blocked lands and on scattered parcels are described in detail in the Final EIS (2010), Chapter 4, page 4-324. We note that Table 2-2 from the HCP has since been revised and is presented in this BO as Table II-14, but the revisions did not change the road density estimates identified in the Final EIS/HCP (2010) and captured in Tables II-15 and II-20 of this BO.

Additionally, we note that when the EIS/HCP analysis was completed, the primary adjacent landowner in the Swan River State Forest was the PCTC. Therefore, in the EIS/HCP analysis the assumption was made that if the Swan Agreement was terminated or if PCTC were to dispose lands in the Swan River State Forest, the existing reciprocal access agreement could require DNRC to consider a number of roads as open on these adjacent lands as access would no longer be controlled by the Swan Agreement or DNRC. As a result, the calculation of open road miles and densities as presented in the Final EIS/HCP (2010) is high. In 2008, TNC and the Trust for Public Land entered into a real estate purchase and sale agreement with PCTC to purchase approximately 310,585 acres of forested land in Montana (Montana Legacy Project). As part of this sale agreement, TNC transferred approximately 45,000 acres of land in the Swan Agreement area to the Flathead National Forest in March 2010. As part of the sale agreement, Plum Creek Marketing, Inc. and TNC entered into a Fiber Supply Agreement (FSA) requiring TNC to harvest and deliver a steady supply of logs over ten years to Montana mills owned by PCTC. In the conveyance of forest lands to the USFS, in order to satisfy the FSA, TNC has reserved all trees of merchantable timber value on the USFS lands until 2018 and has the right and obligation to undertake clean-up and slash reduction activities until December 31, 2021. As it fulfills the FSA, TNC has agreed to follow the requirements of Swan Agreement, as had PCTC. Additionally, TNC also owns the remaining PCTC lands managed under the Swan Agreement. Plum Creek no longer owns land within the Swan Agreement area. DNRC recently acquired 1,900 acres on 4 parcels from TNC in the Swan River State Forest. DNRC also has a one-year purchase agreement for the remaining 14,630 acres, but has secured no funds to complete the transaction. Under the Swan Agreement in its current form, no changes are anticipated in the miles of road open to motorized public access in the Swan River State Forest. If the Swan Agreement is terminated, the reciprocal access agreement would allow TNC discretion to manage affected DNRC roads as open for their use, limiting any DNRC regulatory control over their access. Ownership by TNC (versus PCTC) makes this scenario less likely to occur because TNC's objective in acquiring the lands is to seek a conservation buyer so that these lands remain a working forest providing conservation for fish and wildlife.

The effects of roads on grizzly bears are described below in terms of total road density and open road density. For this analysis, total roads include those classified as restricted, along with open, private, or seasonally open roads. Open roads include those classified as open, private, or seasonally open, and exclude restricted highway, and county roads as consistent with the methods of Ake (USFS 1995). Temporary roads would also typically be built and used in conjunction with commercial forest management activities. The construction and use of temporary roads are likely to have similar displacement effects on grizzly bears as more

permanent, restricted roads, albeit for much shorter times. We presume that permanent open and permanent restricted roads pose a greater potential risk for grizzly bears than temporary roads because after a period of use (typically 3 to 5 years), temporary roads are physically treated so that they no longer function as open or restricted roads or as trails. Therefore, temporary roads would not be subject to long-term periodic motorized or nonmotorized use as would be expected for a permanent open or restricted road. Thus, the quantified analysis of permanent open and total road densities was considered the most relevant analysis approach for assessing risk to grizzly bears at the landscape scale.

Potential Effects of Total Road Densities on Grizzly Bears

- The presence of a network of open and restricted roads on the landscape, and routine, sporadic or infrequent motorized use of these roads by people, may cause some bears to avoid areas they might otherwise use for feeding, breeding, and sheltering.

Indicators Used to Measure Effects of Total Road Density on Grizzly Bears

As described above, in a number of North American studies, the presence of roads has been shown to reduce habitat effectiveness or increase the risk of grizzly bear mortality. It is widely accepted that grizzly bears shift their behavior in response to human activities on roads, not in response to the physical presence of the roads themselves. Open roads appear to elicit a more pronounced response than closed roads (Mace et al. 1996; IGBC 1998). However, even closed roads elicit a response, probably because closed roads still receive certain levels of human use.

Road densities are an index of the extent of human access on the landscape. Total road density is used as an indicator of the relative amount of road prisms on the landscape to assess risk of grizzly bear displacement from habitat important for feeding, breeding, and sheltering. As described above, the USFWS generally evaluates the effects of road presence on grizzly bears expressed as a percent of a given BMU or BMU subunit with a total road density greater than 2 miles per square mile, based on the available research and information on roads and grizzly bears (Waller and Mace 2006, IGBC Taskforce 1998, Wakkinen and Kasworm 1997, Mace and Manley 1993). In the South Fork study area in the NCDE, generally, adult female grizzly bears significantly underused habitat with total road densities higher than 2 miles per square mile (Mace and Manley 1993). Additionally, less than 19 percent of a composite home range for adult females had total road densities of 2 miles per square mile or more (Ibid). Therefore, we assume that an adult female in the NCDE can likely effectively use her home range to successfully breed and raise her cubs if about 19 percent or less of a BMU subunit exhibits a total road density greater than 2 miles per square mile, and open road densities and core are managed adequately (see below, *Indicators Used to Measure Effects of Open Road Densities on Grizzly Bears*). Above this level of total road density, adult females may begin to experience loss of important habitat resources through significant avoidance of highly roaded areas. In the CYE, this avoidance may occur when the total road density exceeds two miles per square mile in over 26 percent of a BMU, based on the moving windows method used in the CYE (Wakkinen and Kasworm 1997).

Analysis of Effects of Proposed Total Road Density Management on Grizzly Bears

This section describes the measures DNRC would implement under the HCP to minimize and mitigate the effects of total road densities on grizzly bears in the HCP project area.

Under existing practices ARM 36.11.421 requires that forest managers plan transportation systems for the minimum number of road miles needed. This measure would continue under the HCP. In addition, transportation plans in the Stillwater Block and Swan River State Forest specify how many miles and where new roads can be constructed over the 50-year Permit term thereby controlling the total number of roads that could be constructed on blocked lands.

The commitments under the HCP for the Stillwater Block, Swan River State Forest, and scattered parcels are further described below. See also Final EIS/HCP 2010, Appendix A.

***Stillwater Block* -** The transportation plan for the Stillwater Block under the HCP (ST1) would prohibit the construction of new permanent roads on Class A lands (19,400 acres)(ST2). The prohibition of new permanent roads on Class A lands would minimize long-term displacement and mortality risk to bears using these areas. Further ST2, also requires a subzone management/rest scenario to provide secure habitat for grizzly bears. Class A lands are lands adjacent to federal ownership currently managed by the USFS as secure habitat for grizzly bears. The transportation plan would designate the length and locations of roads to be constructed on Class B lands (71,400 acres). Class B lands are adjacent to industrial private or federally-managed timberlands and rural/residential properties. New road construction on Class B lands would be limited to 19.3 miles in the Stillwater Block over 50 years (Table II-14). See the HCP (Final EIS/HCP 2010, Appendix A) for complete conservation measures for the Stillwater Block.

Table II-14. Road miles by road class, activity category, and restriction type for the Stillwater Block under baseline conditions and at year 50 under the proposed HCP.

Road Class	Activity Category			Road Miles	
	Motorized Public Access	Commercial Forest Management Activity	DNRC Low Intensity Forest Management Activity	Baseline Condition	Year 50 Proposed HCP
Existing Roads	**Restriction Type**	**Restriction Type**	**Restriction Type**		
Open (Highway/ County) − 170	Open Year-Round	Open Year-Round	Open Year-Round	1.9	1.9
Open (Forest Road) − 190	Open Year-Round	Open Year-Round	Open Year-Round	123.4	103.9
Restricted − 130	Restricted Seasonally†,††	Restricted Spring	Open Year-Round	6.4† –	25.7† 19.2
Restricted − 131	Restricted Seasonally†,††	Restricted Spring	Restricted Spring	– –	5.1† 5.0††
Restricted − 120, 121	Closed Year-Round	Open Year-Round	Open Year-Round	229.3	126.9
Restricted − 127, 128	Closed Year-Round	Restricted Spring	Open Year-Round	–	55.6
Restricted − 125, 126	Closed Year-Round	Restricted Spring	Restricted Spring	–	17.5
			Subtotal	361.0	360.9
Proposed Roads	**Restriction Type**	**Restriction Type**	**Restriction Type**		
Proposed − 021	Closed Year-Round	Open Year-Round	Open Year-Round	–	12.4
Proposed − 027	Closed Year-Round	Restricted Spring	Open Year-Round	–	2.6
Proposed − 025	Closed Year-Round	Restricted Spring	Restricted Spring	–	4.3
			Subtotal	0.0	19.3
			TOTAL	361.0	380.2

[a] Numbers reflect those used in DNRC road database and are shown in this table for organizational purposes.
† Public Spring Restrictions − April 1 - June 30
†† Public Spring/Fall Restrictions − April 1 - June 30 AND September 16 - November 30
Source: DNRC 2011. Updated version of DNRC HCP, Chapter 2, Table 2-2.

On the HCP lands in the Stillwater Block the proportion of trust lands where TRDs exceed two miles per square mile occurs in five subunits (Table II-15): Lazy Creek, Stryker, Upper Whitefish, Hay Creek and State Coal Cyclone. The 'TRD' on DNRC *portions* of these subunits currently exceed the research benchmark for 'TMRD' (i.e., less than 19 percent [*of a subunit*] exceeding 2 miles per square mile). This condition would persist and increase in four of these five subunits under the HCP (Table II-15, columns 4 and 6). In four of the eight subunits on the Stillwater Block, DNRC has substantial ownership (greater than 40 percent): Lazy Creek, Stryker, Upper Whitefish, and State Coal Cyclone. The TMRDs measured at the BMU subunit scale for all ownerships in these subunits also exceed the research benchmark. Thus, due to high TRDs and the amount of DNRC ownership, DNRC TRDs substantially impact TMRDs at the

BMU subunit scale in these four subunits. The levels of subunit TMRD in these four subunits are likely to impair the breeding, feeding, or sheltering needs of some individual adult female grizzly bears attempting to use the areas now and during some periods of the 50-year permit term. In the Hay Creek subunit, where TRDs are high, DNRC's TMRD is below research benchmarks and expected increases do not cause increases in TMRD. The subunit TMRD is below the research benchmark and expected to remain so. Hence, for this subunit, and the other subunits, including Werner Creek, Krinklehorn, and Coal and South Coal, we expect that adverse effects on bears may occur on DNRC lands on occasion, but these effects are insignificant given conditions in the subunit (including federal land management), effects of the projected increases in subunit and the measures implemented by the HCP and the amount of DNRC landownership in the subunit.

Table II-15. Moving windows estimate of TMRD (all ownerships) and TRD (DNRC lands) within grizzly bear subunits containing HCP project area lands under baseline conditions and in 50 years under the HCP.

	Baseline Condition				HCP – Year 50		
	All Ownerships		HCP Portion of the Action Area		All Ownerships	HCP Portion of the Action Area	
BMU, and Corresponding Subunit	**Subunit Acres**	**Percent of Subunit Exceeding 2 mi/mi^2 TMRD**	**Acres (Percent) of HCP Project Area Lands within Subunit**	**Percent of Project lands Exceeding 2 mi/mi^2 TRD**	**Percent of Subunit Exceeding 2 mi/mi$_2$ TMRD[1]**	**Acres (Percent) of Lands Exceeding 2 mi/mi^2 TRD**	**Acres of Lands Exceeding 2 mi/mi^{2}TRD**
Stillwater Block							
Lower N. Fork Flathead BMU							
Werner Creek	28,607	26	383 (1.3)	5	26	5	19
Murphy Lake BMU							
Krinklehorn	47,487	18	326 (0.7)	0	19	0	0
Stillwater River BMU							
Lazy Creek	34,559	82	14,365 (41.6)	80	83	80	11,432
Stryker	40,860	34	32,923 (80.6)	38	34	42	13,866
Upper Whitefish	32,201	58	27,035 (84.0)	64	59	67	18,124
Upper N. Fork Flathead BMU							
Coal and South Coal	25,249	30	413 (1.6)	0	30	0	0
Hay Creek	33,658	14	1,807 (5.4)	55	13	57	1,030
State Coal Cyclone	31,366	27	13,420 (42.8)	45	25	55	7,411
Swan River State Forest							
Bunker Creek BMU							
Goat Creek	27,602	61	5,894 (21.4)	92	61	98	5,752
Lion Creek	29,047	48	3,067 (10.6)	98	49	100	3,067
South Fork Lost Soup	29,883	47	18,324 (61.3)	60	47	81	14,761
Mission Range BMU							
Piper Creek	30,992	48	177 (0.6)	23	49	67	118
Porcupine Woodward	37,666	76	12,237 (32.5)	89	76	99	12,080

[1]. TRD calculated using moving windows method per USFS (1995b).
Source: DNRC Final HCP (2010) Table 7-2. TMRD and TRD were rounded for the purposes of this analysis.

The DNRC would restrict motorized public use on all new roads to decrease displacement of bears and to reduce human-caused mortality risk to grizzly bears. Of the 19.3 miles of new road, all would be restricted year-round from motorized public access, 6.9 miles would be further restricted from commercial use by DNRC during spring, and 4.3 miles would be subject to spring restrictions for low-intensity DNRC activities. However, roads would receive varying levels of use by DNRC and their contractors for 50 years, likely imparting similarly varying levels of displacement effect: from very little to significant effects. Therefore, now and during some periods of the 50 year permit, the levels of TMRD in Lazy Creek, Stryker, Upper Whitefish, and State Coal Cyclone subunits are likely to impair the breeding, feeding or sheltering needs of some individual adult female grizzly bears attempting to use the area, given existing subunit conditions and anticipated increases in total roads. Because site-specific conditions will vary over the years, and because individual grizzly bears respond differently to roads, we do not expect that all adult female grizzly bears living in the area over the Permit-term would experience this level of impacts. We expect the transportation plan, Stillwater commitments, and other applicable would directly or indirectly reduce the adverse effects on grizzly bears related to high linear TRDs on DNRC parcels. The Final EIS /HCP 2010, Appendix A describes each of these commitments and how these commitments reduce impacts on grizzly bears, including reducing road construction and retaining visual screening in the riparian and wetland management zones and avalanche chutes. Firearms use by employees and contractors would not be allowed and proper food storage is required. These reduce and minimize some of the adverse impacts of high road densities on grizzly bears using the area. We note that over the 50-year Permit term, TMRDs will remain high, but either will not increase, or increase only slightly in the Stillwater.

***Swan River State Forest* -** Transportation commitments for the Swan River State Forest would be very similar to those for the Class B lands in the Stillwater Block, except that all of the Swan River State Forest lands would be subject to the subzone rest requirements under both the Swan Agreement and the proposed HCP (whereas in the Stillwater, only Class A lands would be subject to rest). In subzones during rest periods, road access by the public and DNRC commercial activities would be restricted to the winter denning period for grizzly bears. DNRC administrative activities/low intensity activities would be allowed year round with additional spring restrictions (described in commitments GB-ST2(3) and GB-NR3, in Final HCP Chapter 2). New road construction in the Swan River State Forest would be limited to approximately 70.3 miles over 50 years, as identified in the transportation plan (Table II-16). See the HCP (Final EIS/HCP 2010, Appendix A) for complete conservation measures for the Swan River State Forest.

In the Swan River State Forest, the proportion of trust lands where TRDs exceed two miles per square mile occurs on five BMU subunits (Table II-15): Goat Creek, Lion Creek, South Fork Lost Soup, Piper Creek, and Porcupine Woodward. The DNRC *portions* of these subunits currently exceed the research benchmark for TMRD (i.e. less than 19 percent [*of a subunit*] exceeding 2 miles per square mile). In four of these five subunits, DNRC has substantial ownership (at least 10 percent): Goat Creek, Lion Creek, South Fork Lost Soup, and Porcupine Woodward. TMRDs measured at the BMU subunit scale for all ownerships are currently high, and on HCP lands in the subunits as well. The DNRC portions of these subunits currently

exceed research benchmarks for TMRDs and this condition would persist under the HCP. However, the TMRD at the subunit scale would not increase substantially, TMRD on three subunits would remain the same and two would increase by only one percent (Table II-15, columns 2 and 5). Still, because of the amount of DNRC ownership and high TRDs, DNRC TRDs substantially impact TMRDs at the BMU subunit scale in these four subunits. These levels of subunit TMRD are likely to impair the breeding, feeding or sheltering needs of some adult female grizzly bears attempting to use the area over the Permit term. Because site-specific conditions will vary over the years, and because individual grizzly bears respond differently to roads, we do not expect that all adult female grizzly bears living in the area over the Permit-term would experience this level of impact. We expect the transportation plan, Swan-specific commitments, and other applicable commitments would directly or indirectly reduce some of the adverse effects on grizzly bears related to high linear TRDs on DNRC parcels. The Final EIS/HCP 2010, Appendix A describes each of these commitments and how these commitments reduce impacts on grizzly bears, such as reducing road construction and retaining visual screening in the riparian and wetland management zones and avalanche chutes. Firearms use by employees and contractors would not be allowed and proper food storage is required. These reduce and minimize some of the adverse impacts of high road densities on grizzly bears.

Table II-16. Road miles by road class, activity category, and restriction type for the Swan River State Forest under current management strategies and estimated under the Swan Agreement and HCP.

	Activity Category					
Road Class[1]	Motorized Public Access	Commercial Forest Management Activity	DNRC Low-Intensity Forest Management Activity	Swan Agreement Current	Swan Agreement Future	HCP Year 50
Existing Roads						
Open (Highway/ County) − 170	Open Year-Round	Open Year-Round	Open Year-Round	6.9	6.9	6.9
Open (Forest Road) − 190	Open Year-Round	Open Year-Round	Open Year-Round	38.1	38.1	66.3[2]
Restricted − 130	Restricted Seasonally	Restricted Seasonally	Open Year-Round	2.8†	2.8†	−
Restricted − 131	Restricted Seasonally	Restricted Seasonally	Restricted Seasonally	2.5†	2.5†	−
Restricted − 120, 121	Restricted Year-Round	Open Year-Round	Open Year-Round	64.5	64.5	−
Restricted − 125, 126	Restricted Year-Round	Restricted Seasonally	Restricted Seasonally	99.7†	99.7†	141.1 †
			Subtotal	214.5	214.5	214.5
Proposed Roads						
Proposed − 021	Restricted Year-Round	Open Year-Round	Open Year-Round	−		−
Proposed − 025	Restricted Year-Round	Restricted Seasonally	Restricted Seasonally	−	70.3†	70.3†
			Subtotal		70.3	70.3
			TOTAL	214.5	284.8	284.8

1. Road class reflects those used in DNRC road database and are shown in this table for organizational purposes.
2. The estimated total of 66.3 miles of open road under the HCP reflects the possibility that DNRC would have to open roads due to reciprocal access agreements on roads currently managed as restricted.

† Spring Restrictions − April 1- June 15.

Source: DNRC FINAL HCP, Table 2-3.

Scattered Parcels in the NCDE Recovery Zone , TRDs The analysis of effects of road densities on scattered parcels is more difficult than for blocked lands, where subunits provide an appropriate scale of analysis (i.e. approximately the size of a female home range) within which to assess the effects of high road densities on grizzly bears. While DNRC did predict future road miles on scattered parcels, the locations of those roads were not determined because precise field evaluation and verification is required, which could not be accomplished in a reasonable manner across all of DNRC's scattered ownership prior to the analysis for this project. For scattered parcels within recovery zones, a moving windows analysis of DNRC lands is inappropriate for the reasons discussed in Section D (Analysis of Road Densities). However, road density information is readily available for subunits in which the scattered parcels lie and thus provide an

indication of the overall condition of the subunit and the potential effects of DNRC's linear road densities in those subunits.

DNRC owns approximately 17,500 acres on scattered parcels in the NCDE recovery zone. For scattered parcels in the NCDE recovery zone, the HCP includes no conservation commitments that specifically limit total road density. Based on the linear density calculation method, total road densities on scattered parcels in all DNRC land offices would increase by year 50 of the proposed HCP (Table II-17). Although a comparison of linear road densities to moving windows road densities is not possible, it is likely that under baseline conditions and future projections, road densities in NROH are generally higher than in the recovery zones (Table II-17).

In the NCDE recovery zone, DNRC manages scattered parcels in fourteen subunits. Table II-18. reveals that in nine (Peters Ridge, Cedar Teakettle, S.F. Jocko, Noisy Red Owl, Lower Whale, Alice Creek, Arrastra, Ketchikan, and Red Mountain) of the 14 subunits, TMRDs are near, or over the research benchmark of 19 percent. Thus, although DNRC ownership is not as high as elsewhere in the HCP Project area, increases in linear TRDs could contribute to TMRDs increasing over research benchmark. Because there is no cap on TRDs, for this analysis we will assume that all DNRC Project lands will eventually have TRDs over 2 miles per square mile. If this occurs, we anticipate the effect on subunit conditions (i.e. TMRDs) will result in some adverse effects to grizzly bears. We conservatively include Ketchikan here, given the ownership of DNRC Project area lands. We reasonably anticipate some impairment of breeding and feeding of female bears. Given the commitments, site specific conditions, and individual grizzly bears' response to roads, we reasonably do not expect that all adult female grizzly bears living in the area over the Permit-term would experience this level of effects.

In the remaining five subunits, Lower Big Creek, Crane Mountain, Stryker, Red Meadow Moose and Falls Creek, DNRC land ownership is very limited. Increases in TRDs in these subunits, would likely result in negligible changes in subunit TMRD if additional roads are constructed on scattered parcels in the subunit. While there is a potential for some short term displacement, this would not rise to levels that would impair the breeding, feeding or sheltering of grizzly bears.

Related to the need for easements, we expect some of increases would occur with a low frequency. For instance in the case of easements, the adjacent landowners must first demonstrate that they have exhausted all other alternatives to access their lands. Additionally, under the HCP, these easements would be discouraged by DNRC on recovery zone lands to the extent possible. If an easement is granted in the recovery zone, DNRC would work with the landowner to minimize the effects of the road on grizzly bears by including provisions to the easement such as requirements for visual screening along the road and gating the road entrance.

Further, in addition to the other applicable commitments, four scattered parcel commitments as well would directly or indirectly reduce the adverse effects on grizzly bears related to high linear TRDs on DNRC parcels. The Final EIS/HCP 2010, Appendix A describes each of these commitments and how these commitments reduce impacts on grizzly bears, including reducing road construction and retaining visual screening in the riparian and wetland management zones and avalanche chutes. Firearms use by employees and contractors would not be allowed and

proper food storage is required. These reduce and minimize some of the adverse impacts of high road densities. Notably, the commitment requiring that all open roads be examined for possible closing or restriction on use (GB-SC1) would minimize displacement of bears (biological goal 2) and promote habitat connectivity (biological goal 3) as would commitment GB-SC2, which promotes grizzly bear habitat security by requiring that lands be rested for a period of 8 years following 4 years of active management. Commitments would minimize displacement of bears from suitable habitat (biological goal 2) by limiting the number, size, and location of gravel pits (GB-SC4).

Table II-17. Average linear TRD[1] on scattered parcels for recovery zones and NROH in the HCP portion of the action area under baseline conditions and the HCP at 50 years.

	Baseline Conditions		**Year 50 Proposed HCP**	
Land Office	**Recovery Zones**	**NROH**	**Recovery Zones**	**NROH**
NWLO	2.8	3.8	3.4	4.5
SWLO	2.3	2.9	3.5	4.2
CLO	0.2	1.5	0.6	1.9

1. Determined using linear road density calculation: average linear TRD exceeding 2 miles per square mile across scattered parcels in each Land Office area.

Source: Final EIS/HCP Chapter 4, Table 4.9-12 (USFWS and DNRC 2010).

Table II-18. TMRDs (all ownerships) and linear TRDs (DNRC lands) for BMU subunits in the NCDE with DNRC scattered parcels in the HCP portion of the action area.

		All Ownerships[1]		HCP Portion of the Action Area	
BMU	**BMU Subunit**	**BMU Subunit Acres**	**Percent of Subunit Exceeding 2 mi/mi^2 TMRD**	**Acres of DNRC Lands within Subunit (% of All Ownerships)**	**Acres of DNRC Lands within Subunit Exceeding 2 mi/mi^2 Linear TRD[2]**
Hungry Horse	Peters Ridge	25,109	25	742 (3.0)	158
Lower N. Fork Flathead	Cedar Teakettle	31,704	24	481 (1.5)	0
	Lower Big Creek	30343	25	82 (0.3)	0
Mission Range	Crane Mtn	36,692	60	85 (0.2)	0
Rattlesnake	South Fork Jocko	49,187	NA	3,095 (6.3)	0
Sullivan	Noisy Red Owl	37,096	20	5,137 (13.8)	2,028
Stillwater River	Stryker	40,860	34	5 (0)	1
Upper N. Fork Flathead	Ketchikan	23,911	3	1,097 (4.6)	0
	Lower Whale	19,020	17	1,100 (5.8)	0
	Red Meadow Moose	33,367	17	198 (0.6)	0
Monture Landers Fork	Alice Creek	70,175	16	1,194 (1.7)	716
	Arrastra Mountain	69,256	19	1,696 (2.4)	420
	Red Mountain	76,674	18	1,888 (2.5)	1,031
Dearborn Elk Creek	Falls Creek	84,931	NA	639 (0.8)	0
			Total Acres	**17,439**	**4,992**

[1] Data for the Mounture Landers Fork BMU subunits based on a 12/11/08 moving windows analysis provided by Pat Shanley, Helena National Forest. TMRD for all other subunits based on the 2007 moving windows analysis under A19 for the Flathead National Forest.

[2] Road densities on DNRC lands determined using a linear road density calculation.

Scattered Parcels in NCDE and GYE NROH – DNRC owns approximately 72,900 acres and 27,700 acres, respectively, in the NCDE and GYE NROH. For scattered parcels in recovery zones, we have detailed and reliable information on ownership (primarily federal), future subunit management by the USFS, and TMRD for the subunits. For scattered parcels in NROH associated with the NCDE or GYE as well as scattered parcels outside both NROH and recovery zone (i.e., all other HCP project area lands – 281,600 acres) DNRC does not have data on road densities on adjacent lands; nor information on the future actions that may occur on adjacent parcels. Therefore, a moving windows analysis was not conducted for these lands. Rather, linear road density calculations are used. As shown in Table II-17, linear TRDs are generally higher in NROH than in recovery zones, and we assume the same for scattered parcels outside both recovery zones and NROH.

Under the HCP, DNRC would continue to minimize the miles of road needed for active management when planning road systems (ARM 36.11.421), but does not have a numerical constraint on the miles of roads that can be constructed on these scattered lands. Given that the NCDE and GYE bear populations are increasing both in numbers and distribution, we assume that grizzly bears will occur on these lands, and they will increase or remain stable. Thus, we conservatively assume that we cannot rule out the possibility that at some points in some locations on these lands over the Permit term high linear TRDs could impair a female grizzly bears' ability to breed, feed, or shelter.

We cannot determine how the juxtaposition of DNRC scattered parcels would affect a home range as female grizzly bears potentially move into these areas, nor do we have information on road densities, ownership and management of adjacent parcels of lands. However, we anticipate that the amount (i.e. the number of) adult female grizzly bears and/or cubs affected would be very low over the Permit term because:

1. We expect significant impairment of breeding or feeding only on lands where adult female grizzly bears would establish home ranges only in those areas where habitat conditions are suitable and where DNRC scattered parcels occur in close proximity to each other. Unpublished information from DNRC suggests that about 97 percent of the DNRC parcel clusters on scattered lands are of area size less than 10 percent of a potential 50,000-acre grizzly bear home range. Most parcel groupings would make up less than 3 percent of the area required for a female grizzly bear home range as most are less than 1,280 acres (R. Baty, pers. comm. 2011).

2. In general, in the majority of locations DNRC land scattered parcels in NROH are isolated (about 95 percent of the parcels on scattered lands occur in scattered, isolated groupings less that 2 sections in size (i.e., 1,280 acres), which represents about 75 percent of the total acreage of scattered HCP lands) and isolated parcels alone are less likely to fall within a female home range and unlikely to comprise a great enough proportion of any grizzly bear home range to result in impairment in breeding, feeding, or reproductive needs;

3. The number of grizzly bears living in NROH is and would likely continue to be below the numbers in recovery zones. Recovery zones are primary federal lands, and as the habitat needed for recovery (USFWS 1993), these lands are managed to favor the needs of grizzly bears. IN contrast NROH and areas beyond are generally lower quality habitat for grizzly bears as security conditions are lessened by multiple land ownerships and a variety of land uses, public roads, human settlement and more intense human activity that are inherently present. Sizable portions of these DNRC lands occur near highways, towns, cities, subdivisions, intensively managed private industrial lands, and agricultural lands (R. Baty, DNRC pers. comm.). These DNRC HCP lands overall make up less than three percent of the surrounding land base in western Montana. Thus, it is less likely for female bears on average to successfully occupy these lands over multiple generations than in recovery zones. In some local areas however, females have been able to successfully rear young and we expect this to continue as grizzly bears expand their range, given federal lands management outside recovery zones, large areas of open space in some places. Grizzly bears do and are expected to live outside recovery zones, albeit at lower numbers than within the recovery zone.

Furthermore, the adverse effects on grizzly bears in NROH are minimized by the six program-wide commitments and six additional commitments applied to the NROH. The Final EIS/HCP 2010, Appendix A describes each of these commitments and how these commitments reduce impacts on grizzly bears.

Notably, although there is not cap on total road densities, NR1 requires that new roads will <u>only</u> be managed as open when necessary to meet project or near-term management objectives. Existing roads that are restricted will generally remain restricted, except in cases where access easements are granted. As stated in the HCP "The intent of this measure is to reduce the displacement risk to grizzly bears from open roads…there are situations where the amount of open roads would increase by leaving newly constructed roads open or by opening currently restricted roads. <u>This is expected to be the exception rather than the rule</u> [*emphasis added*] and will be minimized while taking into account project, access management, and land management objectives". Thus we expect new open roads on these lands to be minimized. Thus the risk of displacement and direct morality risks from illegal shooting would be reduced.

Other key commitments include: prohibiting commercial forestry (and limiting other low-intensity and motorized activities) during the spring period in spring habitat for bears (GB-NR3), and providing visual screening in clearcuts and seed tree harvests such that grizzly bears are no more than 600 feet from cover (GB-NR4).

Finally, commitments include discouraging easements that relinquish DNRC's ability to regulate use of the road (GB-NR2), and limiting the number and size of gravel pits (GB-NR6).

These HCP measures would minimize the risk of displacement of bears from key habitats during important times of the year. Notably, although there is no cap to total roads on NROH, we expect minimal increases in open roads as a result of implementation of NR1. Thus for all reasons stated above, while we expect some adult females to experience impairment of breeding or feeding over the 50-year permit, we expect this number to be low. Further we do not expect

that all acres of DNRC NROH and surrounding covered parcels will be occupied by females with home ranges, over the permit term, nor do we expect conditions on the many of DNRC NROH and surrounding acres covered by the HCP would cause such impairment of breeding and feeding.

***Scattered Parcels in the CYE Recovery Zone and its NROH* -** In the CYE, DNRC owns approximately 6,200 acres and 12,100 acres, respectively of scattered parcels in the recovery zone and NROH. Aside from implementation of ARM 36.11.421, under the HCP, there would be no limits on total roads. In the CYE, DNRC scattered parcels comprise less than about three percent of land within any BMU that has DNRC lands in the HCP action area (Table II-19). Increases in TRDs on this low percentage of ownership would not contribute measurable changes in the BMU TMRD. We expect that minor increases in TRDs on DNRC lands in the CYE could cause displacement or underuse of affected habitat by a few grizzly bears living in the area, but that these changes would not result in substantial impairment in breeding, feeding, or reproductive needs of female bears. This is because of the amount and juxtaposition of habitat affected in any BMU (three percent or less of any BMU, and in scattered parcels of typically 640 acres or less). In most cases, grizzly bears would have options to find food and shelter in their home ranges (from 50 to over 150 square miles), especially given the surrounding BMU lands managed under federal access management standards.

Further, the likelihood and magnitude of effects is low because all future roads in both the recovery zone and NROH would be subject to restrictions on public motorized use in key habitats during important times of the year for grizzly bears (i.e., spring and/or fall) (DNRC HCP). Also, DNRC would apply enhanced *recovery zone commitments* in both the recovery zone and NROH in the CYE, as well as the *scattered parcels in recovery zone commitments* in both the recovery zone and NROH in the CYE. The enhanced recovery zone commitments include: (1) limiting activities in spring habitat during the spring period to 15 days total per parcel up to the maximum allowable days; (2) restricting more administrative motorized activities in spring habitat during the spring season as identified in Table 2-7 of the Final HCP; (3) requiring USFWS approval of mitigation plans prepared for salvage projects; 4) expediting reduction of open road densities, and 5) avoiding effects on grizzly bears from helicopter flights by limiting helicopter use associated with short duration activities to those requiring less than 48 hours to complete (DNRC HCP, Commitments GB-CY1 through CY5).

Table II-19. TRDs by BMU in the CYE for all ownerships and on DNRC lands in the HCP portion of the action area.

	All Ownerships[1]		HCP Portion of Action Area	
DNRC Administrative Unit and BMU	**BMU Acres**	**Percent of BMU Exceeding 2 mi/mi^2 TMRD**	**Acres of DNRC Lands within BMU (Percent of All Ownerships)**	**Acres of DNRC Lands within BMU Exceeding 2 mi/mi^2 Linear TRD[2]**
Libby Unit				
Newton BMU	64,284	30	266 (0.4)	0
Spar BMU	71,472	27	642 (0.9)	0
Callahan BMU	43,449	26	663 (1.5)	663 (1.5%)
Cedar BMU	30,804	9	10 (0.0)	10
Snowshoe BMU	65,230	15	1,278 (2.0)	0
Plains Unit				
Bull BMU	81,719	26	311 (0.4)	0
Wanless BMU	23,705	33	733 (3.1)	0
Vermilion BMU	68,533	22	266 (0.4)	0
Mount Headley BMU	152,394	36	1,998 (1.3)	1,798 (1.2%)
	Total Acres that Exceed 2 mi/mi^2 Linear TRD			**2,471**

1 Moving windows TMRD by BMU based on 2008 data provided by Lee Brundin, Wildlife and Fisheries Biologist, Kootenai National Forest.
2 Road densities on DNRC lands determined using a linear road density calculation.

The grizzly bear population within the CYE recovery zone is small, which raises the importance of conservation within that ecosystem at this time. In its grizzly bear conservation strategy, DNRC applied greater levels of commitments in the CYE to address the need for greater conservation of this population. The application of the scattered parcel recovery zone commitments (commitments GB-SC1 through SC4 in the Final EIS/HCP 2010, Appendix A) as well as the enhanced scattered parcels commitments for the CYE (described above) in both the CYE recovery zone and NROH would further ensure that grizzly bears can access key foraging and sheltering habitats with limited risk of displacement and conflicts with people. Greater conservation is achieved in the CYE through commitments to avoid or minimize displacement of bears (biological goal 2) and promote habitat connectivity (biological goal 3). Therefore, adverse effects on bears in the CYE from high road densities are not anticipated to impair the breeding, feeding, or sheltering needs of bears when considering these measures and the limited landscape managed by DNRC.

We note that four federal grizzly bear BMUs containing DNRC ownership exceed the research benchmark for TMRDs (26 percent of the BMU): Newt, Spar, Wanless, and Mount Headley (Table II-19). For three of the BMUs, Newt, Spar, and Wanless (which do not meet the TMRD

recommendations), DNRC's ownership meets the research benchmark and does not contribute to high levels of TMRD at the BMU scale. For the Mount Headley BMU (which does not meet the TMRD standard), all but 200 acres of DNRC's 1,998 acres exceed linear TRD of 2 miles per square mile (Table II-19). Thus, increases in restricted roads, if any, on the remaining DNRC ownership in the Mount Headley BMU would not contribute to a measurable change for the BMU.

Summary of Effects of Total Road Densities on Grizzly Bears

Total road density would increase under the HCP. The implications of these road density increases to grizzly bear conservation vary. On some blocked lands, DNRC ownership is limited and embedded in a matrix of national forest lands where access is limited, (e.g., Hay Creek subunit) and the increase in TRD is minor. Under these circumstances, a female with cubs can likely effectively use the subunit, using DNRC lands during portions of the year and over her lifespan. In other cases (such as the Upper Whitefish BMU subunit of the Stillwater River BMU), DNRC controls more than 80 percent of the lands in a subunit, an area nearly the size of female grizzly bear's potential home range. High road densities could cause reduced habitat effectiveness, resulting in either displacement of grizzly bears from important habitats or increased risk of bear-human encounters for less wary grizzly bears that select these habitats anyway. More tolerant grizzly bears may habituate to roads and human activity and continue to use the affected lands, but they would be at greater risk for conflicts with humans.

The sections above reference and summarize the conservation commitments in the HCP to minimize the effects of road densities in each of the land categories. As detailed above, the effects of roads on HCP Project lands vary with the level of road densities at the BMU or BMU subunit scale, the amount of DNRC ownership in the BMU or subunit, and the level of roading on HCP lands.

Given that there are no limits on linear TRDs on scattered parcels, we expect that linear TRDs that are higher than existing levels on scattered parcels in the NCDE recovery zone may result in adverse effects on bears when both linear TRDs are high and DNRC ownership is enough to make a significant impact on subunit TMRDs: South Fork Jocko, Noisy Red Owl, and Lower Whale. For these same reasons, we expect that at some time and location over the 50-year term, adverse effects on bears are likely to occur in NCDE NROH and GYE NROH, or other scattered parcels in the HCP project area (i.e., non-recovery zone and non-NROH), but at very low levels (i.e. very few bears would be adversely affected. The analysis above details our rationale for expecting that very few female grizzly bears would suffer impairment of breeding, feeding or sheltering due to HCP covered actions in the NROH and non-NROH.

In the CYE, limited DNRC ownership in BMUs presents a low likelihood of adverse effects on grizzly bears in the CYE. Few home ranges of grizzly bears will be affected, and only portions of home ranges would be affected. With the implementation of enhanced measures in the CYE recovery zone and the application of those measure and the recovery zone measures for scattered parcels in CYE NROH, we expect that adverse effects would not impair female bears from meeting their feeding, sheltering, and reproductive needs in the CYE over the permit term. The DNRC would contribute to viable grizzly bear habitat maintained across adjacent federal lands.

Potential Effects of Open Road Densities on Grizzly Bears

- Use of roads in grizzly bear habitat by DNRC to conduct forest management and use of roads by the public may result in avoidance and/or displacement of bears from habitat they would otherwise use for feeding, breeding, and shelter. Grizzly bears avoiding roads may forego resources otherwise available near roads; they may experience increased energy expenditure to search more broadly for adequate resources; they may simply establish home ranges elsewhere to meet their needs; or they could be forced into competition with other bears. Grizzly bears using areas near open roads are exposed to a higher risk of human-caused mortality (e.g. illegal shooting).

Indicators Used to Measure Effects of Open Road Densities on Grizzly Bears

Compared to total road density, open road density is a more direct indicator of the risks posed by roads to grizzly bears. Roads that are open to motorized use by the public receive more use and allow more humans to travel into areas that provide suitable habitat for bears, substantially increasing the risk of displacement of grizzly bears from desirable habitat during key seasons, such as spring, as well as increasing the risk of people illegally shooting bears. Thus, open road density is used as an indicator of levels of human use on the landscape to assess risk of human-bear conflicts and grizzly bear displacement from habitat important for feeding, breeding, and sheltering. To analyze effects on grizzly bears, all roads open to motorized public access during any part of the year (non-denning period) were considered "open" for density calculations (excluding non-DNRC county roads, highways, and private roads) (DNRC 2008a), even though they may be closed to public use during part of the year. Thus, the analysis method is conservative in that respect and is consistent with the methods of Ake (USFS 1995).

In areas where grizzly bear conservation is a priority, road management emphasizes minimizing the amount of road open to motorized public access, either year-round or during key times of year in key areas (e.g., spring foraging areas, denning areas, etc.). As described above, the USFWS generally evaluates the effects of roads on grizzly bears expressed as a percent of a given BMU or BMU subunit with an OMRD of greater than 1 mile per square mile, based on research related to the effects of roads on grizzly bears. Generally, research indicated that adult females in the South Fork area of the NCDE used a composite home range that had an open road density of greater than 1 mile per square mile in about 19 percent of the area (Mace and Manley 1993). Based on this research, we assume that managing for this level of open road densities within subunits (along with TMRD and core) would provide grizzly bears with adequate amounts habitat that is accessible to meet their resource needs. We also assume high road densities affecting more than 19 percent of a subunit(s) across the landscape, may result in conditions where a female with cubs may begin to experience loss of resources through avoidance of key habitats within her home range (USFWS 1995). In the CYE, these adverse effects may occur when the OMRD exceeds 1 mile per square mile in over 33 percent of a BMU (Wakkinen and Kasworm 1997).

Stillwater Block – The transportation plan for the Stillwater Block under the HCP (ST1) would prohibit the construction of new permanent roads on Class A lands (19,400 acres)(ST2). The prohibition of new permanent roads on Class A lands would minimize long-term displacement and mortality risk to bears using these areas. Further ST2, also requires a subzone

management/rest scenario to provide secure habitat for grizzly bears. Class A lands are lands adjacent to federal ownership currently managed by the USFS as secure habitat for grizzly bears. The transportation plan would designate the length and locations of roads to be constructed on Class B lands (71,400 acres). Class B lands are adjacent to industrial private or federally-managed timberlands and rural/residential properties. New road construction on Class B lands would be limited to 19.3 miles in the Stillwater Block over 50 years (Table II-14).

On the HCP lands in the eight Stillwater Block subunits, the proportion of trust lands where ORDs exceed one mile per square mile under baseline conditions occurs in four subunits (Table II-20): Lazy Creek, Stryker, Upper Whitefish, and State Coal Cyclone. The DNRC *portions of these subunits* currently exceed the research benchmark for OMRD (i.e. less than 19 percent [*of a subunit*] exceeding 1 mile open road per square mile) and this condition would persist and increase in three of the four subunits. In these same subunits, DNRC has substantial ownership. The OMRDs in these subunits also exceed the research benchmark. Thus, due to high ORDs and the amount of DNRC ownership, DNRC ORDs substantially impact OMRDs in these four subunits. The DNRC HCP would maintain the existing high ORDs and OMRDs, and would increase high OMRD in all four subunits (Table 20, columns 2 and 5). The OMRD levels in these four subunits are likely to impair the breeding, feeding or sheltering needs of some individual adult female grizzly bears attempting to use the areas during some periods of the 50 year permit. Because site-specific conditions will vary over the years, and because individual grizzly bears respond differently to roads, we do not expect that all adult female grizzly bears living in the area over the Permit-term would suffer adverse effects. The risks and impacts of adverse effects on grizzly bears in the Stillwater Block would be reduced or moderated by the implementation of the suite of applicable conservation commitments in Final EIS/HCP, Appendix A, as described above in the section analyzing TRDs in the Stillwater Block.

Table II-20. Moving windows estimate of NCDE OMRD (all ownerships) and ORD (DNRC lands) within grizzly bear subunits containing HCP project area lands under baseline conditions and in 50 years under the HCP.

BMU, and Corresponding Subunit	Baseline Condition				HCP – Year 50		
	All Ownerships		HCP Portion of the Action Area		All Ownership	HCP Portion of Action Area	
	BMU Subunit Acres	Percent of BMU Subunit Exceeding 1 mi/mi2 OMRD	Acres (Percent) of HCP Project Area Lands within Subunit	Percent of HCP Project Area Lands Exceeding 1 mi/mi2 ORD	Percent of BMU Subunit Exceeding 1 mi/mi2 OMRD	Percent of HCP Project Area Lands Exceeding 1 mi/mi2 ORD	Acres of HCP Project Area Lands Exceeding 1 mi/mi^2 ORD
Stillwater Block							
Lower North Fork Flathead BMU							
Werner Creek	28,607	20	383 (1.3)	6	20	11	42
Murphy Lake BMU							
Krinklehorn	47,487	32	326 (0.7)	4	32	4	12
Stillwater River BMU							
Lazy Creek	34,559	47	14,365 (41.6)	72	48	72	10,371
Stryker	40,860	34	32,923 (80.6)	38	39	44	14,353
Upper Whitefish	32,201	32	27,035 (84.0)	35	47	53	14,243
Upper North Fork Flathead BMU							
Coal and South Coal	25,249	16	413 (1.6)	0	16	0	0
Hay Creek	33,658	25	1,807 (5.4)	3	25	12	220
State Coal Cyclone	31,366	31	13,420 (42.8)	40	33	49	6,593
Swan River State Forest							
Bunker Creek BMU							
Goat Creek	27,602	25	5,894 (21.4)	46	32	88	5,173
Lion Creek	29,047	25	3,067 (10.6)	46	28	86	2,634
South Fork Lost Soup	29,883	26	18,324 (61.3)	31	27	33	5,975
Mission Range BMU							
Piper Creek	30,992	31	177 (0.6)	2	32	35	62
Porcupine Woodward	37,666	29	12,237 (32.5)	37	43	83	10,135

[1]. TRD calculated using moving windows method per USFS (1995b).
Source: DNRC Final HCP (2010) Table 7-1. OMRD and ORD were rounded for the purposes of this analysis.

The other subunits, Werner, Krinklehorn, Coal and South Coal, and Hay Creek all have very low ORD and DNRC has lower ownership. While ORDs would increase under the HCP in two

subunits, Werner Creek and Hay Creek, they would remain below research benchmark and would not contribute to measurable increases in subunit OMRD level (Table 20, columns 2 and 5). Hence, while some adverse effects on bears may occur for bears in these subunits because all exceed the research benchmark OMRD levels, we expect that grizzly bears would successfully use DNRC lands in important seasons and with low risk of disturbance from human because TRDs are very low in those units. Further, as described above, there are a number of commitments that reduce the impacts of road densities, as detailed above and in the HCP. Thus, we conclude that management of ORD under the HCP within these four subunits would likely have negligible influence on grizzly bears using the area, despite increases in open roads.

Swan River State Forest - In the Swan River State Forest, under the existing Swan Agreement, all landowners cooperatively manage their lands to maintain OMRDs at 1 mile per mile square on no more than 33 percent of the BMU subunit. Hence, all subunits currently meet the OMRD objective in the Swan. As discussed in Section D, if the Agreement is terminated and the HCP is implemented, we anticipate that existing ORDs on DNRC lands would more than likely be maintained for the reasons described (reflected in Table II-16, Swan Agreement Future). That is, we do not expect that 66 miles of existing roads would be open year-round (as reflected in Table II-16, Road Miles Under the HCP Year 50). It is possible that due to reciprocal access agreements and depending upon the ultimate landowner(s) of the lands in the Swan currently owned by TNC that some of these 66 miles of road would be open year-round. However, we cannot predict which roads might be opened in which subunits at this time. To partially offset the risk of increases in open roads in the Swan, under the HCP, DNRC would increase the miles of road on which it restricts its own commercial and low-intensity management activities by 41.4 miles (the Road Class, Restricted - 125, 126, increases from 99.7 to 141.1 miles in Table II-16).

Under the Swan Agreement, DNRC would construct 70 miles of new road over the next 50 years. All of these roads would be closed to motorized public access. Approximately half of these roads would be open year-round for DNRC commercial and administrative uses and the other half would be seasonally restricted from DNRC use so that grizzly bears can access important habitat at key times of the year, relatively free from human disturbance.

Under the HCP, with maintenance (no increase) of existing ORDs all subunits would exceed OMRD benchmarks. DNRC lands in the HCP project area in the Swan would continue to support high ORDs, which may increase for some subunits for reasons described above. Thus, due to high ORDs and the amount of DNRC ownership, DNRC ORDs result in high OMRDs in Goat Creek, Lion Creek, South Fork Lost Soup, and Porcupine Woodward (Table II-20). Thus, we expect significant impairment of breeding and feeding of females grizzly bears using these subunits now and over into the future. Because site-specific conditions will vary over the years, and because individual grizzly bears respond differently to roads, we do not expect that all adult female grizzly bears living in the area now or over the Permit-term would suffer adverse effects. The risks and impacts of adverse effects on grizzly bears in the Swan River State Forest would be reduced or moderated by the implementation of the suite of applicable conservation commitments in Final EIS/HCP 2010, Appendix. A, as described above in the section analyzing TRDs in the Stillwater Block. In the Piper Creek subunit, DNRC owns 177 acres and as such would have a negligible effect on changes in OMRD in that subunit.

Transportation commitments for the Swan River State Forest would be very similar to those for the Class B lands in the Stillwater Block, except that all of the Swan River State Forest lands would be subject to the subzone rest requirements under both the Swan Agreement and the proposed HCP (whereas in the Stillwater, only Class A lands would be subject to rest). In subzones during rest periods, road access by the public and DNRC commercial activities would be restricted to the winter denning period for grizzly bears. DNRC administrative activities/low intensity activities would be allowed year round with additional spring restrictions (described in commitments GB-ST2 (3) and GB-NR3, in Final HCP Chapter 2). New road construction in the Swan River State Forest would be limited to approximately 70.3 miles over 50 years, as identified in the transportation plan (Table II-16). The risks and impacts of high OMRDs on grizzly bears in the Swan River State Forest would be reduced or moderated somewhat by the implementation of the suite of applicable conservation commitments in Final EIS/HCP 2010, Appendix A, as described above in the section analyzing TRDs.

Scattered Parcels NCDE Recovery Zone, ORDs – As mentioned above for total roads analysis, the analysis of effects of road densities on scattered parcels is more difficult than for blocked lands, where subunits provide an appropriate scale of analysis (i.e. approximately the size of a female home range) within which to assess the effects of high road densities on grizzly bears. While DNRC did predict future road miles on scattered parcels, the locations of those roads were not determined because precise field evaluation and verification is required, which could not be accomplished in a reasonable manner across all of DNRC's scattered ownership prior to the analysis for this project. For scattered parcels within recovery zones, a moving windows analysis of DNRC lands is inappropriate for the reasons discussed in Section D.2.a Analysis of Road Densities. However, road density information is readily available for subunits in which the scattered parcels lie and thus provide an indication of the overall condition of the subunit and the potential effects of DNRC's linear road densities in those subunits

In the NCDE recovery zone, DNRC owns approximately 17,500 acres of scattered parcels. On these lands, in addition to the commitments that apply in all recovery zone lands, the scattered parcel commitments include: capping the miles of open road such that baseline open road amounts (total length) would not increase at the administrative unit level and requiring that all open roads be examined for possible closing or restriction on use (GB-SC1). This commitment would minimize displacement of bears (biological goal 2) and promote habitat connectivity (biological goal 3). Commitment GB-SC2 would promote grizzly bear habitat security by requiring that lands be rested for a period of 8 years following 4 years of active management. Lastly, commitment GB-SC4 would minimize displacement of bears from suitable habitat (biological goal 2) by limiting the number, size, and location of gravel pits.

In addition to these commitments, GB-NR3 would minimize displacement of bears by prohibiting commercial activities in spring habitat during the spring period. Commitment GB-NR4 would also lessen potential for displacement by requiring limitations on the opening size of forested patches and visual screening cover.

On NCDE scattered parcels in the recovery zone, the HCP would prohibit any increases in baseline linear open road miles at the administrative unit level for conducting forest management activities (Table II-21). Additionally, on a project-by-project basis through commitment GB-

SC1, DNRC would review open road densities on scattered parcels in the recovery zone. Any decisions associated with creating new open roads, closing existing open roads, or maintaining a currently open road as open, would be documented and rationale provided. Commitment GB-SC1.2 requires that DNRC not exceed HCP baseline open road density amounts for the purpose of conducting forest management activities, but allows for minor increases associated with road relocations to address BMP concerns. This would have the effect of maintaining baseline open road densities on scattered parcels (Table II-22), and will encourage decisions to restrict access in areas of potentially suitable grizzly bear habitat.

Program-wide, commitment GB-PR4 discourages open roads in important berry fields, wetlands, unique congregation areas, riparian management zones, wetland management zones and avalanche chutes across the project area including recovery zones, further ensuring that sensitive habitats for bears are protected from open roads under the HCP.

In the NCDE recovery zone, DNRC manages scattered parcels in fourteen subunits. Table II-23. reveals that in all but Alice Creek, OMRDs are near, or over the research benchmark of 19 percent. Thus, although there is less DNRC ownership as elsewhere in the HCP project area, in five subunits, increases in linear ORDs associated with possible road relocations and/or management flexibility exercised to trade open road amounts between parcels could contribute to OMRDs reaching or further exceeding the research benchmark of 19 percent (Peters Ridge, Noisy Red Owl, Ketchikan, Lower Whale, Red Mountain). This is because despite the cap on linear open roads in the recovery zone, we cannot predict with complete certainty where open roads may be distributed across the parcels, or for how long over the Permit term. For example, at the administrative unit, an open road in one parcel could be closed/restricted to allow an open road in another.

However, given that: 1) HCP commitment GB-SC1.2 would cap open road density at the level of the DNRC administrative unit (Table II- 21), 2) the general need to relocate open roads is expected to be rare on scattered lands in recovery zones to address BMP concerns over the permit term, and 3) that on managed road systems with frequent public use it is very difficult to close and trade open road amounts between parcels at the administrative unit scale; we anticipate any impacts associated with changes or potential increases in ORD to be rare and of limited scope and scale. Further, we have determined that the most likely subunits where DNRC's actions could have adverse impacts to bears would be those that are relatively small (<50,000 acres), that currently exceed the research benchmark of 19 percent and that also contain an appreciable amount of DNRC ownership (2 percent or greater). These subunits would be considered the most likely to have potential for minor additional increases in OMRD associated with DNRC road relocations and road trading in subunits with higher inherent levels of risk. If this occurs, in the five subunits above, we anticipate that some effect on subunit OMRDs could occur. Grizzly bears may be displaced from key habitat from the presence of newly created open roads or changes in the location of open roads. However, because GB-SC1.2 requires that ORD be capped at baseline levels at the scale of the DNRC administrative unit, any potential measurable increases in OMRD in any particular grizzly bear subunit would have to be compensated through commensurate reductions in an adjacent or nearby subunit in order to comply with the "no net increase in baseline amounts" requirement of GB-SC1.2. Again, due the

cap on these road miles, and other commitments, we expect this impact to be slight and infrequent. However, due to high existing road densities in several subunits, we cannot rule out the possibility of some impairment of breeding and feeding of female bears using such areas over a 50 year permit term. However, given the commitments, the cap on linear open road miles, the limited number of miles of open road available to close and open, site specific conditions, and variability in individual grizzly bears' responses to roads, this occurrence and the level of impact to female grizzly bears would be low. We do not expect that all adult female grizzly bears living in the affected subunits over the Permit-term would experience this level of effects as a result of DNRC actions.

In the remaining subunits, Lower Big Creek, Crane Mountain, Cedar Teakettle, Stryker, Red Meadow Moose and Falls Creek, DNRC scattered land ownership is very limited. Increases in ORDs in these subunits would likely result in only negligible changes in subunit OMRD, if additional open roads occur. Similarly, in the South Fork Jocko Subunit, the potential for additional impacts associated with increases in ORD is low, as the majority of these lands occurs within existing tribal wilderness areas and is inaccessible to DNRC to conduct forest management activities. In the remaining subunits (Alice Creek and Arrastra Mountain), the potential for additional impacts is low because DNRC owns a small percentage of these subunits, the subunits are relatively large (>65,000 acres), and the existing OMRD for these subunits is below the research benchmark. While there is potential for some short term displacement, this effect would not rise to levels that would impair the breeding, feeding or sheltering of grizzly bears.

Related to the need for easements, we expect some increases would occur with a low frequency. For instance in the case of easements, the adjacent landowners must first demonstrate that they have exhausted all other alternatives to access their lands (GB-RZ6.2). Additionally, under the HCP, these easements would be discouraged by DNRC on recovery zone lands to the extent possible (GB-NR2). If an easement is granted in the recovery zone, DNRC would work with the landowner to minimize the effects of the road on grizzly bears by including provisions to the easement, such as requirements for visual screening along the road and gating the road entrance (GB-RZ6(3).

Further, in addition to the other applicable commitments, several of the program-wide commitments would directly or indirectly reduce the adverse effects on grizzly bears related to high linear road densities on DNRC parcels. The Final EIS/HCP, Appendix A.2 describes each of these commitments and how these commitments reduce impacts on grizzly bears. Briefly, these measures include reducing road construction and retaining visual screening in the riparian and wetland management zones and avalanche chutes (GB-PR4 and GB-PR6); prohibiting employees and contractors from carrying firearms (GB-PR2); and requiring employees and contractors to properly store food (GB-PR3).

These are important measures that reduce and minimize some of the adverse impacts of high road densities where they occur. Notably, the recovery zone commitment capping existing miles of road and requiring that all open roads be examined for possible closing or restriction on use (GB-SC1) would minimize displacement of bears (biological goal 2) and promote habitat connectivity (biological goal 3) as would commitment GB-SC2, which promotes grizzly bear

habitat security by requiring that lands be rested for a period of 8 years following 4 years of active management. Commitment GB-SC4 would further minimize displacement of bears from suitable habitat (biological goal 2) by limiting the number, size, and location of gravel pits (GB-SC4).

Table II-21. Existing open road miles on scattered parcels in the HCP project area in the NCDE and CYE recovery zones and CYE NROH where HCP commitments require DNRC to maintain baseline open road miles at the administrative unit.

Administrative Unity by Recovery Zone	Open Road (Miles)
NCDE Recovery Zone	
Kalispell Unit	17.8
Stillwater Unit	1.8
Clearwater Unit	16.8
Missoula Unit	4.1
Helena Unit	0.2
CYE Recovery Zone	
Libby Unit	3.5
Plains Unit	11.8
NWLO CYE NROH	
Libby Unit CYE	38.0
Plains Unit CYE	7.7

Source: DNRC Final HCP (2010), Chapter 7, Table 7-5.

Table II-22. Open road density using linear calculation of mi/mi^2 on scattered parcels for recovery zones and NROH in the HCP portion of the action area.

	Baseline Conditions		HCP	
Land Office	**Recovery Zones**	**NROH**	**Recovery Zones**	**NROH**
NWLO	1.4	2.1	1.4	2.1
SWLO	1.8	0.8	1.8	0.9
CLO	0.2	1.4	0.2	1.4

Source: Final EIS/HCP Chapter 4, Table 4.9-13 (USFWS and DNRC 2010).

Table II-23. Moving windows estimate of OMRD (all ownerships) and ORD (DNRC lands) within grizzly bear subunits containing HCP project area scattered parcels in the NCDE under baseline conditions.

		All Ownership[1]		HCP Project Area Lands	
DNRC Administrative Unit and BMU	**BMU Subunit**	**BMU Subunit Acres**	**Percent of Subunit Exceeding 1 mi/mi^2 OMRD**	**Acres of Scattered Parcels within Subunit (Percent of All Ownerships)**	**Acres of Scattered Parcels within Subunit Exceeding 1 mi/mi^2 Linear ORD[2]**
Hungry Horse	Peters Ridge	25,109	52	742 (3.0)	158
Mission Range	Crane Mtn	36,692	32	85 (0.2)	0
Rattlesnake	South Fork Jocko	49,187	NA	3,095 (6.3)	631
Sullivan	Noisy Red Owl	37,096	20	5,137 (13.8)	3,188
Lower North Fork Flathead	Lower Big Creek	30,343	19	82 (0.3)	0
	Cedar Teakettle	31,704	26	481 (1.5)	0
Stillwater River	Stryker	40,860	34	5 (0)	1
Upper North Fork Flathead	Ketchikan	23,911	17	1,097 (4.6)	646
	Lower Whale	19,020	36	1,100 (5.8)	0
	Red Meadow Moose	33,367	25	198 (0.6)	0
Monture Landers Fork	Alice Creek	70,175	10	1,194 (1.7)	716
	Arrastra Mountain	69,256	17	1,696 (2.4)	420
	Red Mountain	76,674	23	1,888 (2.5)	1,251
Dearborn Elk Creek	Falls Creek	84,931	NA	639 (0.8)	0
	Total Acres			**17,439**	**8,818**

NA - Not available.

[1] Data for the Monture Landers Fork BMU subunits based on a 12/11/08 moving windows analysis provided by Pat Shanley, Lincoln Ranger District. OMRD for other subunits based on the 2007 moving windows analysis under A19 for the Flathead National Forest.

[2] Road densities on DNRC lands determined using a linear road density calculation.

Scattered Parcels in NCDE and GYE NROH – DNRC owns 72,900 acres and 27,700 acres of scattered parcels in the NROH associated with the NCDE and GYE, respectively. For scattered parcels in recovery zones, we had reliable information on ownership (primarily federal lands) and subunit OMRDs, as well as future USFS subunit management. Here, for scattered parcels in NROH associated with the NCDE or GYE as well as scattered parcels outside both NROH and recovery zone (i.e., all other HCP project area lands - 281,600 acres) DNRC does not have data on road densities. As shown in Table II-22, ORDs are generally higher in these areas than in recovery zones.

The HCP contains limited measures to control roads in NROH. Given that the NCDE (Mace and Roberts 2011) and GYE (Haroldson 2011) bear populations are increasing both in numbers and

distribution, we assume that grizzly bears will occur on these lands, and their will increase or remain stable. Thus, we conservatively assume that we cannot rule out the possibility that at some points in some locations on these lands over the Permit term high linear ORDs could impair a female grizzly bears' ability to breed, feed, or shelter. We cannot determine how the juxapostion of scattered parcels would affect a home range, nor do we have information on road densities, ownership and management of adjacent parcels of lands.

However, we anticipate that the amount (i.e. the number of) adult female grizzly bears and/or cubs affected would be very low over the Permit term for reasons detailed in Section *Scattered Parcels in NCDE and GYE NROH***,** under total roads analysis above.

Furthermore, the adverse effects on grizzly bears in NROH are minimized by the six program-wide commitments and six additional commitments applied to the NROH. The Final EIS /HCP 2010, Appendix A describes each of these commitments and how these commitments reduce impacts on grizzly bears.

Although there is not cap on total road densities, NR1 requires that new roads will only be managed as open when necessary to meet project or near-term management objectives. Existing roads that are restricted will generally remain restricted, except in cases where access easements are granted. As stated in the HCP "The intent of this measure is to reduce the displacement risk to grizzly bears from open roads…there are situations where the amount of open roads would increase by leaving newly constructed roads open or by opening currently restricted roads. This is expected to be the exception rather than the rule [emphasis added] and will be minimized while taking into account project, access management, and land management objectives". Thus we expect new open roads on these lands to be minimized. Thus the risk of displacement and direct morality risks from illegal shooting would be reduced.

Other key commitments include: prohibiting commercial forestry (and limiting other low-intensity and motorized activities) during the spring period in spring habitat for bears (GB-NR3), and providing visual screening in clearcuts and seed tree harvests such that grizzly bears are no more than 600 feet from cover (GB-NR4).

Finally, commitments include discouraging easements that relinquish DNRC's ability to regulate use of the road (GB-NR2), and limiting the number and size of gravel pits (GB-NR6).

These HCP measures would minimize the risk of displacement of bears from key habitats during important times of the year and reduce human-bear conflicts. Notably, we expect minimal increases in open roads as a result of implementation of NR1. These HCP measures would minimize the risk of displacement of bears from key habitats during important times of the year. Thus for all reasons stated above, while we expect some adult females to experience impairment of breeding or feeding over the 50-year permit, we expect this number to be low. Further we do not expect that all acres of DNRC NROH and surrounding covered parcels will be occupied by females with home ranges, over the permit term, nor do we expect conditions on the many of DNRC NROH and surrounding acres covered by the HCP would cause such impairment of breeding and feeding of female bears.

Scattered Parcels in the CYE RZ and NROH - In the CYE, DNRC owns approximately 6,200 acres in the recovery zone and 12,100 acres of scattered parcels in the NROH. On all of these lands (both recovery zone and NROH), the HCP would prohibit any increases in baseline open road miles at the administrative unit level for conducting forest management activities (Table II-21). Additionally, under commitment GB-CY4, DNRC would review open road densities on scattered parcels in the recovery zone for opportunities to close additional roads within the first 5 years of the HCP. In the CYE recovery zone, DNRC has scattered parcels in nine subunits. Table II-24 shows that in five of those BMUs, road densities on some proportion of DNRC lands exceed 1 mile per square mile (linear calculation).

We note that for the purposes of analysis in the HCP, DNRC has included as "open" all roads in the CYE with USFS or PCTC easements even if they are managed as restricted. This is because at some future time, due to the existing easements, DNRC could be forced to open the roads to meet the needs of the easement holders (i.e., the USFS or PCTC). Therefore, true ORDs on DNRC lands are very low within the CYE because in fact most roads are managed as restricted by DNRC, which reduces risks and the impact on grizzly bears.

Four BMUs in the CYE where DNRC has ownership do not meet research benchmark OMRDs (Table II-24). Where the BMU does not meet the OMRD benchmark, DNRC will not increase open roads under the HCP and therefore would not contribute to further changes in the BMU. Additionally, the number of acres where ORD on DNRC lands is high is a small proportion of the entire BMU such that the effects of high ORD within the BMU are negligible.

The HCP also includes 12,122 acres in CYE NROH. Under the HCP, the need for any new roads in both recovery zones and NROH would be highly scrutinized, and any new roads would be managed as temporary roads or closed to public motorized access (i.e., not open roads). Additionally, all *recovery zone commitments for scattered parcels* as well as the CYE enhanced commitments would be applied on scattered parcels in the CYE recovery zone and NROH. Greater conservation is achieved in the CYE through commitments to avoid or minimize displacement of bears (biological goal 2) and promote habitat connectivity (biological goal 3). These commitments include: expediting the examination of all open roads for possible closing or restriction on use (GB-CY4); restricting helicopter use to avoid adverse effects (GB-CY5); 3) increasing the types of restrictions on DNRC activities during the spring period (GB-CY3); and reducing the number of allowable days for commercial activities on rested parcels (GB-CY1).

These enhanced CYE commitments apply to the scattered parcels associated with the CYE grizzly bears. For projects in the CYE NROH and CYE recovery zone, the program-wide, NROH, recovery zone, and scattered parcels in recovery zones commitments also apply. Overall, these commitments would minimize both the displacement impacts associated with open road densities as well the risk of human-bear conflict in the CYE recovery zone and on NROH.

Table II-24. OMRDs (all ownerships) and ORDs (DNRC lands) for BMUs in the CYE with DNRC HCP project area lands.

	All Ownerships[1]		HCP Project Area Lands within BMU	
DNRC Administrative Unit and BMU	**BMU Acres**	**Percent of BMU Exceeding 1 mi/mi^2 OMRD**	**Acres (Percent of All Ownerships)**	**Acres Exceeding 1 mi/mi^2 Linear ORD**
Libby Unit				
Newton	64,284	42	266 (0.4)	266
Spar	71,472	27	642 (0.9)	0
Callahan	43,449	27	663 (1.5)	663
Cedar	30,804	14	10 (0.0)	10
Snowshoe	65,230	19	1,278 (2.0)	0
Plains Unit				
Bull	81,719	37	311 (0.4)	0
Wanless	23,705	39	733 (3.1)	643
Vermilion	68,533	33	266 (0.4)	265
Mount Headley	152,394	38	1,998 (1.3)	1,877

1. Moving windows OMRD by BMU based on 2008 data provided by Lee Brundin, Kootenai National Forest.

Road Use for Forest Management Activities – For this analysis, total roads include those classified as restricted, along with open, private, or seasonally open roads. Open roads include those classified as open, private, or seasonally open, and exclude restricted highway, and county roads as consistent with the methods of USFS 1995b. Permanent open roads pose a greater potential risk for grizzly bears than do restricted roads because of higher motorized road use, thus more displacement effects, and higher risk of illegal mortality. The effects of increased use of permanent restricted roads for commercial activities would increase displacement effects on grizzly bears during commercial and some low-intensity forest management activities, when frequent use of the road is required (i.e. more than one trip per day).

Specifically, we anticipate the effects of increased use of restricted roads to be greatest on DNRC blocked lands because ownership is concentrated and harvest activities are larger scale operations persisting for up to 4 years in duration. On blocked lands, the effect would occur on all restricted roads as depicted in Tables II-14 and II-16 (Final EIS/HCP, Appendix. A). In these areas increased use occurs on restricted roads, female grizzly bears to human activity or where surrounding subunits are highly roaded, may be displaced from key habitat. The HCP would limit effects by limiting commercial harvest windows to 4 years followed by 8 years of rest on 19,400 acres in the Stillwater State Forest and on all lands in the Swan River State Forest. Additionally, the HCP limits the likelihood of displacement of bears by providing cover and screening for grizzly bears, and addressing potential human-bear conflicts. Nevertheless, we anticipate impairment of breeding and feeding of female bears using these areas.

Over the past several decades, the USFS and DNRC have conducted timber sales that temporarily increase use of restricted roads. During that period, Kendall et. al (2006) suggest the

NCDE grizzly bear population was increasing, and in 2004, estimated to be 765 grizzly bears. Further, MFWP indicates an increasing annual trend of about 3 percent in the NCDE since 2004 (Mace and Chilton 2010). Road densities, open and total, on the USFS have decreased overall (e.g. USFS 2010a) and will remain stable, as a result of Forest Plan management. The NCDE grizzly bear population has grown, despite the temporary effects of timber harvest and temporarily increased road density. Therefore, while we expect some impairment of breeding or feeding of some individual female grizzly bears may occur due to increased use along restricted roads, we expect that most females living in and around the project area will have adequate food resources available within their home ranges during project activity.

On scattered parcels in recovery zones we expect displacement may in some cases affect grizzly bears, however, we do not expect this displacement to impair a female bear's ability to feed or raise offspring. This is for several reasons. First, these parcels are typically less than one section (640 acres) in size and therefore the effects are localized and would occur on a small proportion of a grizzly bear home range. Second, because the parcels are small, timber sales activities typically would be relatively short duration (i.e., less than 2 years) and would nevertheless be limited to no more than four years through DNRC's rest/management commitment (GB-SC2). Third, DNRC scattered parcels comprise a very small proportion of the total acres in grizzly bear recovery zones in the action area (0.3 percent in the NCDE and 0.4 percent in the CYE); hence, the effects across the recovery zone would be negligible. Lastly, the HCP includes numerous

Effects of Other Measures to Address Road Densities

The moving windows analysis and linear road density calculation consider whether roads are open or closed but do not consider other measures applied on roads to reduce their effects on grizzly bears. This section describes the other measures DNRC would implement under the HCP to minimize the effects of roads on grizzly bears. These measures include: close administration of easements in grizzly bear habitat; implementation of a rigorous program to inspect and maintain road closure structures (e.g., gates, berms; and implementation of vegetative screening along open roads and harvest units to reduce the likelihood of bears being seen from roads.

Easements - Potential easements issued in the HCP project area were not factored into the road density calculations presented above and could contribute to additional increases in total and open road densities. Regarding easements, the implementation of commitment GB-NR2 under the HCP would discourage the granting of access easements that relinquish DNRC control of roads. Within the recovery zones, this commitment would be complemented by GB-RZ6, under which, individual easements would be evaluated and conditioned with mitigation measures for grizzly bears. The HCP would provide increased protection and specific consideration for grizzly bears when access easements are considered. However, because DNRC is legally obligated to consider all reasonable easement requests, the additional commitments under the HCP might not prioritize bear needs in all cases and would likely not substantially reduce the amount of new road construction across trust lands for this purpose. Nevertheless, these measures would help reduce effects associated with roads by limiting season of use, requiring gates, and avoiding important habitat elements such that grizzly bears would not be displaced from important habitat and risk of conflicts with humans would be minimized.

Road Closures - Under the HCP, all primary road closures on trust lands within recovery zones would be inspected annually, and repairs would be completed within 1 year of identifying the problem. This measure is expected to lead to a decline in the miles of road on which unauthorized motorized public use could occur in grizzly bear recovery zones. The risk of unanticipated adverse effects on grizzly bears due to elevated densities of *de facto* open roads would also be lower with implementation of this measure. Outside recovery zones, DNRC's ARMs would continue to require inspection of all road closures at least every 5 years.

Visual Screening and Hiding Cover - Section D of this BO describes the HCP commitments for cover and visual screening. These measures would reduce the effects of roads by providing visual screening in important foraging areas, near harvest openings, and along open roads, which reduce the likelihood of displacement from important habitat or detection leading to human-bear conflicts and potential bear mortality.

Secure Habitat

In the 1990's, preliminary results of the South Fork Grizzly Bear Study (herein referred to as the South Fork study), coupled with advances in computer modeling of data, revealed patterns in grizzly bear home ranges not previously described (Mace and Manley 1993). These preliminary results formed the basis of the Flathead National Forest's Amendment19, which in part established motorized access standards in grizzly bear habitat, including 68 percent of each BMU subunit being "secure habitat or "core areas" for bears. Through the mid- to late-1990's, the IGBC developed and recommended motorized access guidelines (e.g., IGBC 1994; 1998).

In 1996, the NCDE Access Group was rechartered to review the final results of the South Fork study and to determine if the IGBC motorized access guidelines should be continued or changed (NCDE Access Group, unpubl. rept. 11/24/98). The group of 13 experienced state and federal biologists and grizzly bear researchers and 11 managers, reported a choice of two alternative approaches to motorized access management in grizzly bear habitat: the "Seasonally Secure Areas" (SSA) approach and the "Access Route Density Standards" approach (based in part on the South Fork study prescriptions for "Core" and other habitat (*Ibid.*). The SSA approach employed the concept of severely restricting motorized access in key seasonal habitats during the season of use by grizzly bears (e.g. spring habitat during the spring season). Shortcomings and tradeoffs with both approaches were identified by the task group itself (*Ibid.*) and by invited peer review (McLellan et al. 2000).

For example, identifying and managing blocks of core habitat does not necessarily provide high quality habitat (e.g., forage): "It may be possible that the potentially best bear habitat may be in heavily roaded areas while poor habitat is included in core areas. It is also possible that roads may be closed at great expense in areas of poor habitat that will only have marginal value to bears" (McLellan et al. 2000, pg. 7). On the other hand, the SSA method was much more complex and relied on several assumptions, risks, and uncertainties (McLellan et al. 2000, pp. 8-12).

Thus, most land managers, including units of DNRC, embraced the already implemented "Access Route Density Standards," including "core" habitat. "Core areas" for grizzly bears (or

secure habitat) is specifically defined by the IGBC (1998) as areas that are at least 0.3 mile from any open road or motorized trail and that receive no motorized use of roads or trails during the period they are considered secure habitat (typically at least 10 years). Such lands should also encompass areas of seasonal importance for grizzly bears throughout the year. Core habitat should not receive motorized vehicle use during the non-denning season, but other uses are acceptable, and motorized uses are acceptable during the denning season as well. The guidelines for core areas recommend that "[o]nce core areas become established and effective, these areas should remain in place for at least 10 years. This duration is based upon the generation time for a female grizzly bear or the time it takes a female grizzly bear to replace herself." (IGBC 1998, pg. 5). In fact, core areas may contain restricted roads with effective physical closure devices and no motorized use of those roads during the core period (IGBC 1998, pg. 4).

"Quiet areas" are defined in the HCP as areas periodically free from commercial activities, including subzones or scattered parcels in rest where commercial activities are restricted following periods of active management, or areas where management activities are restricted in certain key habitats during important seasons of the year. The Swan Agreement, under which DNRC and neighboring landowners cooperatively limit management activities following periods of active management in BMU subunits, provides an example of managing for quiet areas.

Potential Effects on Secure Habitat

- Reductions in the amount of area where grizzly bears are relatively safe from disturbance and encounters with humans may result in disturbance, displacement, habituation, and an elevated risk of human-caused mortality.

Indicators Used to Measure Effects of the Proposed HCP on Secure Habitat for Grizzly Bears

An increase in the amount of roads and human use of roads in grizzly bear habitat could reduce the amount of area where grizzly bears are relatively safe from disturbance and encounters with humans, leading to harassment and displacement of grizzly bears from areas they would otherwise use for feeding, breeding, and shelter. Increasing roads and use, which can reduce safe, quiet areas, could also cause grizzly bears to be more vulnerable to human-caused mortality.

In the South Fork Study, research indicated that adult female grizzly bears in the NCDE used a composite home range that secure habitat encompassing 68 percent or more of the area (Mace and Manley 1993). Based on this research, we assume that managing for this level of secure habitat within subunits (along with TMRD and OMRD) would provide grizzly bears with adequate amounts habitat that is accessible to meet their resource needs. We also assume that when less than 68 percent of a subunit(s) supports secure habitat across the landscape, the conditions may result where a female with cubs may begin to experience loss of resources through avoidance of key habitats within her home range (USFWS 1995).

Measures that restrict activities either over a period of time (several years) or during important seasons within a year (as in the SSA approach) can avoid or minimize effects on grizzly bears. Two terms, 1) core areas (or *secure habitat)* and 2) *quiet areas*, are used in this analysis to

describe approaches to managing HCP project area lands to reduce or minimize risk of displacement of grizzly bears and bear-human conflicts.

Analysis of Effects of Proposed Action on Secure Habitat and Quiet Areas

Under the HCP, DNRC would no longer manage for core areas in the Stillwater Block using the traditional "core area" approach. The primary reason being that by implementing the "core area" approach in the Stillwater Block, DNRC effectively removed these lands from management, since it does not have the landownership to be able to move the core area across the landscape over time as allowed under the guideline that core should remain in place for 10 years.

Therefore, the DNRC HCP would implement a combination of seasonally secure areas and quiet areas. DNRC commits to seasonally restricting human uses from important grizzly bear habitats, but also managing larger blocks of habitat, "quiet areas", undisturbed by major human disturbances for periods of at least eight years. The Stillwater Block transportation plan (ST1) identifies four large blocks of trust lands adjacent to National Forest System lands (Class A lands, totaling approximately 19,400 acres) to be managed as quiet areas, called subzones, on a schedule of four years of management and eight years of rest (ST2). Low-intensity forest management activities and allowances for salvage harvest would not be prohibited within rested areas, except as restricted during the spring period. Construction of additional permanent roads on Class A lands would be prohibited for the 50-year Permit term. The Stillwater transportation plan also delineates Class B lands where most roads would be subject to year-round or seasonal restrictions from public motorized use such that grizzly bears could access key habitats during key time periods (ST4).

This approach would focus on minimizing the potential for disturbance in large blocks of habitat during key periods of the year, and on limiting the frequency with which large-scale disturbance (e.g., commercial forestry) may occur. This approach is a shift from disallowing all motorized uses in core for 10 years at a time, to disallowing such use during important seasonal times for grizzly bears, and also limiting large scale commercial activity to four years followed by eight years of rest. The rotation of commercial activities in combination with restrictions on commercial activities in spring habitat in the spring period and no net increases in open road densities on rested subzones would reduce the risk of displacement and bear-human conflicts to increase the likelihood that grizzly bears successfully meet their habitat requirements.

On the Stillwater Block, resting subzones could receive up to 30 days of use per year for small projects, including salvage (ST3). The primary concern for grizzly bears associated with interruptions in rested subzones is displacement from key habitat during critical times of year for grizzly bears, for example spring foraging habitat. The HCP commitments avoid such potential effects of these short disturbances during critical time periods for grizzly bears by the requirement that these days occur either in non-spring habitat or outside the spring period when conducted in spring habitat.

Should management needs specifically for salvage exceed 30 days, usable days allowed for small projects in other subzones would have to be forfeited. Therefore, the occasional impacts of protracted salvage would be localized and would be offset or minimized; i.e., DNRC cannot invoke the allowance everywhere.

In the rare need for a larger salvage project (typically in response to a large fire) resulting in these allowable annual days in total to be exceeded, a one-time allowance would be triggered for additional operating days up to the length of one full non-denning season (i.e., 150 days). Any time this occurs, DNRC would mitigate potential adverse effects by initiating a new eight-year rest period. A full uninterrupted eight-year period of rest would have to be achieved in the disturbed subzone before allowing any future salvage interruptions. This commitment is designed to provide compensatory rest in other non-target subzones and a required additional interruption-free eight-year rest period to mitigate disturbance-related impacts to grizzly bears. Additionally, DNRC would be required to prepare a project mitigation plan to be submitted to the USFWS prior to project implementation. This practice is similar to that that occurs on National Forest lands.

Depending upon the location of access routes and the severity of the fire this type of interruption could increase the risk of disturbance and displacement of grizzly bears from areas they would otherwise use for feeding, breeding, or sheltering. A disturbance of this nature may or may not result in additional effects on grizzly bears. In some cases, the fires affect large areas such that the remaining habitat does not provide adequate food or shelter for grizzly bears. In these cases, salvage harvest in a quiet area would likely have little effect on grizzly bears.

In the event of a natural disturbance triggering a changed circumstance, rested subzones could be further interrupted for salvage harvest. This would occur when 1) a salvage project in a subzone(s) would take more than 151 days during the summer and fall periods to complete or 2) a second interruption of an eight -year rest period extending for greater than 30 days (needed during summer and/or fall periods) is required for the purposes of salvage. These circumstances are further described in the Final EIS/HCP 2010, Appendix A. Section A of this BO describes the measures that would be implemented to mitigate for extended salvage harvest activities. For the reasons presented above, a disturbance of this nature may or may not result in additional effects on grizzly bears.

As long as the Swan Agreement remains in effect, management of the Swan River State Forest under the HCP would implement the “quiet areas” approach to secure habitat whereby the 3 years of active management in a grizzly bear subunit are be followed by 3 years of rest (currently implemented as 6 years of rest). If the Swan Agreement is terminated, the forest would be managed under the HCP as five independent subzones, with each subzone scheduled for four years of active management and eight years of rest and allowances for salvage harvest and changed circumstances as described above for the Stillwater Block. Within the Swan River State Forest, one gravel operation greater than 0.25 mile from an open road would also be allowed in a rested subzone. When this occurs, DNRC would mitigate the potential effects on grizzly bears by (1) placing pits as close as possible to existing open roads, and (2) to the extent possible, ceasing activities on all allowable remaining pits while the pit in the rested subzone is active. The localized nature of the impact of gravel pits in combination with the proposed mitigations would avoid adverse effects on grizzly bears. While 70 miles or road would be constructed under the HCP, all roads would be restricted from public access year-round. Additionally, while some existing roads could be managed as open due to reciprocal access agreements, we expect the number of miles subject to this change over the permit term would be low for the reasons

discussed above in Additional Effects and Mitigation Measures for Roads. Therefore, in general, with implementation or road restrictions and the management/rest scenario, adequate portions of the Swan River State Forest would be available to female grizzly bears and their cubs free from human disturbance.

A similar rest-rotation schedule (four years of activity followed by eight years of rest) would be implemented on all scattered parcels in recovery zones and NROH associated with the CYE under the HCP. The rest commitment for scattered parcels would increase rest and provide quiet areas on approximately 35,770 acres of scattered parcels. This commitment would serve to reduce the risk of disturbance to grizzly bears and lower potential for their displacement on this subset of scattered parcels. Small projects, including salvage, could also be conducted on scattered parcels on a limited number of days specific to each individual administrative unit (ranging from 45 to 90 days). Should management needs specifically for salvage exceed these limits, an allowance would be triggered, similar to that described above for blocked lands, for additional operating days up to the length of one full non-denning season (i.e., 150 days). In such situations, rest periods would not have to be restarted on scattered parcels; however, only one interruption of this type would be allowed per eight-year rest period per parcel for this purpose. Changed circumstances that interrupt rest on scattered parcels would also trigger implementation of a mitigation plan as described above.

In summary, the total amount of land area managed to reduce the risk of long-term displacement and bear-human conflicts would increase under the HCP, from approximately 76,300 acres to almost 95,000 acres. This is because of the addition of scattered parcels subject to the active/rest scenario. The following acres would be managed under the active/rest scenario under the proposed HCP - 39,700 acres in Swan, 19,400 in Stillwater, and 35,770 for scattered parcels.

Analysis of the anticipated changes in strictly managed as secure habitat or “core areas” over 50 years in the Stillwater Block and Swan River State Forest indicates that the availability of such habitat would decrease in both areas (Table II-25). In the Stillwater Block, the greatest decreases would occur in the Upper North Fork Flathead BMU under the HCP, with the adoption of the transportation plan resulting in currently closed roads in the Stillwater Core (Stryker and Upper Whitefish subunits) being opened to motorized public access on a seasonal basis.

Decreases in secure habitat would occur in the Swan River State Forest under the HCP (Table II-25). This is attributed to the construction of up to 70 miles of new road over the 50-year Permit term. Because they are open for some portion of the year, habitat in these areas do not serve as secure habitat under the core areas approach to providing grizzly bear security. However, these 70 miles of roads would be seasonally restricted to provide undisturbed use of key seasonal habitat by grizzly bears.

Decreases in the availability of secure habitat or core areas (as measured using the research benchmarks) on trust lands represent a possible increased risk of mortality to grizzly bears due to encounters with humans, along with an increase in the amount of otherwise suitable feeding, breeding, or sheltering habitat that grizzly bears might avoid. It should be noted, however, that the modeled decreases in secure habitat do not account for application of seasonal restrictions on roads or management of quiet areas in the Stillwater Block, Swan River State Forest, and

scattered parcels. These measures would ensure that grizzly bears have adequate habitat to successfully meet their habitat requirements. We expect that some grizzly bears may experience localized adverse effects as a result of the approach described above, causing a shift in habitat use. However, our analysis above indicates that these effects would occur infrequently within a grizzly bear home range, would be short-term and that grizzly bears would have adequate habitat unaffected by human activity elsewhere within their home ranges for breeding, feeding and sheltering.

Table II-25. Estimated percentage of secure habitat on DNRC blocked lands in BMU subunits in the NCDE under baseline conditions and at 50 years under the proposed HCP.

DNRC Ownership, BMU, and BMU Subunit	Percent of Subunit within HCP Project Area	Baseline Conditions	Year 50 HCP
Stillwater Block			
Lower North Fork Flathead BMU		**80**	**80**
Werner Creek	1.3	80	80
Murphy Lake BMU		**93**	**93**
Krinklehorn	0.7	93	93
Stillwater River BMU		**42**	**31**
Lazy Creek	41.6	16	16
Stryker	80.6	49	40
Upper Whitefish	84.0	48	28
Upper North Fork Flathead BMU		**43**	**28**
Coal and South Coal	1.6	99	99
Hay Creek	5.4	29	30
State Coal Cyclone	42.8	43	25
Swan River State Forest[2]			
Bunker Creek BMU		**23**	**13**
Goat Creek	21.4	10	3
Lion Creek	10.6	5	3
South Fork Lost Soup	61.3	30	17
Mission Range BMU		**16**	**3**
Piper Creek	0.6	66	0.0
Porcupine Woodward	32.5	15	4

[1] Core areas are defined as the area 0.3 mile from an open or restricted road.
[2] Decreases in core areas in the Swan River State Forest depicted under the HCP are a result of the assumption in the analysis that the Swan Agreement in its current form would no longer constrain management, creating more functionally open roads on trust lands due to existing easements. Proposed HCP conservation commitments would not cause these estimated increases.
Source: Final EIS/HCP, Chapter 4, Table 4.9-15, (USFWS and DNRC 2010). Percentages of secure habitat rounded for the purposes of this BO.

Summary of Effects of Proposed Access Management on Grizzly Bears

Within the NCDE recovery zone we expect adverse effects on grizzly bears would occur, specifically in those NCDE subunits where DNRC maintains high TRDs and ORDs and owns

substantial proportions of subunits such that TMRDs and OMRDs exceed research benchmarks. In these instances we expect adverse effects may rise to levels that impair a female grizzly bear's ability to feed and raise young.

Outside these situations in the NCDE, and in the CYE recovery zone, any adverse effects would not rise to the level of significant impairment of breeding, feeding or sheltering of grizzly bears. We expect many effects to be insignificant or discountable, as grizzly bears would have adequate habitat resources for home range use, considering the federally managed lands in affected BMUs and subunits and the HCP commitments on DNRC lands. Among other measures, DNRC would limit open road densities; DNRC would implement seasonal restrictions on roads used by the public and itself to protect bears in key habitats during important times of the year; and DNRC would implement a four-year active, eight-year rest scenario.

Within the NCDE Stillwater Block, DNRC ORDs would increase on five of the eight subunits due to seasonal road use, solely for the purposes of increasing recreational access in the summer (generally, grizzly bear summer habitats are not limiting) with limited additional use in fall. This would occur while DNRC decreases the miles of road open year-round by 19.5 miles. In the Swan River State Forest, DNRC would not increase ORDs for its own management purposes. However, DNRC may be required to open some roads through reciprocal access agreements on lands currently owned by TNC but subject to sale in the future. However, the likelihood that open roads would increase to the extent predicted in the Final EIS is low because these lands are now owned and managed by TNC who intends to sell these lands to conservation buyers (versus industrial timber operators). Additionally, if lands are sold to private landowners the roads would be categorized as open, but would likely be used by individual landowners for property access versus recreation use by the public. As such, these roads would receive relatively low levels of use.

On scattered parcels in recovery zones, DNRC would not increase existing baseline miles of open road (Table II-21); DNRC may open a road in one location, but would concurrently close a road(s) in another location to offset the impact. Additionally, DNRC would reexamine all of its open roads to identify additional roads for closure; therefore, we expect at least a slight decrease in the miles of open road on scattered parcels in recovery zones. Where roads would remain open in recovery zones, DNRC would maintain visual screening on open roads such that grizzly bears are 1) less likely to be observed by passers-by and 2) less likely to be disturbed by motorized activities on roads.

While TRD would increase across the HCP project area, most new roads would managed as restricted, or be subject to seasonal restrictions on public use as well as DNRC use to ensure that grizzly bears can access key habitats during important times of the year. This reduces the risk of displacement as well as risk of human-bear conflicts because during the times when roads are open, grizzly bears are less likely to be present in adjacent habitats. Additionally, DNRC would enhance its monitoring program to ensure that closure devices on closed roads function properly or are repaired in a timely manner. Lastly, across the HCP project area, DNRC will retain visual screening in riparian and wetlands management zones which further ensures grizzly bears could move across the landscape and avoid human detection.

"Core" area as defined by the IGBC would decrease in the HCP project area. DNRC's approach to providing secure habitat would focus on minimizing the potential for disturbance in large blocks of habitat during key periods of the year, and on limiting the frequency with which large-scale disturbance (e.g., commercial forestry) may occur. Additionally, we note that even subzones that are not "in rest" would be subject to restrictions on commercial activities in spring habitat in the spring period and this commitment would also apply in NROH. Overall, we expect that this approach would reduce the risk of displacement and bear-human conflicts such that potential adverse effects on grizzly bears would be sufficiently minimized to provide grizzly bears with sufficient undisturbed access to key habitat to meet their habitat requirements. While rested subzones could be interrupted for salvage harvest, these interruptions are capped and addressed through development of mitigation plans review by the USFWS. In some instances, grizzly bears are likely to have been displaced from the area affected by the event that triggered the need for a salvage harvest, in which case few if any additional effects on grizzly bears are likely to occur. The potential for human-grizzly bear conflicts are further addressed and reduced through an information and education program that is proposed under the HCP, including signs in key locations warning the public of bear presence, as well as firearms restrictions and food storage and sanitation requirements for DNRC and its contractors.

The HCP contains limited measures to control total roads in NROH. Given that the NCDE (Mace and Roberts 2011) and GYE (Haroldson 2011) bear populations are increasing both in numbers and distribution, we assume that grizzly bears will occur on these lands, and their will increase or remain stable. Thus, we conservatively assume that we cannot rule out the possibility that at some points in some locations on these lands over the Permit term high linear miles of roads could impair a female grizzly bears' ability to breed, feed, or shelter. We cannot determine how the juxapostion of scattered parcels would affect a home range, nor do we have information on road densities, ownership and management of adjacent parcels of lands.

However, we anticipate that the amount (i.e. the number of) adult female grizzly bears and/or cubs affected would be very low over the Permit term for reasons detailed in *Scattered Parcels in NCDE and GYE NROH*, under total roads analysis above. Furthermore, the adverse effects on grizzly bears in NROH are minimized by the six program-wide commitments and six additional commitments applied to the NROH. The Final EIS/HCP, Appendix .A also describes each of these commitments and how these commitments reduce impacts on grizzly bears.

Although there is no cap on total road densities, NR1 requires that new roads will only be managed as open when necessary to meet project or near-term management objectives. Existing roads that are restricted will generally remain restricted, except in cases where access easements are granted. As stated in the HCP "The intent of this measure is to reduce the displacement risk to grizzly bears from open roads…there are situations where the amount of open roads would increase by leaving newly constructed roads open or by opening currently restricted roads. This is expected to be the exception rather than the rule [emphasis added] and will be minimized while taking into account project, access management, and land management objectives". Thus we expect new open roads on these lands to be minimized. Thus the risk of displacement and direct morality risks from illegal shooting would be reduced.

Other key commitments include: prohibiting commercial forestry (and limiting other low-intensity and motorized activities) during the spring period in spring habitat for grizzly bears (GB-NR3), and providing visual screening in clearcuts and seed tree harvests such that grizzly bears are no more than 600 feet from cover (GB-NR4).

In summary, DNRC's program to limit open roads, restrict public and state access on other roads during key time of year for grizzly bears, implement a management/rest scenario, provide cover and screening for grizzly bears, and address potential human-bear conflicts would ensure that grizzly bears could access habitats necessary to successfully raise their young. For most individual grizzly bears, we believe the risk of disturbance and displacement is minimized such that any adverse effects would be temporary and/or would not preclude grizzly bears from accessing the habitat necessary to feed, breed, or shelter. However, some more wary individual grizzly bears may underutilize available habitat due to the presence of roads. Hence, the number of miles of road and density of roads on DNRC lands may contribute to significant displacement for some grizzly bears. In general, adult female grizzly bears are most sensitive to road densities, and so we expect that a few female grizzly bears may suffer adverse effects (displacement from key habitat) that lead to impairment of breeding or feeding. We do not expect that such impairment would be permanent; grizzly bears are opportunistic and relatively adaptable, given adequate options. Our analysis indicates that overall, the HCP access management strategy provides adequate space and foraging resource options for grizzly bear home range use. Thus we reasonably assume that wary adult females would eventually adapt and readjust home range use to find needed food and shelter resources. Finally, grizzly bears using habitats adjacent to roads may suffer an increased risk of human-bear conflicts that ultimately result in bear mortality. We conclude that this risk is moderated by seasonal and permanent road use restrictions, and we note that no grizzly bear mortalities have been documented on DNRC trust lands.

Effects of Forest Management Activities on Grizzly Bear Habitat

Forest management leads to the presence of roads and humans in grizzly bear habitat and modifies habitat and cover for grizzly bears. The effects of road densities, human access, and human-bear conflicts are addressed in Section D. This section focuses on vegetative management that affects bear use of habitats or linkage areas.

Hiding Cover and Visual Screening

An obvious consequence of timber harvest is the modification or removal of cover. Cover is important to grizzly bears as security against displacement from habitat and from human-caused mortality. Grizzly bears use cover for movement between foraging sites and seasonal ranges, for foraging, bedding and thermal regulation.

Activities that reduce the potential for vegetation to conceal a grizzly bear can lower effective bear use of habitat and render grizzly bears more vulnerable to human-caused mortality (Servheen et al. 1999). Visual screening along roads and in areas that provide foraging habitat for grizzly bears (e.g., riparian areas, wet meadows, shrub fields, avalanche chutes, etc.) can

reduce the potential for human disturbance, as well as the risk of direct bear mortality due to mistaken identity or malicious actions.

Potential Effects on Hiding Cover and Visual Screening

- Forest management activities that reduce vegetation density may reduce cover for bear movement, resting, feeding, and security, possibly rendering grizzly bears more vulnerable to human-caused mortality.

Indicators Used to Measure Effects of the Proposed Action on Hiding Cover and Visual Screening

For this analysis, modeled cover projections are used to describe hiding cover under the proposed HCP. For the EIS analysis, the model used to determine the DNRC annual sustainable yield calculation (the quantity of timber to be harvested from forested trust lands each year) was also used to estimate forest cover at structural densities that would screen from view large mammals such as grizzly bears under the HCP (DNRC 2008b).

Due to model limitations, hiding cover estimates for NROH lands could not be specifically obtained. Rather, the model estimated cover for HCP project area lands in recovery zones and all other HCP project area lands outside recovery zone boundaries (Table II-11). Another limitation that should be noted is that no size limit or spatial distribution values could be placed on patches classified as cover, which could influence cover effectiveness, particularly at local scales. Even with these limitations, however, modeled outputs were considered reasonable and useful for assessing general trends at a landscape scale. The following subsection presents the analysis of effects of the proposed HCP on hiding cover and visual screening for grizzly bears.

Analysis of Effects of the Proposed Action on Hiding Cover and Visual Screening

Under the HCP, DNRC would retain certain quantities of hiding cover as required under the Swan Agreement. The Final EIS/HCP (2010) analysis of hiding cover shows that the amount of hiding cover on the DNRC landscape would remain similar to baseline conditions over the permit term under the HCP (Table II-11). The existing level of hiding cover for grizzly bears is adequate given that 60 percent of the forested trust lands in the project area provide hiding cover (Table II-11) under baseline conditions and under the proposed HCP at year 50. The values presented in Table II-11 are attributed to several factors including Forest management ARMs that would be implemented under the HCP, requirements for DNRC to harvest at a sustainable rate, and implementation of the HCP commitments as described below.

Under ARM 36.11.415, forest patch size, shape, connectivity, and habitat fragmentation are be considered at the project level. Additionally, the HCP includes commitment GB-PR6 that would require DNRC to provide visual screening in RMZs and WMZs across the project area. In recovery zones and NROH, commitment GB-NR4 would require that distance to visual screening in new harvest units be no more than 600 feet from any point in the unit. Additional visual screening provisions would be implemented in recovery zones, where commitment GB-RZ2 would require DNRC to leave up to 100 feet of vegetation between open roads and clearcut or seed tree harvest units, with some allowances. Collectively, the ARMs and HCP commitments (GB-PR6, GB-NR4, and GB-RZ2) would provide visual screening in important

foraging areas, near harvest openings, and along open roads, reducing the risk of bear displacement and human-bear conflicts. Thus we do not anticipate adverse effects to grizzly bears related to insufficient cover or lack of visual screening.

Habitat Elements

Habitat features consistently described in the literature as favored by bears include avalanche chutes, fire-mediated shrub fields, whitebark pine stands, wetlands, riparian areas, and unique congregation or feeding areas.

Potential Effects on Habitat Elements for Grizzly Bears

- The way specific forest management projects are designed may impact important habitat elements for grizzly bears, such as berry fields and avalanche chutes.

Indicators Used to Measure Effects of the Proposed HCP on Grizzly Bear Habitat Elements
Management activities that reduce the effectiveness of grizzly bear habitat to provide forage, or reduce use of these important places during important seasons, could adversely impact the nutritional condition of grizzly bears. The following section describes the commitments under the HCP that address impacts to these habitat elements.

Analysis of Effects of the Proposed HCP on Grizzly Bear Habitat Elements
The HCP contains provisions for assessing impacts to specific grizzly bear habitat elements for projects in recovery zones. Under commitment GB-RZ1, DNRC would develop measures that minimize impacts to these specific habitat elements. Measures would typically involve scheduling activities to occur while grizzly bears are not likely to be using an area or locating roads or skid trails to conserve important vegetative features, such as berry patches or dense stands or thickets that provide visual screening for likely feeding areas. As a result, the risk of adverse effects on foraging opportunities in key sites would be reduced under the HCP. Additionally, RMZs, WMZs, and avalanche chutes would be similarly protected through the program-wide commitment (GB-PR4) that restricts open road construction in these important areas, thereby reducing the potential for disturbance and displacement of grizzly bears from these areas. Therefore, the proposed HCP is expected to protect grizzly bear use of important forage habitat features thus any potential effects would likely be discountable or insignificant

Habitat Linkage

Habitat linkage and connectivity are important components of grizzly bear habitat (Servheen et al. 2001, 2003; USFWS 1993). The main factors generally considered to affect the quality of linkage zones are major highways, railroads, road density, human site development, availability of hiding cover, and the presence of riparian areas (USFS 2005).

Potential Effects on Habitat Linkage

- Forest management activities may result in increases in human access and reductions in forest cover in areas situated within, or between, existing large blocks of relatively secure habitat, resulting in adverse effects on habitat linkage for grizzly bears.

Indicators Used to Measure Effects of the Proposed HCP on Habitat Linkage for Grizzly Bears
No boundary changes or land additions to any formally identified grizzly bear linkage zones (i.e., USFWS et al. 1995; Servheen et al. 2001) would occur under the HCP. With the exceptions of the Stillwater Block and Swan River State Forest, DNRC's ability to influence linkage areas is relatively limited by the amount of land in recovery zones in the HCP project area (approximately 2 percent as shown in Table II-5) and distribution of linkages in western Montana (Final EIS/HCP 2010, Appendix D, Figures D-18A, B, and C). Therefore, this analysis focuses on linkages associated with these two areas of blocked lands.

The effects of the HCP are evaluated in two ways: (1) a comparison of standards for access management and maintaining vegetative cover and (2) an assessment of the likelihood that portions of linkage areas in the HCP project area would affected under the HCP.

Analysis of Effects of the Proposed HCP on Habitat Linkage for Grizzly Bears
The Stillwater Block and the Swan River State Forest are important land areas with high value for linkage, and linkage zones have been formally identified within these areas (USFWS et al. 1995; Servheen et al. 2001). Under the Swan Agreement, the signatories implement spring restrictions for specific linkage zones in the Swan River State Forest. Under the HCP, DNRC's commitments incorporate measures that are generally supportive of maintaining linkage for a diversity of species but are not tied to specific linkage zones defined by DNRC or others. For example, Servheen et al. (2001) identified a large, important linkage zone along Highway 93 that is adjacent to the southwest boundary of the Stillwater Block. However, there are no specific commitments applicable to that identified linkage zone. Rather, projects on all the bordering trust lands are required to meet cover, security, and road density commitments established in the Forest Management ARMs, or similar commitments associated with the HCP for supporting effective linkage in that area.

As discussed in Section D access management would control ORDs and provide grizzly bears security that supports usage of linkages in the Stillwater Block and Swan River State Forest. As described above, the proposed HCP would adequately maintain hiding cover which would support bear security and habitat linkage. Additionally, the proposed HCP would enhance requirements for vegetative screening in harvest units and along open roads, which would additionally support maintenance of habitat linkages. As described in Section D, numerous provisions decrease the likelihood that DNRC would remove lands from the HCP that would then be subject to development in grizzly bear linkage areas. Habitats within linkages would be highly scrutinized through any disposal process due to heightened concern and awareness of these areas by the public and land managers.

In summary, given the amount and distribution of trust lands in western Montana, habitat connectivity between linkage zones is likely to be most influenced by land use and management on other ownerships, rather than DNRC forest management. Nevertheless, the HCP includes a program for access management and provides for cover maintenance and control of land disposal under the requirements of the Transition Lands Strategy. Therefore, we expect that the HCP would maintain the integrity of linkage zones such that opportunities for movement of grizzly bears between recovery zones and important habitats would continue to occur unaffected.

Summary of Effects of Forest Management Activities on Grizzly Bear Habitat
Vegetation management can affect cover causing grizzly bears to change their use of an area. The DNRC HCP includes provisions to ensure that grizzly bears would continue to access important habitats with a reduced risk of displacement and human-bear conflicts. Additionally, the HCP would maintain the integrity of linkages such that grizzly bears could continue to move between suitable habitats and recovery zones.

Effects of Forest Management Activities that result in Disturbance or Displacement of Grizzly Bears

DNRC activities such as timber sale cruising and layout, site preparation, road maintenance involve people working in bear habitat. Humans in bear habitat can lead to disturbance and displacement of grizzly bears as well as human-bear conflicts. This section addresses the former; human-bear conflicts are addressed in Section D. For the most part, the effects of these motorized and non-motorized activities would be similar to those from dispersed recreational activity (e.g., Mace and Waller [1996]), and from motorized activities summarized by Mace et al. (1996); namely disturbance or displacement due to use of existing roads and activities in adjacent management areas. Displacement of grizzly bears during critical periods or from key habitats may potentially result in adverse effects and therefore the HCP includes measures to address effects in spring habitat and denning and post-denning habitat. Disturbance of grizzly bears from helicopter use is poorly understood; hence the DNRC includes measures to minimize risk to grizzly bears from these activities as discussed below. Lastly, in limited circumstances, gravel operations in grizzly bear habitat may disturb or displace grizzly bears.

Spring Habitat

Upon emerging from their dens in spring, grizzly bears are nutritionally stressed, having undergone inactivity during the winter months. As a result, their habitat use patterns during the spring are driven by the need to maximize energy intake. Activities that displace grizzly bears from spring foraging habitat may adversely affect their ability to consume adequate amounts of food in a short amount of time.

Potential Effects on Spring Habitat

- Forest management activities conducted in spring habitat during the spring season could result in grizzly bears being disturbed or displaced from preferred habitats during this important period of nutritional stress.

Indicators of Effects of the Proposed HCP on Spring Habitat for Grizzly Bears
Effects on grizzly bear spring habitat are measured in terms of commitments that restrict DNRC and public access in spring habitat during the spring period.

Analysis of Effects of the Proposed HCP on Spring Habitat for Grizzly Bears
Restricting DNRC activities in spring habitat during the spring season would minimize and potentially avoid adverse effects on grizzly bears. Activity restrictions, duration of restrictions, and the amount of area over which these activities would be restricted are described. Under the DNRC HCP, restrictions would be implemented during the spring period in spring habitat in

recovery zones and NROH (commitment GB-NR3). These restrictions would prohibit commercial forest management activities, pre-commercial thinning, and heavy equipment slash treatment. Other low-intensity activities, and 10 days for mechanical site preparation, road maintenance, and bridge repair would be allowed, and commercial forest management activities would be allowed within 100 feet of open roads. Allowing short term, low-intensity activities presents limited risk to grizzly bears because of a low likelihood that grizzly bear use and these DNRC activities would overlap in a given location at any given time. The effect on grizzly bears is limited in duration, space and intensity compared to a grizzly bear encountering commercial activities, which may cause a bear to forgo use of an area for an extended period. Activities near roads would not create additional adverse effects on grizzly bears beyond those attributed to the open road.

In the Stillwater Block, spring restrictions are applied not only in spring habitat, but also along a subset of roads in spring habitat during the spring period. In the Swan River State Forest, the spring habitat restrictions described above would be applied in all project area lands below 5,200 feet elevation, not just within linkage zones as currently required by the Swan Agreement. Therefore, even in active subzones, DNRC would not conduct commercial activities during spring in spring habitat.

In the CYE recovery zone and associated NROH, additional limits would be placed on the amount and location of motorized low-intensity activities in spring habitat under the HCP (see Final EIS/HCP 2010, Appendix A). Specifically, no motorized activities associated with sale preparation, road location or data collection/monitoring would be allowed in the CYE or associated NROH, whereas these activities are allowed in the NCDE. Additionally, slash treatment and chainsaw use would be prohibited in the CYE and associated NROH. The remaining motorized, low-intensity activities that are allowed in the NCDE, including tree planting, prescribed burning, patrol of slash burns, noxious weed management and road maintenance, mechanical site preparation and bridge replacement would be limited to no more than 10 days per year per parcel in the CYE or associated NROH.

In summary, under the HCP, spring habitat restrictions would be implemented on 161,068 acres (sum of recovery zone and NROH in the HCP project area) of trust lands, of which approximately 48,600 acres would be in the Stillwater Block, 31,700 acres would be in the Swan River State Forest, and 17,900 acres (Libby and Plains Units) would be in the CYE (Table II-10). We note that under the HCP, the spring period is 15 days shorter than recommended by the IGBC (1998) and NCDE Access Group (2002), but the same as that used under the Swan Agreement. The effects on grizzly bears attributed to a shorter spring window (two weeks) would be minor, because, as discussed in Section C, eighty percent of bear locations in the NCDE after mid-June were at higher elevations whereas spring habitat is found at lower elevations. Additionally, the acreage of lands where the shorter period is applied represents 3 percent of the spring habitat in the action area. Overall, restricting activities in 161,068 acres of lands in the HCP project area would ensure grizzly bears can access the habitats they need with low risk of displacement during this important season for grizzly bears. Based on the analysis above, we expect only discountable or insignificant effects on grizzly bears with implementation of the measures described above.

Denning and Post-denning Habitat

As described under Section B, human activity near grizzly bear dens can cause physiological stress or, in some cases, den abandonment. Additionally, activities during the post-denning period in post-denning habitat pose a risk of disturbance to females with young cubs who have recently emerged from den sites.

Potential Effects on Denning and Post-denning Habitat

- Mechanized forest management activities and/or the presence of humans near denning habitat, den sites, and post-denning habitat may result in physiological stress or den abandonment.

Indicators of Effects of the Proposed HCP on Denning and Post-denning Habitat

The risk of disturbance to grizzly bears in dens during the denning period (winter period) is avoided by measures that restrict activities in denning habitat, defined as areas at elevations greater than 6,300 feet. Limitations on activities during the post-denning period (through May 26 [Mace and Waller 1997]) would avoid adverse effects on females with cubs.

Analysis of Effects of the Proposed HCP on Grizzly Bear Denning and Post-denning Habitat

Under the HCP**,** commitment GB-PR5 would prohibit mechanized operations within 0.6 mile of known active, occupied den sites from the date of discovery until March 31. Where specific information is available, (e.g., for grizzly bears that are subjects of radio-tracking studies, etc.), this measure would avoid the risk of physiological stress to denning grizzly bears. Because no consistent, formal survey efforts would be dedicated to locating den sites, it is possible that forest management activities may be allowed to take place near undetected, occupied dens. However, the likelihood that this would occur is extremely low. This is because 1) there is a low likelihood of overlap between a harvest unit and a den site, because generally, it is not feasible to conduct most forest management activities in denning habitat (slopes greater than 45 percent at elevations greater than 6,300 feet) during the denning season when snow depths are still high. Under the HCP, components of commitments GB-ST2, GB-SW3, and GB-SC2 would also restrict motorized activities above 6,300 feet, further reducing potential for physiological stress to any denning grizzly bears on or nearby trust lands.

In recovery zones, commitment GB-RZ5 in the HCP requires additional restrictions in post-denning habitat. The HCP would seasonally restrict forest management activities in all post-denning habitat in recovery zones (5,863 acres) (Table II-12). No motorized forest management activities would be allowed in areas of mapped post-denning habitat (slopes greater than 45 percent at elevations greater than 6,300 feet) from April 1 through May 31. Implementation of the management/rest scenario in the Stillwater Block, Swan River State Forest, and scattered parcels in recovery zones under the HCP may provide for additional reduction of the risk of disturbance because in addition to post-denning restrictions, commercial activities would only be allowed from November 16 through March 31, such that all activities would cease during the post-denning period.

In summary, the risk of adverse effects on denning grizzly bears is discountable because of restrictions near den sites and limitations on activities at those elevations and conditions during winter. Further, displacement or disturbance of females with cubs in post-denning habitat in recovery zones would be avoided under the HCP.

Helicopter Operations

Similar to other motorized ground activities, helicopter flights have the potential to disturb grizzly bears. Effects on grizzly bears from aerial flights have not been extensively studied; however, there is general agreement that helicopters create audible temporary disturbance that can influence grizzly bears, but without the longer lasting effects associated with roads. Recently, USFS and USFWS (2009) provided guidance to National Forests on effects analysis of helicopter use in grizzly bear habitat. The document states that the available evidence suggests that aircraft flying at relatively low altitudes in occupied habitat can elicit a response by grizzly bears. Effects may range from a simple awareness of the aircraft (i.e., raising the head but otherwise continuing uninhibited) to short-term disturbance or flight response (resulting in physiological changes such as increased stress and energetic demands) to temporary displacement from an area.

Potential Effects of Helicopter Operations

- The use of helicopters for forest management activities can disturb grizzly bears and/or displace them from preferred areas.

Indicators Used to Measure Effects of Helicopter Use under the Proposed HCP on Grizzly Bears
The 2009 Guide identified the following levels of effects are likely based on altitude, frequency, and duration:

- Flights more than 500 meters above ground level with no landings are likely to have minimal effects on grizzly bears, regardless of their frequency and duration.
- Low-altitude flights less than 500 meters above ground level are likely to elicit a response by grizzly bears, which may result in adverse effects to varying degrees depending on their frequency and duration.

The guide further stipulates that helicopter use of short duration and low frequency may affect grizzly bears, but typically does not result in adverse effects. When extended helicopter use (more than 2 consecutive days) involves low-altitude flights in proximity to grizzly bears or their habitat, that use is likely to have adverse effects on grizzly bears. These effects may be greatest when logging or flights occur in secure habitat for grizzly bears or otherwise undisturbed bear habitat.

Analysis of Effects of Helicopter Use under the Proposed HCP on Grizzly Bears
As described in Part I.C. of this BO, DNRC infrequently uses helicopters to access harvested timber or accomplish other short-duration foresee management activities. Only a portion of the estimated helicopter harvest between 1998 and 2005 would have occurred on HCP project area lands within

grizzly bear recovery zones and no DNRC timber sales included helicopter logging units in the past two years. While overall helicopter use for forest management occurs infrequently on DNRC lands, associated disturbance can have adverse effects on grizzly bears. Use of helicopters in lieu of roads can also benefit both land managers and grizzly bears by 1) decreasing the need for additional roads on the landscape, 2) minimizing the duration of the disturbance, and 3) decreasing the risk for grizzly bears associated with ground crews (e.g., seeding, weed spraying) operating in grizzly bear habitat for days or weeks at a time.

Disturbance zones for helicopter yarding in a logging unit requiring flights less than 500 meters above ground level could be as large as 8 square miles, considering a relatively long turn distance of 2 miles and an assumed disturbance buffer of 1 vertical mile from the flight path.

Under the HCP, commitment GB-PR8 would require DNRC to design helicopter flight paths to avoid or minimize flight time over known seasonally important areas in NROH or recovery zones, scattered parcels in rest in recovery zones, grizzly bear subzones in rest in recovery zones, and/or federally identified security core areas in recovery zones.

In NROH and recovery zones associated with the CYE, commitment GB-CY5 would require DNRC to design flight paths to occur at least 1 mile from scattered parcels in rest or federally identified security core areas. With implementation of GB-CY5 in the CYE, potential disturbance to grizzly bears from helicopter operations associated with logging activities would be avoided.

In other portions of the HCP project area, commitment GB-PR8 would minimize the potential for effects on grizzly bears from helicopter operations associated with logging activities. Additionally, other HCP commitments, including the den site and denning habitat protections provided by commitments GB-PR5 and GB-RZ5 and the spring management restrictions in commitment GB-NR3, would further avoid or minimize effects on grizzly bears in denning habitat and spring habitat from helicopter use for logging activities through seasonal restrictions on commercial harvest and motorized activities.

In some instances, DNRC may find that flight paths designed to avoid seasonally important areas or rested subzones are not economically feasible. In the NCDE, depending on the timing and circumstances of the activity, adverse effects on grizzly bears may result, and these would primarily be attributable to disturbing grizzly bears from important foraging areas. Disturbance in the fall may have a greater effect on grizzly bears than during the summer because grizzly bears are feeding and building up fat stores for the approaching denning season. Effects on grizzly bears attributable to DNRC's helicopter activities in the NCDE would likely be minor because (1) the nature of helicopter disturbance in areas important for grizzly bears is infrequent on a program basis: each year less than 5 projects contain helicopter harvest units when compared to the 548,500-acre project area; (2) the nature of the disturbance type occurs within small geographic areas when it does occur; statewide approximately 160 to 320 localized acres on average would be harvested annually using helicopters, and only a portion of those occur in areas important for grizzly bears; (3) when forest stands are logged using a helicopter, the associated disturbance is usually initiated and completed within one 3- to 6-month operating season :the activity occurs infrequently and is of relatively short duration; and (4) abundant forest cover is frequently present in western Montana where helicopter logging activities would take place. While short-term helicopter disturbance can

be intense for an individual bear(s) using a local area, the long-term effect of the activity provides considerably less risk than similar ground-based yarding methods requiring new road construction or existing road systems.

In summary, under the HCP, short-duration activities that use helicopters may result in some disturbance to grizzly bears, particularly if these flights occur in or over federal security core or seasonally important areas. Because DNRC's short duration activities may require low-altitude flights with or without landings, but are limited to 1 or 2 days, no adverse effects on grizzly bears are anticipated because the effect would be minor in intensity and would not persist for a long period of time. However in the NCDE, DNRC may find that flight paths designed to avoid seasonally important areas or rested subzones are not economically feasible. In these cases, grizzly bears may be adversely affected by helicopter use through disturbance from key habitats. Because of the reasons listed above, we do not anticipate that adverse effects would rise to levels that impair breeding, feeding or sheltering.

In NROH and recovery zones associated with the CYE, commitment GB-CY5 would require DNRC to design flight paths to be more than 1 mile from scattered parcels in rest or federally designated security core areas. In the CYE, effects of helicopter use on grizzly bears using secure habitats and seasonally important areas would be avoided.

Gravel Operations

Gravel pits are typically located adjacent to roads to limit costs associated with road construction and hauling distances. There are no IGBC or USFWS standards for gravel pits in grizzly bear habitats because generally, the effects are accounted for in analyses pertaining to disturbances associated with road densities and are otherwise not considered a significant risk factor for grizzly bears.

Potential Effects of Gravel Operations

- Increased levels of human activity associated with gravel operations in areas serving as secure habitat may disturb or displace grizzly bears.

Indicators Used to Measure Effects of Gravel Operations on Grizzly Bears

Effects associated with gravel developments less than 0.25 mile from open roads are considered as disturbance associated with open roads, which is addressed in the analysis of access management in Section D. Therefore, this analysis primarily addresses provisions for gravel pits that would occur greater than 0.25 mile from open roads and/or operated during periods of rest under the HCP. Limitations on the number and size of active gravel pits and duration of activities are the primary means for avoiding or minimizing potential effect on grizzly bears.

Analysis of Effects of Gravel Operations under the Proposed HCP on Grizzly Bears

Gravel pits have specific definitions in the HCP regarding size: borrow-size (up to 1 acre), medium (1 to 4.9 acres), and large (5 to 40 acres). Under current practices, the only stipulation for gravel pits is that they be located as close to planned roads as possible and large gravel pits in all areas must adhere to the requirements of Opencut Mining Permits administered by Montana DEQ. With implementation of the HCP, effects on grizzly bears from gravel pits within 0.25

mile of restricted roads would be avoided because those pits could only be operated during the seasons the roads are not restricted as described in the transportation plans. The HCP limits the size and number of pits located more than 0.25 mile from an open road as described below. The number of pits allowed includes those operated on trust lands for federal and state highway purposes.

- Stillwater Block – up to 5 active (3 may be large),
- Swan River State Forest – up to 4 active pits (3 may be large), and
- Scattered parcels in recovery zones and NROH – 3 pits per DNRC Administrative Unit (2 may be large.)

The effects of gravel pits operated greater than 0.25 mile from an open road are further minimized through the following measures:

- For pits operated in the spring period, the days of operation would count against the 10 days allowed for low-intensity activities as described in commitment GB-NR3 (Final HCP, Chapter 2).

- No gravel pits would be allowed in SMZs for all HCP project area lands, and only one medium pit would be allowed in RMZs (but outside SMZs) within the Stillwater Block and Swan River State Forest.

Operation of gravel pits in rested subzones could affect the integrity of these areas as secure habitat for grizzly bears. DNRC anticipates this type of affect would occur infrequently, but over the 50-year term, could not ensure that it would never need to operate a pit in a rested subzone, particularly in the case of the need for a gravel pit associated with a fire or other disturbance event.

To minimize its effects associated with operating gravel pits in rested subzones in the Stillwater Block, DNRC would:

- prohibit large pits in Class A lands
- operate only 1 pit more than 0.25 mile from an open road on Class B lands outside the restrictions required in the transportation plan, but would
    - minimize the distance from the road
    - cease activities on other allowable active pits to the extent feasible.

To minimize its effects associated with operating gravel pits in rested subzones in the Swan River State Forest, DNRC would:

- operate only one pit more than 0.25 mile from an open road
    - minimize the distance from the road
    - cease activities on other allowable active pits to the extent feasible.

To minimize its effects associated with operating gravel pits in rested scattered parcels in recovery zones, DNRC would:

- operate only one pit more than 0.25 mile from an open road in a rested parcel

- minimize the distance from the road
- cease activities on other allowable active pits to the extent feasible.

With these gravel pit commitments in place under the HCP, potential effects to grizzly bears are mostly discountable or insignificant for the following reasons: 1) most pits will be located adjacent to roads such that the effects of the pit are already accounted for in the effects of the road and 2) pits adjacent to roads would follow the same restrictions on seasons of use, which are meant to allow grizzly bears to access important habitats during key time periods free from human disturbance. However, adverse effects to grizzly bears may occur in order for DNRC to address a fire or disturbance event, but these effects are not likely to rise to levels that impair breeding, feeding or sheltering due to the minimization measures listed above.

Livestock Operations on Forested Trust Lands

Livestock grazing (including the use of domestic sheep and goats for integrated noxious weed management) can increase the risk of bear-human conflicts. Grizzly bears may be attracted to sheep grazing operations and facilities and to the carcasses of dead livestock. Grizzly bear predation on sheep can result in risks to human life, property damage, death of individual bears, or indirectly, in mortality through habituation and removal of a bear to protect human safety. Bears can benefit from feeding on livestock carcasses in remote locations away from people. However, when dead livestock occur near human dwellings or other areas with high levels of human activity, the potential for bear-human encounters may be high, which can eventually lead to the death of the bear through management actions (purposeful removal of a bear from the population by wildlife managers).

Potential Effects of Livestock Operations

- Livestock operations or use of livestock for weed control in grizzly bear habitat, may lead to management actions resulting in bear mortality.

Indicators Used to Measure Effects of Livestock Operations Under the Proposed HCP on Grizzly Bears

Livestock grazing licenses include management measures that favor the needs of grizzly bears including a requirement for development of a plan to address potential attraction of grizzly bears to weed-grazing livestock, reduction in the number of licenses or acres subject to grazing licenses in forested landscapes, and contact between wildlife and livestock, DNRC would continue to work with MFWP on a case-by-case basis to develop grazing plans and to lessen the risk to predators, such as wolves and grizzly bears.

Analysis of Effects of Livestock Operations under the Proposed HCP on Grizzly Bears

Currently, DNRC has very few grazing licenses on very limited ownership in grizzly bear recovery zones (Table II-26).

Table II-26. Acreage of grazing licenses on blocked lands and scattered parcels in recovery zones and NROH in the HCP project area portion of the action area.

Recovery Zone, Land Office, Unit Office, (Scattered or Blocked Status)	Acres of Licenses in the HCP Project Area[1]	
	Recovery Zone	NROH
NCDE	**8,979**	**30,711**
NWLO-Kalispell Unit (Scattered)	2,137	584
NWLO-Plains Unit (Scattered)	N/A	786
NWLO-Stillwater (Blocked	2,061	N/A
NWLO-Stillwater Unit (Scattered)	0	2,509
NWLO-Swan River State Forest	0	N/A
SWLO-Anaconda Unit (Scattered)	N/A	4,070
SWLO-Clearwater Unit (Scattered)	4,142	20,963
SWLO-Missoula Unit (Scattered)	0	0
CLO-Helena Unit (Scattered)	639	1,799
CYE	**1**	**3,997**
NWLO-Libby Unit (Scattered)	0	3,346
NWLO-Plains Unit (Scattered)	1	651
GYE		**3,806**
CLO-Bozeman Unit (Scattered)	N/A	3,166
CLO-Dillon Unit (Scattered)	N/A	640
Total	**8,980**	**38,514**

[1]. Actual acres may be less than depicted. Acreage amounts were calculated based on parcel area. When licenses or leases where granted for a subset of the actual parcel acreage that license or lease acreage is an overestimate of the true license or ease area.
[2]. N/A = not applicable. Where N/A is listed in the table, there is no such land area in the given unit.
Source: Final EIS/HCP (2010), Chapter 4, Table 4.9-3.

Under the HCP in NROH and recovery zones, commitment GB-NR5 would require mitigation plans for use of sheep and goats for noxious weed control. Mitigation plans would minimize risk of depredation of livestock by grizzly bears and other predators (e.g., through the use of human shepherds, fencing/bedding areas, guard dogs, etc.). Additionally, under commitment GB-NR5, prompt removal of all livestock carcasses identified as creating the potential for bear-human encounters would also minimize risk of bear-livestock conflicts. Within recovery zones, commitment GB-RZ4 would prohibit the authorization of any new small livestock grazing licenses, including those for the purposes of weed control. In addition, DNRC would not initiate the establishment of new grazing licenses, although proposals initiated by the public for larger, less vulnerable classes of livestock (such as cattle and horses) may be considered and allowed by DNRC. The measures contained in the HCP would provide greater assurance that the potential for conflicts is minimized on trust lands.

We do not anticipate that the HCP will result in habituation of grizzly bears leading to conflicts in the CYE because DNRC has few active grazing licenses in the CYE affecting a limited number of acres (Table II-26). We note there is no history of bear management actions in the CYE on DNRC lands, and no new grazing licenses would be authorized. Additionally, grizzly bear/livestock conflicts have not been an issue in the CYE, and we do not consider this type of land use, at its current levels, a threat to grizzly bears. For the NCDE, we cannot conclude that no conflicts would occur since the grizzly bear population is increasing and expanding its range. Therefore, we conservatively assume that some habituation of grizzly bears to seeking livestock as prey would occur on DNRC lands in the NCDE resulting in grizzly bear mortality.

Human-Bear Conflicts Resulting from Forest Management Activities

Human contact is among the greatest risk factor for grizzly bears. Habituation to human presence and human foods can lead to increases in bear-human interactions, resulting in an elevated risk of injury or death to both (Mace and Waller 1998). Public use of trust lands for recreation or DNRC staff presence in the project area increase the risk of encounters. Public use of recreation facilities, including leased cabin sites and developed recreation sites, can also lead to increased risk of bear-human interactions. Management of recreation facilities is not a covered activity under the HCP, and trends in the use of such sites under the HCP are not expected to change from current trends. Therefore, public use of recreation facilities is not addressed further in this analysis. Public use of roads is also not a covered activity under the HCP. The discussion of roads in Section D. describes DNRC efforts to control the type, location, and nature of public use of DNRC forested trust lands.

There has never been a case of a DNRC employee or its contractor, having a direct conflict with a grizzly bear that resulted in a management action or death of a grizzly bear because of a human-bear conflict (DNRC Final HCP 2010).

<u>Potential Effects of Bear-Human Encounters</u>

- The presence of DNRC staff and contractors working in grizzly bear habitat, as well as public access and presence on DNRC roads, may lead to bear-human encounters that could result in bear mortality.

<u>Indicators Used to Measure the Risk of Bear-Human Encounters Under the Proposed HCP</u>
The risk of direct conflict can be managed by informing the public and DNRC staff of ways to avoid encounters with grizzly bears. Stringent requirements for food storage and sanitation can minimize the risk of habituation of grizzly bears to human foods and waste. Limitations on firearm possession may reduce the likelihood that a grizzly bear would be shot because of misidentification or malice by anyone conducting forest management activities on trust lands. No known incidents related to encounters or improper food storage and sanitation by DNRC staff and contractors leading to the death of a bear have occurred to date. The following subsection identifies and compares the rules, policies, and commitments under that address risk management through public education, food storage and sanitation, and limitations on firearms possession.

Analysis of Risk of Bear-Human Conflicts Under the HCP

Information and Education – Under the HCP, DNRC would provide grizzly bear awareness information to all contractors and their employees, as well as training to DNRC employees. Under the HCP, the long-term information and education program would help ensure that the risk of bear-human conflicts from DNRC activities remains low.

Food Storage – The HCP, via commitment GB-PR3, would provide new rules requiring bear-resistant storage of all food and sanitation for all DNRC employees and in all forest management contracts for DNRC contractors and their employees, which would increase protection for people and grizzly bears. The HCP would increase awareness of agency personnel and contractors, and would reduce the potential for food and sanitation-related risks to grizzly bears. DNRC considers risks to grizzly bears attributable to food storage and sanitation concerns to be low across the forest management program because camping by staff and contractors is relatively uncommon and few livestock, food storage facilities, campgrounds, or other food or sanitation/storage facilities occur on, or are managed in association with, HCP project area lands. Implementation of the HCP would ensure that the risk to grizzly bears from these factors remains low.

Firearms – Under current practices, contractors and employees are prohibited from carrying firearms, except in the case of employees who are specifically authorized to carry a firearm under special circumstances. The HCP would continue this prohibition, and would additionally require authorized employees to maintain a current written authorization on file. Although this additional requirement would not explicitly limit the availability of firearms to DNRC staff, it may reduce the risk of unauthorized firearm possession, it promotes greater awareness of the concern, and further emphasizes the importance of existing enforceable policies. Thus, the proposed HCP is expected to continue to reduce the risk to grizzly bears associated with misidentification or malice by anyone conducting forest management activities on trust lands.

In summary, the HCP would implement a program to ensure that DNRC and its contractors are working responsibly in bear habitat and reducing risk of conflict. We do not anticipate that the HCP will result in habituation of grizzly bears leading to conflicts in the CYE because the population of grizzly bears in the CYE is low and the number of DNRC acres in the recovery zone is low. Hence the likelihood of overlap of grizzly bears and DNRC actions is low. Further, we anticipate that DNRC program to avoid and minimize conflicts would not result in habituation of grizzly bears in the CYE leading to the need for management actions. For the NCDE, we cannot conclude that no conflicts would occur since the grizzly bear population is large and increasing and expanding its range. Therefore, we conservatively assume that some habituation of grizzly bears leading to depredation on livestock grazing under DNRC licenses HCP may occur over the Permit term. Such habituation leads to grizzly bear mortality. Again, given the proposed information and education program and other measures to avoid and minimize the risk of human-bear conflicts, we expect the number of conflicts would be low.

Land Disposals and Acquisition on the Forested Land Base

The HCP includes conservation measures within the Transition Lands Strategy (DNRC HCP, Chapter 3) for the addition and removal of lands from the HCP project area. The effects of this strategy are described below.

Potential Effects of Land Disposals and Acquisitions

- Lands removed from the HCP project area may be subject to subsequent development or management that no longer provides habitat for grizzly bears.

- Lands added to the HCP project area may benefit grizzly bears or represent increased risk of incidental take for grizzly bears depending on existing management practices.

Indicators Used to Measure Effects of Land Disposals and Acquisitions on Grizzly Bears
Effects associated with development on any HCP project area property sold, are not actions authorized or regulated by DNRC, nor would they be considered covered activities under this HCP. Similarly, should DNRC decide to develop and lease an HCP project area parcel, such DNRC actions would not be "covered activities" under this HCP. Upon transfer of deeds and ownership, the subsequent landowner would be required to comply with all state and federal laws during development of their property. Therefore, the primary means for minimizing risk of effects on grizzly bears from land disposals is to control the amount of land removed from the provisions of the HCP and provide opportunities for application of alternative conservation measures on those lands prior to their disposal.

Analysis of Effects Land Disposals and Acquisitions on Grizzly Bears Under the HCP
This section describes the effects of land disposal and addition of lands containing grizzly bear habitat in the HCP project area.

Effects of Disposal of Lands from Recovery Zones – Under current practices, lands identified for potential disposal undergo considerable evaluation and analysis as outlined in the Real Estate Management Rules and MEPA process, and described in the Final EIS/HCP 2010, Appendix A. Through the disposal process and in accordance with the Administrative Rules of Montana (ARM) 36.25.803, DNRC may sell a parcel of trust land that is determined significant to threatened or endangered species only if the Land Board provides or approves compelling reasons for the sale. These layers of review and consideration (Real Estate Rules, MEPA process, and Land Board approval) would be implemented under the HCP and decrease the likelihood that important grizzly bear habitats would be disposed, or that those lands that are disposed would be subject to major developments with substantial adverse effects on Federally-listed species. Nevertheless, disposal of lands from DNRC trust management may result in adverse effects on grizzly bears, depending upon the nature of the proposed use of such lands.

Under the HCP, removal of lands from the HCP could affect the ability of the HCP to meet the biological goals and objectives established for grizzly bears. The specific effects are impossible to analyze at this time, without specific proposals. However, we anticipate that the lands remaining in the HCP project area would continue to provide a conservation benefit to grizzly

bears and meet the goals and objectives of the HCP. The potential for land disposal to affect the overall HCP goals and objectives is tempered for several reasons.

First, lands in grizzly bear recovery zones (and CYE NROH) would be subject to the more restrictive cap on removing lands (5 percent of the baseline HCP project area, meaning no more than 10,880 acres, could be removed from grizzly recovery zones and CYE NROH, lynx management areas, or bull trout core areas). Second, DNRC is less likely to sell its lands within its blocked ownership (representing the largest blocks of DNRC-administered grizzly bear habitat) because these areas facilitate efficient management and increased opportunities for meaningful and effective landscape–scale conservation of wildlife habitat. Third, in determining the HCP project area, DNRC identified lands likely to be targeted for disposal and already excluded those parcels from the HCP project area. Fourth, through the process of removing lands from the HCP, DNRC is required to notify conservation buyers of proposed sales to provide opportunities for outright sale to a conservation entity or easement purchase.

Lastly, as described for current practices, lands identified for potential disposal undergo considerable evaluation and analysis which decreases the likelihood that important grizzly bear habitats would be disposed, or that those lands that are disposed would be subject to major developments with substantial adverse effects on Federally-listed species. If disposals did occur on blocked lands, the subsequent development activities are not actions authorized or regulated by DNRC, nor are they covered activities under this permit. As such, the new landowners would be required to comply with all state and federal laws during development of their property.

Removal of lands that provide grizzly bear habitat may have some adverse effects on individual grizzly bears, or portions of grizzly bear home range, but are unlikely to be a great enough number of acres or located in sensitive enough habitat to affect the overall habitat integrity of a grizzly bear home range or population. The DNRC HCP does not cover activities on lands once they are disposed, so the ultimate effect of individual disposals is not analyzed or permitted here.

Effects of Disposal of Scattered Parcels Outside of Grizzly Bear Recovery Zones – Removal of lands comprised of scattered parcels outside the grizzly bear recovery zone would be subject to the provisions of the DNRC Real Estate Management Rules and the MEPA process.

We expect that removal of scattered parcels from the HCP would have a low likelihood of resulting in adverse effects on grizzly bears. This is because these lands would be subject to a 10 to 15 percent cap of the baseline HCP project area or 33,090 to 49,640 acres, respectively, that could be removed from the HCP project area over the permit term (anticipated to be 50 years). DNRC would be limited to removal of 33,090 acres (the 10 percent cap) until it adds 15,000 additional acres to the HCP, which is likely to partially offset the loss of habitat from prior disposals. Upon the addition of 15,000 acres to the HCP project area, DNRC could increase the removal of acres from the HCP project area to 49,640 acres (15 percent cap). The cap on the removal of lands, coupled with the provisions of the Real Estate Management Rules and the MEPA process, and measures contained in the Transition Lands Strategy make it unlikely that parcels with high threatened species value would be disposed to a non-conservation entity.

Overall, removal of lands from the DNRC HCP (within grizzly bear recovery zones and outside of recovery zones) would not likely adversely affect the HCP's ability to meet its biological goals and objectives for grizzly bears because sufficient amounts of habitat would remain to support grizzly bear conservation. Nevertheless, DNRC would evaluate the effects of land disposals on the covered species at the time of such proposals. Additionally, we would work with future landowners to determine if Act compliance is needed. .

Effects of Lands Acquisitions – When the state acquires forested trust lands with habitat for HCP species, DNRC will consider adding the parcels to the HCP project area. For newly acquired parcels that would have otherwise been subjected to development (possibly resulting in the permanent loss of habitat) if they had not become trust lands, their addition to the HCP could benefit grizzly bears. The impacts on grizzly bears and their habitat associated with adding these lands under the HCP would be limited to the mitigated and mostly temporary effects associated with forest management activities, and not associated with development that would permanently remove grizzly habitat or result in attractants. Most lands likely to be acquired and considered for addition to the HCP project area are former private timberlands, currently with few provisions for the conservation of grizzly bears with the exception of private timberlands managed under the Swan Agreement. Adding lands to the HCP project area would provide more assurances and conservation for the species than present under existing baseline conditions. Potential benefits include increased acres managed as suitable habitat for grizzly bears, increased protection of special habitats (like spring forage areas or denning and post-denning habitat), and increased connectivity and integrity of linkage areas. Even if the added lands are not potential grizzly habitat, they could still facilitate habitat connectivity and linkage for grizzly bears within the action area and western Montana in general.

At this time, near-term acquisitions under consideration for addition to the HCP project area include four transactions comprising approximately 63,300 acres. If all these acquisitions were added to the HCP, it would increase the proposed project area by 12 percent. Lands that will be considered for addition to the HCP project area in the near term include the Lolo land exchange, the Chamberlain Creek acquisition, the Potomac acquisition, scattered parcels in the SWLO, and the North Swan acquisition. These acquisitions are described below.

Lolo Land Exchange – Under the Lolo Land Exchange, DNRC has acquired approximately 10,500 acres of lands that were previously National Forest system lands. If these lands are added to the HCP, DNRC would apply the program-wide commitments for grizzly bears. Because these lands are outside the grizzly bear recovery zone, application of the DNRC commitments would provide a similar level of conservation as National Forest lands.

Chamberlain Creek Acquisition – DNRC recently acquired title to 14,581 acres of land in the SWLO referred to as the Chamberlain Creek parcels. These parcels are mostly contiguous and adjacent to several DNRC scattered parcels in the HCP project area. Most roads necessary for forest management in this area have already been constructed and are in fair condition. DNRC is currently conducting inventories of the forest stands and will determine the presence of habitat in the near future. Given that these lands were formerly managed by private timber landowners with few requirements for the protection of grizzly bears, at the present time, there may be excessive road densities and limited cover. DNRC management of these lands under the HCP

would apply the program wide and NROH commitments, which would ultimately improve these habitats for grizzly bears through retention of visual screening, restrictions on forest management activities in the spring period, and possibly through road closures.

Potomac Acquisition – DNRC recently acquired 32,000 acres of land in the SWLO referred to as the Potomac Acquisition. These mostly contiguous parcels are primarily forested stands of varying age classes, composed of ponderosa pine, western larch, Douglas-fir, lodgepole pine, Engelmann spruce, and other mixed conifers and hardwoods. Most currently non-merchantable stands are fully stocked, and pre-commercial thinning has been completed on many of the more advanced sapling stands. Many of these stands will be approaching merchantable size within the next 20 to 30 years. Parcels in this area are roaded to accommodate future forest management. DNRC management of these lands under the HCP would apply the program wide and NROH commitments, which would benefit grizzly bears as described for the Chamberlain Creek Acquisition.

Scattered Parcels in the SWLO – In summer 2008, DNRC acquired the Ovando Mountain, Tupper Lakes, and North Lincoln scattered parcels, which encompass several sections and partial sections totaling 4,258 acres in the SWLO. Approximately 1,280 acres (2 parcels) of these lands occur in NROH associated with the NCDE. DNRC is still in the process of acquiring data associated with these parcels and does not yet know the presence of habitat, road conditions, or forest stand attributes. Once data associated with the parcels are acquired, DNRC will evaluate these parcels for potential addition to the HCP project area. Given that these lands were previously managed for private, industrial timber production, implementation of the HCP would result in a net benefit for grizzly bears if added to the HCP.

North Swan Acquisition – D NRC recently acquired 1,917 acres in the north Swan. The entire acquisition is former timber industry lands and is primarily forested. Most of the property has been logged at various times since the early 1900's resulting in stands of various age classes composed of ponderosa pine, western larch, Douglas-fir, western white pine, lodgepole pine, Engelmann spruce, grand fir, cedar, and other mixed conifers and hardwoods. Existing merchantable timber is found mainly in streamside management zones and as scattered overstory in previously harvested stands. Most non-merchantable stands are fully stocked; many of the more advanced sapling stands have been pre-commercially thinned. Many of these stands will be approaching merchantable size within the next 20 to 30 years. Parcels in this area are roaded to accommodate future forest management. If added to the HCP project area, these lands would be managed within the Swan River State Forest and NCDE recovery zone. Overall, adding lands to the DNRC HCP is expected to result in beneficial effects for grizzly bears. These benefits would arise from the application of the HCP commitments and the caps and processes in the HCP transitions lands strategy that would be applied to these lands.

In summary, the likelihood that lands providing important grizzly bear habitat would be removed from the HCP is low. If lands are removed and subject to subsequent development, we would coordinate with the new landowners to determine if Act compliance is required. Added lands are most likely to be private industrial timber lands and would generally result in a net benefit to grizzly bears. However, if DNRC maintains high road densities on these lands, existing adverse effects on grizzly bears would persist. While these effects would be tempered by the

commitments to provide for grizzly bear security and minimize risk of displacement from human disturbance, given the increasing population of grizzly bears in the NCDE, we anticipate a that at some point over the permit term, road densities would impair a bear's ability to meet is feeding, breeding, or sheltering needs on DNRC lands.

Summary of Effects of Disturbance and Displacement from Forest Management Activities

The DNRC designed the proposed action to address those risk factors to grizzly bears attributable to its forest management program. In many instances, the commitments were modeled after the IGBC guidelines, though tailored to the management needs of DNRC or updated based upon recent guidelines (i.e., USFS and USFWS 2009).

For many individual grizzly bears, we believe that the risk of disturbance and displacement from key habitats within home ranges is minimized such that any adverse effects would be temporary and/or short term and would not preclude grizzly bears from accessing the habitat necessary to feed, breed, or shelter. However, some individual grizzly bears may underutilize available habitat due to the presence of roads. Hence, as explained in the sections above, where DNRC ownership is blocked and/or substantial, the number of miles of road and density of roads on DNRC lands may contribute to significant displacement of some female grizzly bears that would impair breeding, feeding sheltering. We expect this impact to be limited to affect very relatively few female grizzly bears, given the numbers of grizzly bears and scale of the Project area and the impacts that would be minimized because of the numerous commitments in the HCP that avoid or minimize the impact of adverse effects (see Final EIS /HCP 2010, Appendix A). DNRC's program to limit open roads, restrict public and state access on other roads during key time of year for grizzly bears, implement a management/rest scenario, provide cover and screening for grizzly bears, and address potential human-bear conflicts would ensure that most grizzly bears could access habitats necessary to successfully raise their young. Notably, the HCP includes an extensive program to minimize risk of disturbance and displacement of grizzly bears from key habitats during important seasons.

Further, the risk of adverse effects on denning grizzly bears in the HCP project area is negligible because of restrictions near den sites and limitations on activities at those elevations and conditions during winter. Displacement or disturbance of females with cubs in post-denning habitat in recovery zones would be avoided under the HCP. We also do not anticipate adverse effects on grizzly bears due to displacement from spring habitat. Short-duration activities that use helicopters may result in some disturbance to grizzly bears, particularly if these flights occur in or over federal security core or seasonally important areas but the effects would be limited for the NCDE and avoided in the CYE. The likelihood of adverse effects to grizzly bears from gravel operations is low, and we do not expect effects would lead to impairment of breeding, feeding or sheltering.

Vegetation management can affect cover causing grizzly bears to change their use of an area. The DNRC HCP includes provisions to ensure that grizzly bears would continue to access important habitats with a reduced risk of displacement and human-bear conflicts. Additionally, the HCP would maintain the integrity of linkages such that grizzly bears could continue to move between suitable habitats and recovery zones.

Overall, the DNRC HCP includes an extensive program to minimize risk of disturbance and displacement of grizzly bears from key habitats during important seasons. Further, the risk of adverse effects on denning grizzly bears in the HCP project area is discountable because of restrictions near den sites and limitations on activities at those elevations and conditions during winter. Displacement or disturbance of females with cubs in post-denning habitat in recovery zones would be avoided under the HCP. We also do not anticipate adverse effects on grizzly bears due to displacement from spring habitat. Short-duration activities that use helicopters may result in some disturbance to grizzly bears, particularly if these flights occur in or over federal security core or seasonally important areas but the effects would be limited for the NCDE and avoided in the CYE. The effects to grizzly bears from gravel operations would be largely discountable or insignificant because of the measures described above. Adverse effects to grizzly bears related to gravel pit operations for a fire or disturbance event are not likely to rise to levels that impair breeding, feeding or sheltering due to the minimization measures listed above.

Measures contained in the HCP would help reduce the risk direct mortality of grizzly bears. Commitments address and reduce the potential for bear-livestock conflicts as well as human-bear conflicts surrounding livestock on trust lands. Nevertheless, we conclude that in the NCDE, conflicts could occur resulting in management actions that cause grizzly bear mortality. While the HCP would implement a program to ensure that DNRC and its contractors are working responsibly in bear habitat and reducing risks to grizzly bears, conflicts may still occur given the increasing population and range of grizzly bears in the NCDE project area. These conflicts could lead to management actions resulting in grizzly bear mortality at some point over the 50-year Permit term. Any potential effects of the limited grazing in the CYE are expected to be discountable. Additionally, grizzly bears using habitats adjacent to roads may suffer an increased risk of human-bear conflicts that ultimately result in bear mortality. We expect this risk to be very low, given the record, causes and locations of mortalities in both the NCDE the CYE, and lack of known mortalities on DNRC lands. This risk is discountable in the CYE where HCP lands are limited.

In areas outside the recovery zones in NROH and other areas, the DNRC would provide several commitments to reduce the adverse effects on grizzly bears from high road density or vegetation management. These include the suite of 8 program-wide commitments, notably a food storage order and restriction of firearm use for all employees and contractors, protection of den sites, reduction of road construction in riparian zones, wetland management zones, and avalanche chutes, visual screening . Further, 6 additional commitments would reduce and minimize adverse effects in NROH. NR1 would minimize construction of new open roads. Notably, although there is not cap on total road densities, NR1 requires that new roads will only be managed as open when necessary to meet project or near-term management objectives. Existing roads that are restricted will generally remain restricted, except in cases where access easements are granted. As stated in the HCP “there are situations where the amount of open roads would increase by leaving newly constructed roads open or by opening currently restricted roads. This is expected to be the exception rather than the rule and will be minimized while taking into account project, access management, and land management objectives”. Thus we expect new open roads on these lands to be minimized. Further, commitments restrict management activities in the spring season, limit distance to cover to no greater than 600 feet for clearcut or seed tree

harvest designs, develop minimization measures for small livestock grazing licenses. As anticipated in the Recovery Plan, grizzly bears are expanding their range outside of the recovery zone. Grizzly bears outside the recovery zone experience a higher level of adverse impacts due to land management actions than do grizzly bears inside. Some grizzly bears have evidently adapted to higher levels of human activity across the landscape and are able to raise offspring. Considering the large size of the both the NCDE and GYE, the increasing populations in both, land management within the recovery zone, and the status of the grizzly bear population in the NCDE, we do not expect the level of effects on grizzly bears living in these areas now and in the future would negatively affect the GYE or NCDE populations, given the HCP commitments.

Removal of lands that provide grizzly bear habitat may have some adverse effects on individual grizzly bears, or portions of grizzly bear home range, but are unlikely to be a great enough number of acres or located in sensitive enough habitat to affect the overall habitat integrity of a grizzly bear home range or population. The ultimate effect of individual disposals is not permitted under the HCP. Independent evaluation of disposals will take place by the USFWS in coordination with the new landowner at the time of such proposals, and consequences of such proposals evaluated. Overall, adding lands to the DNRC HCP is expected to result in beneficial effects for grizzly bears. These benefits would arise from the application of the HCP commitments and the caps and processes in the HCP transitions lands strategy that would be applied to these lands.

In the CYE, we expect a low likelihood of adverse effects from high road densities on DRNC lands and that any adverse effects would not rise to levels that result in incidental take of grizzly bears. This is because numerous measures are in place to ensure that grizzly bears can access seasonal habitats during key times of the year with low risk of human disturbance. The HCP applies additional measures to reduce displacement and human-caused mortality of grizzly bears. Under the HCP, the need for any new roads in the CYE would be highly scrutinized, and any new roads would be managed as temporary roads or restricted to public motorized access (i.e., not open roads). Further, in the CYE recovery zone, the HCP would expedite reduction of open road densities (GB-CY4). Additionally, in the CYE recovery zone and NROH, the HCP would: 1) prohibit commercial forestry in the spring in spring habitat, 2) limit other motorized activities in spring habitat during the spring period to 10 days per parcel up to the maximum allowable days, 3) require additional restrictions on allowable activities in spring habitat during the spring period, 4) avoid potential effects on grizzly bears from helicopter flights, 5) require USFWS approval of mitigation plans for salvage projects, and 6) rest parcels for 8 years following 4 years of commercial activity. These commitments are in addition to other commitments that would also minimize displacement, such as the requirements for maintaining 600 feet to cover in harvest units and retaining cover near RMZs and WMZs.

The 1993 Recovery Plan states that a unified recovery effort, coordinated research of Federal and State agencies and a supportive public is the most effective approach to ensure that grizzly bears will be present in all remaining ecosystems in the future. The DNRC HCP addresses grizzly bear recovery goals and objectives that are applicable on DNRC lands. The 1993 Bear Grizzly Recovery Plan outlined the following goals:

1. Establish the population objectives for recovery and identify limiting factors

2. Redress population limiting factors:
    - Manage sources of direct mortality
    - Reduce the sources of indirect mortality

3. Determine habitat and space requirements for achievement of grizzly bear population goals

4. Monitor populations and habitats

5. Manage populations and habitats

6. Develop and initiate appropriate information and education programs

7. Implement the Recovery Plan through appointment of a recovery coordinator

8. Revise appropriate Federal and State regulations to reflect current situations and initiate international cooperation

This BO (*Effects of the Action* section) described and analyzed how the HCP would directly contribute to addressing goals 2, 4, 5 and 6, which are applicable to DNRC's land management actions. Further, DNRC contributes to goals 1, 3 and 4 through participation in the NCDE Manager's Subcommittee and by contributing to interagency monitoring and research through funding and staffing for research and work teams, and providing access to DNRC lands.. Since the early 1990s, DNRC has been an active participant in various interagency work and research groups examining population and habitat issues, such as the IGBC access group, the Cumulative Effects Model team, Swan Valley technical team and other efforts.

Grizzly Bear Response to the Proposed HCP

The proposed HCP would implement an access management program and numerous other provisions to minimize the risk of disturbance and displacement of grizzly bears from key habitats and reduce the risk of human-bear conflicts on DNRC lands. For the most part, timber harvest activities are not anticipated to result in adverse effects on grizzly bears given limitations on commercial harvest in rested subzones, during spring in active subzones, and at elevations supporting denning and post-denning habitat in winter.

However, the residual effects of timber harvest, namely roads and human access on those roads may result in adverse effects on grizzly bears when displacement, disturbance, or human-bear conflicts occur. The proposed action would no longer provide secure 'core' areas as per the IGBC definition. In the NCDE, where DNRC manages larger blocks of habitat, grizzly bears in affected subunits may be adversely affected. These effects are minimized by strict limitations on opportunities for human-bear conflicts and displacement of grizzly bears from important seasonal habitat during key times of the year.

The proposed action minimizes adverse effects from these actions through the following means:

- Maintaining (not increasing) or reducing miles and densities of open roads on DNRC trust lands
- Limiting DNRC activities in spring habitat in the spring period in recovery zones and NROH including in subzones that are not "in rest"
- Placing seasonal restrictions (on both DNRC and public motorized use) to ensure that grizzly bears can access key habitats during important times of the year
- Minimizing the potential for disturbance in large blocks of habitat during key periods of the year (4 year management /8 year rest scenario), and limiting the frequency with which large-scale disturbance (e.g., commercial forestry) may occur
- Implementing an information and education program and food storage and sanitation program for DNRC and its contractors
- Prohibiting the authorization of new small livestock grazing licenses in recovery zones
- Capping the total number of acres that can be removed from the HCP project area over the permit term.
- Maintaining the integrity of habitat linkage zones.

To give perspective on what these effects mean to grizzly bears, consider that DNRC trust lands and the HCP project area comprise a small proportion of grizzly bear recovery zones and NROH (Tables II-3 and II-5). DNRC trust lands comprise 3.6 percent and 6.5 percent of recovery zones and NROH, respectively in the NCDE. Approximately 2.6 and 3.0 percent of recovery zones and NROH, respectively in the NCDE are included in the HCP project area. DNRC trust lands comprise 0.5 percent and 0.4 percent of recovery zones and NROH, respectively in the CYE and the same percentage, though slightly fewer acres, are included in the HCP project area. The proportions are smaller in the GYE. Federal land management assumes the largest single role in the conservation of the grizzly bears in the contiguous United States because of the preponderance of grizzly bear habitat and occurrence on Federal lands (Tables II-5 and II-6). This is in contrast to the acres of lands managed by DNRC in grizzly bear habitat in western Montana. We lack complete information on the numbers or density of grizzly bears using various areas of the ecosystems, but we assume the entire action area is occupied by grizzly bears, including females. Therefore, we anticipate that adverse effects on grizzly bears would occur from the proposed action, including take of some female grizzly bears as described in the BO above. However, considering the extent of grizzly bear range, the size of grizzly bear home ranges and the extent of DNRC land ownership, it is reasonable to assume that the proposed DNRC actions are likely to affect relatively few grizzly bears.

E. CUMULATIVE EFFECTS

Cumulative effects include the effects of future State, tribal, local or private actions that are reasonably certain to occur in the action area considered in this BO. Future Federal actions that are unrelated to the proposed action (issuance of the HCP) are not considered in this section because they require separate consultation pursuant to section 7 of the ACT.

Habitat Loss versus Conservation Trends

Private lands in the action area are being developed at a moderate rate for residential or business use. It is impossible to inventory all ongoing and reasonably certain future developments. In general , recreation and sanitation issues on private land continue to create human-grizzly bear conflicts, which often results in a management removal (and mortality) of the bear(s). The human population in the area has experienced relatively high growth during the recent decade, and growth is expected to continue. As the human population grows and more land is developed, the challenge to accommodate human uses in ways that continue to protect the grizzly bear population increases. We expect continued human-caused mortalities of grizzly bears, but continued growth in the grizzly bear populations as well. At this point in time, the grizzly bear populations in the NCDE and GYE continue to increase, despite the number of human-caused mortalities of grizzly bears on private lands. As mentioned earlier, in the CYE, human-caused mortality on private lands is a growing concern.

Private forest lands are located in the action area. Some of those private lands are on the market for residential development. The largest landowner is PCTC. Some of its lands have been sold for private development. However, PCTC has recently sold 310,000 acres into conservation and public ownership through The Nature Conservancy and the Trust for Public Lands in a transaction called the Montana Legacy Project. Much land has already been transferred to the USFS, MFWP, and Montana DNRC. Other lands remain under TNC ownership with the long-term goal of finding conservation buyers. Plum Creek Timber Company was a partner in the Swan Agreement and developed an HCP to support a 10(a)(1)(B) permit for native fish. The lands in the Swan are now owned by The Nature Conservancy, which is voluntarily following the Swan Agreement measures.

The large federal land ownership, large blocks of wilderness within which human access is restricted by regulation and topography, and regulated uses of state land, such as proposed in this HCP and through existing ARMs, serve to reduce the impacts of increasing human populations on grizzly bears.

Bear-Human Conflicts

As mentioned in the section above, the existing trend in human population increases and recreational use of public lands in grizzly bear habitat within the action area will likely continue. Bear Management Specialists with MWFP in the NCDE, GYE and CYE, and a number of Indian Tribes have a history of working with private landowners and recreational users to reduce and eliminate bear-human conflicts on private land in Montana. These management efforts have a successful track record and are reasonably certain to continue.

F. CONCLUSION

After reviewing the current status of the grizzly bear, the environmental baseline for the action area, the effects of the proposed action, and the cumulative effects in the action area, it is the USFWS's biological opinion that the DNRC HCP is not likely to jeopardize the continued existence of the grizzly bear. No critical habitat has been designated for the grizzly bear, therefore none will be affected.

Regulations implementing section 7 of the Act define "*jeopardize the continued existence of*" as: "*to engage in an action that reasonably would be expected, directly or indirectly, to reduce appreciably the likelihood of both survival and recovery of a listed species in the wild by reducing the reproduction, numbers, or distribution of that species*." (50 CFR 402.02).

The best information suggests that forest management activities managed under the conservation commitments of the DNRC HCP would not appreciably reduce the likelihood of survival and recovery of grizzly bears. Our conclusion is based on the literature and information referenced in this document, meetings and discussions with DNRC, discussions with grizzly bear experts, the information in the Final EIS/HCP (2010), and information in our files. The *Effects of the Action* section analyzed and summarized key factors in detail. We find that although adverse effects are likely to some individual grizzly bears, the proposed action is not reasonably expected to reduce appreciably the likelihood of both the survival and recovery of any grizzly bear populations in the wild by reducing the reproduction, numbers or distribution of the species. The HCP conservation commitments include measures that minimize and reduce the effects of high road densities, and reduce the potential for human-bear conflicts and for livestock-bear conflicts.

The scale of the DNRC HCP is not large, in relation to the range of grizzly bears:

- The DNRC HCP lands account for 1.8 percent of grizzly bear recovery zone lands in Montana (154,201 acres out of 8,565,699 acres).

- The DNRC HCP project area accounts for 2.5 percent of the lands encompassed by the NCDE recovery zone (147,845 acres out of 5,717,399 acres) and 1 percent of the lands encompassed by the CYE recovery zone (6,174 acres out of 1,699,760 acres). The project area encompasses no recovery zone lands in the GYE.

- The HCP lands are dispersed across western Montana; even where they are localized in "blocked lands" (like the Stillwater or Swan State Forests), in no case does DNRC ownership encompass even a single BMU or subunit (which approximate the size of a female home range).

The status of grizzly bear populations is considered:

- In the NCDE, the grizzly bear population was estimated at 765 grizzly in 2004 (Kendall et al. 2009) and research suggests an increasing (+3 percent in 2010) population trend since 2004 (Mace and Roberts 2011). This population is increasing and approaching

recovered levels. Of the DNRC HCP lands within grizzly bear recovery zones, nearly 96 percent (147,845 acres out of 154,201 acres) occur in the NCDE.

- The GYE in northwest Wyoming, eastern Idaho, and southwest Montana (9,200 sq mi) has nearly 600 bears (Haroldson 2009). In 2008, the total population size for the GYE population was estimated at 596, with a 95 percent confidence interval between 535 and 656 in 2008 (Haroldson 2009). The GYE population is increasing in size approximately 4-7 percent annually (Haroldson 2009; Harris et al. 2006). This population is also at recovered levels. The DNRC HCP has no covered lands in the GYE recovery zone; however, does include 27,000 acres in NROH.

- The CYE grizzly bear population is small and was estimated to contain at least 42 grizzly bears during 2004-2009 (Kasworm et al. 2010). During 2004-2009, there were approximately 16 individuals in the Cabinet Mountains and 26 individuals in the Yaak portion of the recovery zone (Kasworm et al. 2010). High rates of known mortality from 1999 to 2009 (3.36 mortalities per year) suggest the population has most likely been decreasing (Kasworm et al. 2010; Wakkinen pers. comm. January 2011 in USFS 2011 BA supplement). However, improved subadult female and adult female survivorship resulted in an improved trend over recent estimates (e.g. 2004), although still declining. Improving survival by reducing human-caused mortality is crucial for recovery of this population, as is augmentation of the population and ensuring connectivity with Canada (Proctor et al. 2004) and between the Cabinet Mountains and the Yaak River portions of the ecosystem.

The complete suite of HCP conservation commitments for grizzly bears was analyzed in the BO and are described and analyzed in the Final EIS/HCP 2010, Appendix A. The HCP includes:

- The conservation commitments begin with commitments that apply to the entire HCP project area and then progressively identifies higher levels of commitments that are applied to various areas as the likelihood of grizzly bear presence and the need for conservation increase. The progression culminates with the highest levels of DNRC conservation being placed on the HCP project area within the grizzly bear recovery zones, including the Stillwater Block, the Swan River State Forest, and numerous scattered parcels, including lands in the CYE.

- .Grizzly bear population levels are currently low within the CYE, which raises the importance of conservation within that ecosystem at this time. In this grizzly bear ecosystem, DNRC considered the current higher level of risk associated with the CYE population, and applied greater levels of mitigation in the CYE to address this greater sensitivity. Greater protections in this area apply to the HCP project area within the CYE recovery zone, and to the HCP project area within the NROH.

- The BO analyzed the full complement of commitments that work together to either avoid or minimize the potential for and the impact of adverse effects to grizzly bears. As explained in this opinion, as well as in the HCP (Final EIS/HCP, 2010, Appendix A), the

suite of measures covers broad and specific issues at several scales: program-wide, NROH, recovery zones, blocked lands, scattered parcels and additional measures for the CYE.

- These commitments address and reduce the potential for grizzly bear mortality associated with grizzly bear conflicts with people and livestock through managing open roads, restricting firearm use and requiring food storage by employees and contractors, and limiting grazing licenses.

- The commitments related to reducing the effects of roads on grizzly bears are numerous. The BO discusses how these commitments address habitat and security needs of grizzly bear, and reduce the impacts of roads. Some key commitments would result in the following: new roads would be managed as restricted, open road levels would be controlled in key areas, commercial activities would be limited to four years and followed by eight years of rest on blocked and scattered lands in recovery zones, roads in important seasonal habitat for grizzly bears would be restricted during season of use, visual cover would be maintained and road miles minimized in riparian and wetlands zones important to grizzly bears, the distance to cover for grizzly bears would be minimized in openings, and the effects of helicopter use would be minimized or avoided.

- Enhanced commitments would apply in the CYE and NROH. For projects in the CYE NROH and CYE recovery zone, the program-wide, NROH recovery zone, and scattered parcels in recovery zones commitments. Further, in the CYE recovery zone and its NROH, minor projects are further restricted during the eight-year rest period, salvage projects require a mitigation plan approved by the USFWS, adverse effects of helicopter use are avoided, and road use and minor activities will be reduced and affect no more than 50 percent of the parcels in spring habitat during the spring period. Finally, DNRC will expedite addressing open road densities recovery zone parcels.

- The potential disposal of approximately 45,500 acres from the HCP would not compromise the HCP's ability to complement grizzly bear recovery efforts on adjacent Federal lands managed by the Forest Service, because sufficient amounts of habitat would remain in the HCP to support grizzly bear conservation on DNRC lands.

- Disposal of lands in grizzly bear recovery zones and CYE NROH would be limited to 5 percent of the baseline HCP project area. Therefore, no more than 10,880 acres could be removed from grizzly recovery zones and CYE NROH, lynx management areas, and bull trout core areas, combined.

- Lands that may be added to the HCP over the Permit term are most likely to be private industrial timber lands and would generally result in a net benefit to grizzly bears because these lands are presently not managed with the same conservation commitments as the in HCP. If DNRC maintains high road densities on these lands, existing adverse effects on grizzly bears would persist but would be tempered by the HCP commitments to provide for grizzly bear security and minimize risk of displacement from human disturbance.

- The HCP includes commitments for implementation monitoring, effectiveness monitoring, and for adaptive management (Final EIS/HCP 2010, Appendix A).

The best available science and information indicates that grizzly bears are capable of surviving and reproducing in multiple-use forest environments when such considerations are made to manage human activities in space and time. It is the USFWS's opinion that the proposed DNRC HCP adequately conserves grizzly bear habitat, and adequately minimizes or mitigates for adverse effects on grizzly bears related to high road densities and risks of grizzly bear-human and bear-livestock interactions that ultimately lead to the removal of grizzly bears from the population. Our analysis in this BO leads us to conclude that the anticipated levels of adverse effects would not impede either recovery or survival of the grizzly bear.

As explained throughout this BO, the HCP would affect a small area of the overall range of grizzly bear in Montana, and so affects a correspondingly low number of grizzly bear home ranges. Importantly, we examined and considered the full suite of HCP conservation commitments detailed in the HCP, as summarized and analyzed in this BO. We have determined that this suite of measures conserves grizzly bear habitat and minimizes the potential for and impact of adverse effects in the recovery zones. Further, the suite of conservation measures includes measures to reduce and minimize the potential for and impact of take on grizzly bears that may occur in the NROH surrounding the NCDE and GYE and CYE, and into the future, in areas still further from recovery zones.

In the NCDE recovery zone and GYE and NCDE NROH, DNRC forest management activities covered under the HCP have the potential to result in impairment of breeding and feeding of female grizzly bears. However, we have determined that this would not rise to a level that impacts the survival or recovery of either the NCDE (or GYE) populations, as a whole. This is because the impact of the adverse effects associated with HCP covered activities within recovery zones is relatively low given the size of the recovery zones and the amount of habitat managed for grizzly bear recovery by the USFS, NPS, and BLM. Further, open road densities, the larger threat to grizzly bears, would be controlled under the HCP within recovery zones, and minimized in NROH of the NCDE and GYE. Importantly, the HCP conservation commitments protect and conserve key seasonal grizzly bear habitat, minimizes disturbance during seasons of use, provides information and education as well as food storage and sanitation programs for DNRC staff and its contractors to reduce the risk of human-bear conflicts. No new grazing licenses for small livestock would be granted in recovery zones, thereby reducing conflicts associated with grazing licenses. Thus, the DNRC HCP promotes survival and recovery of grizzly bears on HCP project lands. Finally, federal lands encompass the preponderance of habitat in grizzly bear recovery zones. Both the GYE and NCDE recovery zones contain large portions of wilderness and national park lands, which are protected from the influence of many types of human uses occurring on lands elsewhere. Further, federal land management is guided by IGBC Guidelines for grizzly bear habitat management, and nuisance bear control actions. These factors have facilitated the growth of the GYE and NCDE grizzly bear populations to nearing or achieving recovered levels. Recovery zones were established to identify areas necessary for the recovery of a species and are defined as the area in each grizzly bear ecosystem within which the population and habitat criteria for recovery are measured. The NCDE and GYE recovery zones

contain the area and habitat adequate for managing and promoting the recovery and survival of these grizzly bear population (USFWS 1993). The HCP contributes to conserving grizzly bear habitat on HCP project area lands in the recovery zones. As anticipated in the Recovery Plan, grizzly bears are expanding their range outside of the recovery zone. Grizzly bears outside the recovery zone experience a higher level of adverse impacts due to land management actions than do grizzly bears inside. The HCP contains measures to reduce adverse effects on grizzly bears in NROH and beyond. Considering the large size of the both the NCDE and GYE, the increasing populations in both, land management within the recovery zone, and the status of the grizzly bear population in the NCDE, we do not expect the level of adverse effects that result from implementation of the DNRC HCP on project area lands to appreciably reduce the likelihood of both the survival and recovery of the grizzly bear in these ecosystems.

In the CYE recovery zone and NROH, we expect the potential for adverse effects from high road densities on DNRC lands would be sufficiently reduced and minimized, such that any adverse effects would not result in impairment of breeding, feeding or shelter of grizzly bears. This is because numerous measures in the HCP that address high road densities on DNRC HCP project lands. In addition to program-wide commitments, the HCP applies enhanced commitments on CYE lands in the recovery zone and in the associated NROH as well. To name some of these, measures are in place to ensure that grizzly bears can access seasonal habitats during key times of the year with low risk of human disturbance; the need for any new roads in the CYE would be highly scrutinized; and any new roads would be managed as temporary roads or restricted to public motorized access (i.e., not open roads). Further, in the CYE recovery zone, the HCP would expedite reduction of existing open road densities (GB-CY4). Additionally, in the CYE recovery zone and NROH, the HCP would: 1) prohibit commercial forestry in the spring in spring grizzly bear habitat, 2) limit other motorized activities in spring habitat during the spring period to 10 days per parcel up to the maximum allowable days, 3) require additional restrictions on allowable activities in spring habitat during the spring period, 4) avoid potential effects on grizzly bears from helicopter flights, 5) require USFWS approval of mitigation plans for salvage projects, and 6) rest parcels for 8 years following 4 years of commercial activity. These commitments are in addition to other commitments that would also minimize displacement, such as the requirements for maintaining 600 feet to cover in harvest units and retaining cover near RMZs and WMZs.

Six conservation needs were identified for the CYE grizzly bear population (Proctor et al. 2004; Servheen 2006). With the HCP, DNRC would address the four applicable needs on their trust lands: reduction in human-caused mortality, completion of a final access management strategy and food storage order (on federal lands), increased public outreach, and address needs of grizzly bears outside the recovery zone. The primary factors affecting grizzly bears in the CYE are motorized access and human-caused mortality. These factors have recently been addressed on federal lands by the completion of the Kootenai National Forest Access Amendment (USFS ROD, USFWS 2011) and food storage order. Thus we do not expect that survival or recovery of the CYE grizzly bear population would be diminished through implementation of the DNRC HCP.

The BO examined how the HCP addressed each of the recovery plan objectives pertinent to the proposed action. DNRC further addresses additional recovery plan objectives through long term participation on numerous IGBC committees and work groups.

We conclude that the proposed action is not likely to appreciably reduce the numbers, distribution or reproduction of grizzly bears in the NCDE, GYE, or CYE. The proposed action adequately minimizes adverse effects of forest management on grizzly bears and conserves functional grizzly bear habitat on HCP lands that supports the continued recovery and survival of each these grizzly bear populations. Therefore, the proposed action is not likely to jeopardize grizzly bears.

G. INCIDENTAL TAKE STATEMENT

Section 9 of the Act and Federal regulation pursuant to section 4(d) of the Act prohibit the take of endangered and threatened species, respectively without special exemption. Take is defined as to harass, harm, pursue, hunt, shoot, wound, kill, trap, capture or collect, or to attempt to engage in any such conduct. Harm is further defined by the USFWS to include significant habitat modification or degradation that results in death or injury to listed species by significantly impairing essential behavioral patterns, including breeding, feeding, or sheltering. Harass is defined by USFWS as intentional or negligent actions that create the likelihood of injury to listed wildlife by annoying it to such an extent as to significantly disrupt normal behavior patterns, which include breeding, feeding, or sheltering. Incidental take is defined as take that is incidental to, and not the purpose of, carrying out an otherwise lawful activity. Under the terms of section 7(b)(4) and section 7(o)(2), taking that is incidental to and not intended as part of the agency action is not considered to be prohibited taking under the Act provided that such taking is in compliance with the terms and conditions of this Incidental Take Statement.

The proposed DNRC HCP and its associated documents clearly identify anticipated impacts to affected species likely to result from the proposed taking and the measures that are necessary and appropriate to minimize those impacts. All conservation measures described in the proposed HCP, together with the terms and conditions described in any associated Implementing Agreement and any section 10(a)(1)(B) permit expected to be issued with respect to the DNRC HCP, are hereby incorporated by reference as reasonable and prudent measures and terms and conditions within this incidental take statement pursuant to 50 CFR §402.14(i). Such terms and conditions are non-discretionary and must be undertaken, and must be undertaken by the USFWS so that they become binding conditions of the incidental take permit issued to DNRC, as appropriate, for the exemptions under section 10(a)(1)(B) and section 7(o)(2) of the Act to apply. The USFWS has a continuing duty to regulate to the full extent of its authority the activities covered by this incidental take statement wherever they occur. If the USFWS (1) fails to assume and implement the terms and conditions or (2) fails to require the applicant to adhere to the terms and conditions of the incidental take statement through enforceable terms in the HCP, the protective coverage of section 7(o)(2) may lapse [50 CFR § 402.14(i)(3)]. In order to monitor the impact of incidental take, the applicant must report the progress of the action and its impact on the species to the USFWS as specified in the incidental take statement (50 CFR 402.14(i)(3)).

Amount or Extent of Incidental Take

This section describes the amount and extent of incidental take of grizzly bears anticipated from implementation of the DNRC HCP. As described in this BO, the proposed action avoids the potential for incidental take to occur as a result of several actions implemented under DNRC's forest management program with a few exceptions. We anticipate that incidental take in the form of harm or harassment would occur associated with high road densities on HCP project area lands. We anticipate this take in the form of harm, because the HCP would result in high road densities in some key habitats where a female bear and her cubs may suffer impairment of their ability to feed, breed or shelter. We also anticipate incidental take from failure of measures to avoid habituation of grizzly bears from bear-livestock or bear-human encounters that ultimately lead to management removal of the bear.

When estimating the potential for incidental take associated with forest management activities, it is important to recognize that results of scientific studies rarely lend themselves directly and unequivocally to precise management standards or thresholds – especially for low density species such as grizzly bears (Mace 2004). This is because scientific methods often used in most studies have narrow focus, such as null hypothesis testing. It is also difficult to design and implement a study *a priori* that examines all of the relevant physical parameters, environmental variability, and other relevant issues associated with any particular study topic or problem such that perfect management standards can be derived. Studies involving rare species are also often constrained by small sample sizes and may lack replication. Establishing definitive review standards may be further complicated when pertinent studies draw contradictory conclusions, including those documenting behavioral differences in study animals at local and/or regional scales, especially when studies are not comparable due to differences in research design and methodology. Under the Act, managers and agencies are required to use the best available information, whether peer reviewed or not, and therefore must acknowledge a higher measure of uncertainty than may be found in published information (Mace 2004). For these reasons and others associated with environmental and temporal variability, these areas of uncertainty are important considerations when exploring definitive answers and conclusions regarding incidental take, particularly for large, free ranging species such as grizzly bears.

Incidental Take in the NCDE and GYE Attributed to Habitat Degradation Due to Roads

DNRC's forest management activities include the construction, use, and maintenance of roads. High road densities create localized areas of avoidance for some bears, while evidence suggests that other bears may become "habituated." Habituated bears will use such habitats uninhibited but with a higher probability of human encounter, which may or may not lead to mortality or other conflicts.

High road densities may result in take in the form of harm by modification of key habitats through high road densities, or harassment by displacing some female bears from essential habitat. Such displacement may result in significant under-use of habitat or a female may choose not to establish a home range because habitat is undesirable. This could lead to reduced fitness of a female or her cubs, most likely failure to breed or complete gestation, or in fewer cases an increased risk of cub mortality prior to or after parturition. We do not expect incidental take of

male grizzly bears or subadults. Males and subadults do not have the physiological stresses and energetic needs of reproductive-aged females to breed and raise offspring.

The effects of displacement of female grizzly bears from key habitats are difficult to quantify. In most cases, no information or methodology is available to precisely measure or estimate the actual physical effects on individual bears in the wild. On DNRC lands, high road densities persisting in some areas may contribute to conditions with greater potential to lead to incidental take. The best scientific and commercial data available at this time are not sufficient to determine or detect a specific number of grizzly bears that may be significantly affected by displacement and therefore be vulnerable to incidental take. This is due to the lack of information related to the following factors:

- The number of grizzly bears living in the HCP project area.
- The number of adult female grizzly bears with home ranges encompassing all or portions of any particular subunit, groups of subunits, or scattered parcels with high road densities.
- The individual day- and night-time response of individual adult female grizzly bears to roads across the HCP project area, particularly adult females with home ranges encompassing areas with high road densities. Grizzly bears are individualistic in nature; some are more tolerant and adapt to human influences in their environment, while others are wary and tend to avoid human influences.
- Demographic parameters, such as individual female survivorship and fecundity are influenced by inherent variation in physiology, climate and other natural factors.
- Detection of loss of cubs prior to or after parturition is difficult to impossible.
- We lack a comprehensive understanding of all causative factors associated with mortalities of grizzly bears.

In instances where incidental take is difficult to quantify or detect, the USWS uses a “surrogate measure” of take. The number of grizzly bears that use the action area is unknown but grizzly bear observations have been documented for many years in recovery zones and NROH. Grizzly bears occur at relatively low numbers across landscapes, using large overlapping home ranges. Research has indicated significant underuse of preferred habitat by adult female grizzly bears where road densities, including open and total roads, are high (Mace and Manley 1993, Mace and Waller 1996, Wakkinen and Kasworm 1997). The research provides “benchmarks” or thresholds for road densities above which significant underuse of habitat by adult female grizzly bears has been documented. If significant underuse of key seasonal habitats occurs, females may suffer decreased fitness which impairs breeding or feeding. Therefore, the USFWS employs these road density benchmarks as surrogate measures for incidental take of grizzly bears. The benchmarks are based on research specific to the NCDE or the CYE. These benchmarks are useful in determining when take occurs, and the level of take anticipated through the proposed action.

Thus, for this analysis we will use research-based benchmark levels for road density in the NCDE (detailed in BO) to establish when incidental take is likely to occur. These benchmarks are described in Section D. Incidental take in the NCDE for high road densities is described below for blocked lands and scattered parcels.

Incidental Take for High Road Densities in the NCDE on DNRC Blocked Lands

Incidental take would occur under the HCP on DNRC blocked lands where TRD and ORD levels on DNRC lands are high (i.e. above the research benchmarks) and DNRC owns enough acreage to significantly affect TMRD or OMRD in the subunit.

In the Stillwater Block, this scenario occurs related to high TMRDs and TRDS on 4 BMU subunits: Lazy Creek, Stryker, Upper Whitefish, and State Coal Cyclone. In these four subunits, DNRC owns and manages substantial portions (40 percent or more) of the acreage in the subunit. As detailed in this BO, TMRDs are currently high as calculated at the subunit scale and on HCP lands in the subunits as well (Table II-15). Thus, due to high TRDs and the amount of ownership, DNRC makes a significant impact in high TMRDs in these four subunits. The DNRC HCP would maintain the existing high TMRDs in these four BMU subunits, increasing TRD in all but Lazy Creek (Table II-15). Therefore, the USFWS anticipates incidental take in the form of harm from high TRDs on 50,833 acres of DNRC lands in the Stillwater Block in four BMU subunits: Lazy Creek, Stryker, Upper Whitefish, and State Coal Cyclone (Table II-27).

In the Swan River State Forest, incidental take would occur as a result of high TMRDs and TRDs on four subunits: Goat Creek, Lion Creek, South Fork Lost Soup, and Porcupine Woodward. In these four subunits, DNRC Project area land is also substantial Subunit TMRDs are currently high as calculated at the subunit scale and TRDs on HCP lands in the subunits are high as well. Thus, due to high TRDs and the amount of ownership, DNRC TRDs make a significant impact on high TMRDs in these four subunits The DNRC HCP would maintain the existing high TMRDs in these four BMU subunits, increasing TRD in all subunits (Table II-15). Therefore, the USFWS anticipates incidental take in the form of harm on 35,660 acres of DNRC lands in the Swan River State Forest in four BMU subunits: Goat Creek, Lion Creek, South Fork Lost Soup, and Porcupine Woodward (Table II-27).

Table II-27. Acres of incidental take from high TRDs on DNRC blocked lands in the NCDE recovery zone under the HCP.

			HCP – Year 50		
			All Ownerships	HCP Portion of the Action Area	
BMU and Subunit	**Subunit Acres**	**Acres (Percent) of DNRC Lands within Subunit**	**Percent of Subunit Exceeding 2 mi/mi^{2}TRMD[1]**	**Percent of Lands Exceeding 2 mi/mi^2 TRD[1]**	**Acres of Lands Exceeding TRD 2 mi/mi^2**
Stillwater Block					
Stillwater River BMU					
Lazy Creek	34,559	14,365 (41.6)	83	80	11,432
Stryker	40,860	32,923 (80.6)	34	42	13,866
Upper Whitefish	32,201	27,035 (84.0)	59	67	18,124
Upper N. Fork Flathead BMU					
State Coal Cyclone	31,366	13,420 (42.8)	25	55	7,411
		Stillwater Block Subtotal Acres of Incidental Take			**50,833**
Swan River State Forest					
Bunker Creek BMU					
Goat Creek	27,602	5,894 (21.4)	61	98	5,752
Lion Creek	29,047	3,067 (10.6)	49	100	3,067
South Fork Lost Soup	29,883	18,324 (61.3)	47	81	14,761
Mission Range BMU					
Porcupine Woodward	37,666	12,237 (32.5)	76	99	12,080
		Swan River State Forest Subtotal Acres of Incidental Take			**35,660**

[1]. TMRD and TRD calculated using moving windows method per USFS (1995b).
Source: DNRC Final HCP (2010) Table 7-2. Percentage of acres exceeding research benchmarks rounded for this analysis.

Incidental take attributed to high OMRDs and ORDs would occur in four subunits in the Stillwater Block: Lazy Creek, Stryker, Upper Whitefish, and State Coal Cyclone. As detailed above, the DNRC ownership is substantial in these subunits. In all subunits, OMRD increases between 1 and 15 percent (Table II-20). OMRD is high as calculated at the subunit scale and ORDs on DNRC lands are also high. Thus, due to high ORDs and the amount of ownership, DNRC ORDs make a significant contribution to the high OMRDs in the Lazy Creek, Stryker, Upper Whitefish, and State Coal Cyclone subunits. Both OMRDs and ORDs would increase under the HCP. Therefore, the USFWS anticipates incidental take in the form of harm or harassment (i.e., adult female grizzly bears being displaced from habitat along roads due to human presence) from high ORDs on 45,560 acres of DNRC lands in the Stillwater Block in four BMU subunits: Lazy Creek, Stryker, Upper Whitefish, and State Coal Cyclone (Table II-28).

In the Swan River State Forest, under the existing Swan Agreement, all landowners cooperatively manage their lands to maintain OMRDs at 1 mile per mile square on no more than 33 percent of the BMU subunit. Hence, all subunits currently meet the OMRD objective in the Swan. As

discussed in Section D if the Agreement is terminated and the HCP is implemented, we anticipate that existing ORDs on DNRC lands would more than likely be maintained for the reasons described. Under the HCP, with maintenance of existing ORDs and application of the research benchmark in the NCDE, all subunits would exceed OMRD benchmarks. Additionally, all DNRC lands in the HCP project area would support high ORDs. Thus, due to high ORDs and the amount of ownership, DNRC OMRDs make significant contribution to the high OMRDs in Goat Creek, Lion Creek, South Fork Lost Soup, and Porcupine Woodward (Table II-20). Therefore, the USFWS anticipates incidental take in the form of harm or harassment of adult female grizzly bears on 23,917 acres of DNRC lands in the Swan River State Forest in four BMU subunits: Goat Creek, Lion Creek, South Fork Lost Soup, and Porcupine Woodward (Table II-28).

Table II-28. Acres of incidental take from high ORDs on DNRC blocked lands in the NCDE recovery zone under the HCP.

			HCP – Year 50		
			All Ownerships	HCP Portion of the Action Area	
BMU and Subunit	**Subunit Acres**	**Acres (Percent) of DNRC Lands within Subunit**	**Percent of Subunit Exceeding 2 mi/mi^{2}OMRD[1]**	**Percent of Lands Exceeding 2 mi/mi^2 ORD[1]**	**Acres of Lands Exceeding ORD 2 mi/mi^2**
Stillwater Block					
Stillwater River BMU					
Lazy Creek	34,559	14,365 (41.6)	83	80	10,371
Stryker	40,860	32,923 (80.6)	34	42	14,353
Upper Whitefish	32,201	27,035 (84.0)	59	67	14,243
Upper N. Fork Flathead BMU					
State Coal Cyclone	31,366	13,420 (42.8)	25	55	6,593
		Stillwater Block Subtotal Acres of Incidental Take			**45,560**
Swan River State Forest					
Bunker Creek BMU					
Goat Creek	27,602	5,894 (21.4)	61	98	5,173
Lion Creek	29,047	3,067 (10.6)	49	100	2,634
South Fork Lost Soup	29,883	18,324 (61.3)	47	81	5,975
Mission Range BMU					
Porcupine Woodward	37,666	12,237 (32.5)	76.1	98.7	10,135
		Swan River State Forest Subtotal Acres of Incidental Take			**23,917**

[1]. OMRD and ORD calculated using moving windows method per USFS (1995b).
Source: DNRC Final HCP (2010) Table 7-1. Percentage of acres exceeding research benchmarks rounded for this analysis.

Incidental Take for High Road Densities in the NCDE and GYE on DNRC Scattered Parcels

Incidental take would occur under the HCP on DNRC scattered parcels in the NCDE recovery zone as well as NCDE and GYE NROH and HCP project area lands (i.e., those lands not in recovery zones or NROH). Quantification and a measure for incidental take on scattered parcels is more difficult than for blocked lands, where subunits provide an appropriate scale of analysis (i.e. approximately the size of a female home range) within which to assess the effects of high road densities on grizzly bears. For scattered parcels outside recovery zones, the DNRC has no data on road density conditions on adjacent parcels, nor information on the future actions that may occur on adjacent parcels. Here we use two methods to quantify and measure incidental take on scattered parcels. One for parcels within recovery zones, where road density information is readily available for adjacent federal lands, and the other for parcels in the NROH, where such information does not exist.

In the NCDE recovery zone, DNRC manages scattered parcels in fourteen subunits. For total roads, nine subunits (Peters Ridge, Cedar Teakettle, S.F. Jocko, Noisy Red Owl, Lower Whale, Alice Creek, Arrastra, Ketchikan, and Red Mountain) TMRDs are near, or over the research benchmark of 19 percent. Because there is no cap on TRDs on these lands, for this analysis we will assume that all DNRC Project lands will eventually have TRDs over 2 miles per square mile over the Permit term. Thus, increases in linear TRDs could contribute to TMRDs increasing or remaining over research benchmarks. If this occurs, we anticipate the effect on subunit conditions (i.e. TMRDs) will result in incidental take of female grizzly bears through impairment of breeding and feeding of female bears as a result of displacement from key habitat. Given the commitments, variability in site specific habitat conditions, and individual grizzly bears' response to roads, we reasonably do not expect that all adult female grizzly bears living in the area over the Permit-term would experience this level of effects. We do not anticipate that impairment of breeding or feeding would be permanent for a female grizzly bear, as it is likely to eventually adapt to conditions or adjust her annual home range use. Therefore, the USFWS anticipates incidental take in the form of harm (high TRDs) or harassment (displacement) of a low number of adult female grizzly bears at times over the 50 year term, from high TRDs on no more than 16,430 acres of DNRC scattered parcels in the NCDE in the Peters Ridge, Cedar Teakettle, S.F. Jocko, Noisy Red Owl, Ketchikan, Lower Whale, Alice Creek, Arrastra, and Red Mountain subunits (Table II-29).

Table II-29. Acres of incidental take from total road densities on DNRC scattered parcels in the NCDE recovery zone under the DNRC HCP.

BMU Subunit	BMU Subunit Acres	Acres of DNRC Lands within Subunit Receiving Take Coverage for TRDs
South Fork Jocko	49,187	3,095
Noisy Red Owl	37,096	5,137
Lower Whale	19,020	1,100
Ketchikan,	23,911	1,097
Peters Ridge	25,109	742
Cedar Teakettle	31,704	481
Alice Creek	70,175	1,194
Arrastra Mountain	69,256	1,696
Red Mountain	76,674	1,888
Total	402,132	16,430

For open roads in the recovery zone scattered parcels, the HCP would maintain baseline open road miles at the administrative unit level (Table II- 21), and we expect that this commitment would significantly minimize the potential for adverse effects due to increased ORD in any subunit. As detailed in this BO, in five subunits, increases in linear ORDs associated with possible DNRC road relocations and/or management flexibility exercised to trade open road amounts between parcels in an administrative unit could contribute to these subunits reaching or further exceeding the research benchmark of 19 percent (Peters Ridge, Noisy Red Owl, Ketchikan, Lower Whale, Red Mountain) (Table II-29). We do not expect adverse conditions as a result of high open road miles on all acres of the project area in these subunits because the cap on open road miles significantly limits the amount of acres that could be affected. On the other hand, we cannot predict where or when particular miles of open road might increase within a subunit, and where they would correspondingly decrease in the same or nearby subunit. As explained in the BO, we expect this situation to be infrequent and in most cases, the effects on grizzly bears would be of low intensity.

Nevertheless, in the five subunits above, we anticipate the potential increase in ORD and its effect on subunit conditions (i.e. OMRDs) in some cases could result in adverse effects to grizzly bears. Given the commitments, the cap on linear open road miles, site specific habitat conditions, the applicable suite of commitments in the HCP, and variability in individual grizzly bears' response to roads, we reasonably do not expect that all adult female grizzly bears living in the area now or over the Permit-term would experience this level of effects as a result of DNRC actions. However we cannot rule out the possibility that some female grizzly bears at specific points in time, in specific circumstances over the 50 permit term may suffer impaired reproduction as a result of displacement from key habitat. Therefore, we anticipate some harm or harassment of impairment of a very low number of female bears at times over the 50 year term. We do not anticipate that impairment of breeding or feeding would be permanent for a female grizzly bear, as it is likely to eventually adapt to conditions or adjust her annual home

range use. The DNRC has committed to no increase in the miles of open roads in Table II-21. The project area ORDs are limited by the cap on these open roads, thus we will use these miles of open road per administrative unit in Table II-30 as surrogates to measure and limit the level of incidental take as a result of increased ORD.

Table II-30. Existing open road miles on scattered parcels in the HCP project area in the NCDE where HCP commitments require DNRC to maintain baseline open road miles at the administrative unit.

Administrative Unity by Recovery Zone	Open Road (Miles)
NCDE Recovery Zone	
Kalispell Unit	17.8
Stillwater Unit	1.8
Clearwater Unit	16.8
Missoula Unit	4.1
Helena Unit	0.2

For scattered parcels in NROH associated with the NCDE or GYE as well as additional scattered parcels outside both NROH and recovery zone (i.e., all other HCP project area lands), DNRC does not have data on road densities. Nor are there data on road densities on adjacent lands. As demonstrated in Section D, TRDs and ORDs are generally higher in these areas than in recovery zones. The HCP contains no measures to constrain total roads on these lands in NROH. Given that the NCDE and GYE grizzly bear populations are increasing both in numbers and distribution, we assume that grizzly bears will occur on these lands, and that grizzly bear numbers will increase or remain stable. Thus, we conservatively assume that incidental take of adult female grizzly bears in the form of harm or harassment is likely to occur at some point at some location(s) on these lands over the 50-year Permit term.

Here, due to this uncertainty in site-specific information, we use the number of acres that will potentially be affected by high road densities in the NROH. For reasons explained in the BO, the USFWS anticipates a low but not discountable potential for incidental take in the form of harm of a very few adult female grizzly bears over the Permit term. This take may occur due to high road densities in portions of 72,875 acres in the NCDE and 27,714 acres in the GYE NROH, and 281,588 acres outside the recovery zones and NROH in the HCP project area over the permit term (Table II-31).

In the event that the lands described in Section D are added to the DNRC HCP under the terms of the Transition Lands Strategy, an additional 61,256 acres within these categories (NCDE NROH and all other HCP project area lands occupied by grizzly bears, outside recovery zones) would also pose a slight risk for incidental take. We anticipate the likelihood of incidental take to be low (i.e few grizzly bears would be adversely affected) for the reasons described above in this opinion, including application of the HCP commitments.

Table II-31. Acres where incidental take may occur in the NCDE and GYE NROH and HCP project area.

Location	Acres
NCDE NROH	72,875
GYE NROH	27,714
All Other HCP Lands	281,588
Total Incidental Take	**382,177**
Additional lands in the event DNRC adds lands to the HCP	61,256

1. Additional incidental take would be authorized in the event that DNRC adds lands in compliance with the DNRC HCP, Chapter 3 - Transition Lands Strategy.

Incidental Take for Road Use for Forest Management Activities

Incidental take associated with increased use of permanent restricted roads for commercial activities and low-intensity activities requiring frequent use of roads (i.e., greater than 1 trip per day) would occur on blocked lands. As explained in the BO, this use may result in displacement of adult female grizzly bears that results in impairment of breeding or feeding. The USFWS anticipates a low level of incidental take in the form of harm from increased use on 274.4 miles of restricted roads in the Stillwater and Coal State Forests (Table II-14) and 239.8 miles of restricted roads in the Swan River State Forest (Table II-16).

Incidental Take Summary for Roads

Specifically, incidental take attributed to high road densities on DNRC HCP project area lands would be exceeded if the following occurs:

1. The acres of DNRC lands with TRDs above 2 miles per square mile in the Lazy Creek, Stryker, Upper Whitefish, State Coal Cyclone, Goat Creek, Lion Creek, South Fork Lost Soup and Porcupine Woodward subunits increase above the acres identified in the last column of Table II-27.

2. The acres of DNRC lands with ORDs above 1 mile per square mile in the Lazy Creek, Stryker, Upper Whitefish, State Coal Cyclone, Goat Creek, Lion Creek, South Fork Lost Soup and Porcupine Woodward subunits increase above the acres identified in the last column of Table II-28.

3. The acres of DNRC scattered parcels in recovery zones with TRDs above 2 miles per square mile exceed 16,430 acres of DNRC scattered parcels in the NCDE in the Noisy Red Owl, South Fork Jocko, and Lower Whale subunits (Table II-29).

4. The acres of DNRC scattered parcels in recovery zones with OMRDs above 1 mile per square mile exceed 9,964 acres in the Noisy Red Owl, South Fork Jocko, and Lower Whale and Ketchikan subunits (Table II-29).

5. If more than 61,256 of the acres added to the HCP during the Permit term in any combination of NCDE and GYE NROHs and all other HCP project lands, excluding the CYE, exceeds linear Total Road Density of 2 miles per square mile.

6. The miles of open roads per Administrative Unit in Table II-30 are exceeded.

7. The use of permanent restricted roads for commercial activities and low-intensity activities DNRC forest management activities exceeds 274.4 miles of restricted roads in the Stillwater and Coal State Forests (see BO Table II-14) or exceeds 239.8 miles of restricted roads in the Swan River State Forest (see BO Table II-16).

Incidental Take in the NCDE Attributed to Bear-human and Bear-livestock Conflicts

Incidental take in the HCP project area may occur in the NCDE due to bear-human or bear-livestock conflicts that result in management actions that remove a grizzly bear from the population. The incidental take covered in this statement is for DNRC activities that result in behavior changes in bears (habituation) that lead to needed management actions. The likelihood of incidental take for grizzly bear-human and grizzly bear-livestock conflicts is low for the following reasons:

1. There has never been a documented case of a direct conflict with DNRC staff or contractors and grizzly bears that resulted in a bear's death.

2. The probability of such an adverse outcome will be minimized through implementation of the HCP conservation commitments described in the DNRC HCP, Chapter 2, including training people working in bear habitat (GB-PR1), firearms restrictions (GB-PR2), sanitation (GB-PR3), and livestock management restrictions (GB-NR5 and GB-RZ4), as well as commitments that provide visual screening and cover (GB-PR6, NR4, RZ2).

However, the potential for take cannot be completely eliminated because grizzly bears are currently relatively abundant in the NCDE (Kendall et al. 2009); bear-human interactions are increasing; and the permit spans 50 years. To approximate the number of grizzly bears that might be affected as a result of covered activities, an analysis was conducted that considered known grizzly bear mortalities in the NCDE and causes during the last 28 years (USFWS 2009). To conduct the analysis, several assumptions were required:

- DNRC manages a similar proportion of its acreage for grazing purposes as other major land owners and land management agencies associated with the NCDE.

- Grizzly bear mortalities occur on all ownerships due to similar causes in relative proportion to the availability of a particular ownership within the NCDE.

- Similar land management activities conducted by all other major land owners and land management agencies are likely to influence bears at the same rates. That is, similar forest management activities, such as setting up timber sales, logging, and managing

livestock allotments, are likely to affect bears similarly whether they are conducted by DNRC, the USFS, or by private industrial land managers, etc.

The specific mortality causes in the NCDE described by the USFWS (USFWS 2009) deemed most similar to those that might occur from DNRC activities and result in incidental take were (1) livestock-related mortalities and (2) mortalities related to human self-defense (Table II-32). For this analysis, the total number of grizzly bears that died related to these combined causes in the NCDE (n=59) was divided by 28 years to derive a value for average grizzly bear deaths per year (2.1) for the entire ecosystem. This value was then multiplied by the proportion of DNRC land ownership in the NCDE (3.6 percent), and finally multiplied by 50 years – the life of the HCP and term of the Permit. The resulting number of 3.78 bears, given the assumptions above, is the number of bears that could be lost to the population given general characteristics of the types of activities, land area involved, and duration (in years) of the activities.

Therefore, rounding this number up, we anticipate that incidental take from failure of measures to prevent habituation of grizzly bears could result in direct mortality of up to four grizzly bears within the NCDE and all other remaining HCP project area lands (excluding the CYE) over the Permit term.

Incidental take on HCP covered lands would be exceeded if more than 4 grizzly bears are removed from the NCDE population through control actions attributed to failures in DNRC's programs to prevent habituation and/or food conditioning of grizzly bears. If DNRC actions contribute to management removal of more than 4 bears over the 50-year term, the level of incidental take we anticipate in this BO would be exceeded. Specifically, grizzly bears removed from the NCDE population for either of the following reasons would be a loss attributed to incidental take of as result of DNRC related actions:

1. Management removal of grizzly bears as a result of habituation and food conditioning (i.e. attraction to and/or depredation livestock feed and livestock or livestock feed) where DNRC has grazing licenses for grazing on forested trust lands,

2. Management removal of grizzly bears related to failure of DNRC staff or its contractors to properly store food or waste whereby a conflict results.

Table II-32. Evaluation of incidental take of grizzly bears related to bear-livestock or human-bear conflicts on DNRC lands based on causes of mortality in the NCDE from 1980 to 2008.

Statistic or Calculation	Result
Livestock-related mortalities from 1980 to 2008 in the NCDE[1]	29
Self-defense-related mortalities from 1980 to 2008 in the NCDE[1]	30
Total number of bears killed during 28 years due to self-defense- and livestock-related causes[1]	59
Long-term average number of bears per year that died in the NCDE due to these causes[1]	2.1
DNRC portion of the potential annual mortality given its 3.6% ownership within the NCDE	0.08
Level of incidental take anticipated over the 50-year Permit term as a result of DNRC HCP.	3.78

1. No grizzly bear mortality on DNRC lands, or as a result of DNRC actions
Source for mortality data for the NCDE: USFWS (2009).

Incidental Take in the Cabinet-Yaak Ecosystem

On February 12, 1993, the USFWS issued a 12-month finding of "warranted for endangered status but precluded by other listing actions" for grizzly bears in the CYE (58 FR 8250-8251). The population is currently considered to contain about 30 to 40 individuals (Section B). Given the population status and risk factors associated with the CYE recovery zone, the USFWS has formally stated that the mortality objective for this ecosystem is zero grizzly bears. Given the greater risk and sensitivity of this ecosystem, the USFWS worked with DNRC to develop HCP commitments that avoid incidental take of grizzly bears in the CYE. This is reflected specifically in grizzly bear commitments GB-CY1 through GB-CY5, which require higher levels of conservation to further minimize any adverse effects on bears.

No take is anticipated within the CYE (both recovery zone and NROH) for the following reasons:

- DNRC has few active grazing licenses (n=4) in the CYE, with no history of bear management actions, and no new grazing licenses would be authorized.

- In general, grizzly bear/livestock conflicts have not been an issue in the CYE and the USFWS does not consider this type of land use, at its current levels, a threat to grizzly bears.

- DNRC lands comprise less than 0.5 percent of the land area within the CYE and so would affect only portions few home ranges.

- Given the size of the CYE population of bears and the amount of DNRC lands in the CYE, and HCP commitments to avoid or minimize the risk, the risk of human-bear conflicts resulting in the death of a bear is discountable.

- The risk of adverse effects to grizzly bears from displacement as a result of ORDs and TRDs on DNRC lands are minimized and although infrequently adverse effects may occur, these would not rise to levels that would result in under-use of habitat to a degree that feeding, breeding, or reproductive would be impaired:

    a. DNRC exceeds 1 mi/mi^2 ORD on five of its nine scattered parcels in the CYE recovery zone. However, true ORDs on DNRC lands are very low within the CYE. Most roads in the CYE are managed as restricted by DNRC. However, for the purposes of its analysis, DNRC has included as "open" all roads with USFS or Plum Creek easements even if they are managed as restricted, thus the ORDs are inflated. This is because at some future time, due to the existing easements, DNRC could be forced to open the roads to meet the needs of the easement holders (i.e., the USFS or Plum Creek).

    b. Four grizzly bear BMUs in the CYE where DNRC has ownership do not meet research benchmarks for OMRDs (Table II-24). Where the BMU does not meet the OMRD benchmark, DNRC commits to not increasing open roads under the HCP and therefore would not contribute to further changes in the BMU.

    c. Four grizzly bear BMUs with DNRC ownership exceed research benchmarks for TMRDs: Newton, Spar, Wanless, and Mount Headley (Table II-19). For the Newton, Spar, and Wanless BMUs, TRDs on DNRC's ownership meet the benchmarks and do not contribute to high OMRDs in the BMU. For the Mount Headley BMU, all but 200 acres of DNRC's 2,000 acres are roaded (Table II-19). Any increases in restricted roads on the remaining DNRC ownership in the Mount Headley BMU would not contribute to a measurable change for the BMU TMRD.

- The Kootenai National Forest recent amended their Forest Plan (October 9, 2011) to address access management in grizzly bear habitat. This management will moderate the effects of access management on grizzly bears on adjacent lands, including DNRC.

In the CYE, we expect a low likelihood of adverse effects on grizzly bears from high road densities on DNRC HCP lands and that any adverse effects would not rise to levels that result in incidental take of bears. This is because numerous measures are in place to ensure that bears can

access seasonal habitats during key times of the year with low risk of human disturbance. In addition to the measures listed above, under the HCP, the need for any new roads in the CYE would be highly scrutinized, and any new roads would be managed as temporary roads or restricted to public motorized access (i.e., not open roads). Further, in the CYE recovery zone, the HCP would expedite reduction of open road densities (GB-CY4). Additionally, in the CYE recovery zone and NROH, the HCP would: 1) prohibit commercial forestry in the spring in spring habitat, 2) limit other motorized activities in spring habitat during the spring period to 10 days per parcel up to the maximum allowable days, 3) require additional restrictions on allowable activities in spring habitat during the spring period, 4) avoid potential effects on bears from helicopter flights, 5) require USFWS approval of mitigation plans for salvage projects, and 6) rest parcels for 8 years following 4 years of commercial activity. These commitments are in addition to other commitments that would also minimize displacement, such as the requirements for maintaining 600 feet to cover in harvest units and retaining cover near RMZs and WMZs.

Overall, the application of the enhanced commitments in the CYE recovery zone and the application of recovery zone commitments in CYE NROH would minimize adverse effects such that no incidental take is anticipated due to road densities or actions conducted under the HCP.

Effect of the Take

In the accompanying BO, we determined that the anticipated level of incidental take is not likely to result in jeopardy to the species. As explained throughout this BO, the HCP would affect a relatively small area of the overall range of grizzly bear in Montana, (3.6 percent of the NCDE recovery zone and no recovery zone lands in GYE), a correspondingly low number of grizzly bear home ranges, and adverse effects would be would be minimized by the full suite of HCP conservation commitments detailed in the DNRC HCP as summarized and analyzed in this BO. Population in both the NCDE and GYE are large and increasing. Further, the suite of conservation measures includes measures to reduce and minimize the potential for and impact of take on grizzly bears that may occur in the NROH surrounding the NCDE and GYE, and into areas even further from recovery zones as bears may expand their range. DNRC forest management activities covered under the HCP have the potential to result in incidental take of individual grizzly bears; however, the amount of take has been determined to not rise to a level that impacts the either the NCDE (or GYE) population, as a whole. This is because the impact of the take associated with HCP covered activities within recovery zones is relatively low, considering the status of the NCDE, the size of the recovery zones and the amount of habitat managed for grizzly bear recovery by the USFS, NPS, and BLM under IGBC Guidelines. Further, open road densities, the larger threat to grizzly bears, would be controlled under the HCP within recovery zones, and minimized in NROH of the NCDE and GYE. In addition, the HCP commitments conserve key seasonal grizzly bear habitat, minimize disturbance during seasons of use, provide information and education as well as food storage and sanitation programs for DNRC staff and its contractors to reduce the risk of human-bear conflicts. No new grazing licenses for small livestock would be granted in recovery zones, thereby reducing conflicts associated with grazing licenses. While adding lands to the HCP the likelihood for incidental take of grizzly bears would be minimized by the HCP measures that would be implemented on these lands. Thus, the DNRC HCP promotes survival and recovery of grizzly

bears. Federal land management is guided by IGBC Guidelines for land management and grizzly bear management, all of which has led to the GYE and NCDE grizzly bear populations nearing or at recovered levels.

Reasonable and Prudent Measures & Terms and Conditions

Under the terms of section 7(b)(4) and section 7(o)(2), taking that is incidental to and not intended as part of the agency action is not considered to be prohibited taking under the ESA provided that such taking is in compliance with the terms and conditions of this incidental take statement.

As described in the introduction to this ITS, all conservation measures described in the proposed HCP, together with the terms and conditions described in any associated Implementing Agreement and any section 10(a)(1)(B) permit or permits issued with respect to the proposed HCP, and all associated reporting requirements, are hereby incorporated by reference as reasonable and prudent measures and terms and conditions within this Incidental Take Statement pursuant to 50 CFR §402.14(i).

Reporting Requirements

In accordance with 50 CFR §402.14(i)(3), the DNRC HCP specifies provisions for monitoring and reporting the effects and effectiveness of the mitigation and minimization measures on the covered species and their habitats. DNRC will also submit periodic monitoring reports to the USFWS, according to the monitoring and reporting schedule contained in the HCP.

H. CONSERVATION RECOMMENTATIONS

Section 7(a)(1) of the Act directs Federal agencies to utilize their authorities to further the purposes of the Act by carrying out conservation programs for the benefit of endangered and threatened species. Conservation recommendations are discretionary agency activities to minimize or avoid adverse effects of a proposed action on listed species or critical habitat, to help implement recovery plans, or to develop information. The USFWS believes that the following recommendations should be considered for implementation:

1. The USFWS should provide technical assistance to DNRC throughout the term of the ITP.

2. The USFWS should review periodic, scheduled monitoring reports and use that opportunity to provide technical assistance.

I. REINITIATION NOTICE

This concludes formal consultation on the DNRC HCP and its effects on grizzly bears. As provided in 50 CFR 402.16, reinitiation of formal consultation is required where discretionary Federal agency involvement or control over the action has been retained (or is authorized by law) and if one or more of following occurs:

1. Notwithstanding changes resulting from the addition of lands to the HCP or changes

resulting from database corrections, the amount or extent of incidental take permitted is exceeded as described above in the ITS section of this BO.

2. New information reveals effects of the agency action that may affect listed species or critical habitat in a manner or to an extent not considered in this opinion.

3. The agency action is subsequently modified in a manner that causes an effect to the listed species or critical habitat not considered in this opinion.

4. A new species is listed or critical habitat designated that may be affected by the action.

In instances where the amount or extent of incidental take is exceeded, any operations causing such take must cease pending reinitiation. The amount or extent of take we anticipated in this BO would be exceeded when any of the conditions regarding roads and road densities listed as 1. through 7. in the incidental take statement were exceeded. Further incidental take on HCP covered lands would be exceeded if more than 4 grizzly bears are removed from the NCDE population through control actions attributed to failures in DNRC's programs to prevent habituation and/or food conditioning of grizzly bears.

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K. APPENDICES

Appendix A. Status of Access Management on Federal Lands in the Western Montana and the Action Area.

Table A-1. Status of NCDE BMU subunits managed in part by the Flathead National Forest, where national forest ownership is greater than 75 percent of the BMU.

#	BMU Subunit	RD	OPEN Route Density	TOTAL Route Density	Security CORE
1	Frozen Lake	GV	10	4	81
2	Ketchikan	GV	16	3	68
3	Upper Trail	GV	14	4	88
4	Lower Whale (amended 37-19-47)	GV	**36**	17	**49**
5	Upper Whale Shorty	GV	12	10	86
6	Red Meadow Moose	GV	25	17	55
7	Hay Creek	GV	24	13	55
8	Coal and South Coal	GV	15	24	72
10	Werner Creek (amended 29-19-63)	GV	**19**	21	42
11	Lower Big Creek	GV	18	20	64
12	Canyon McGinnis (amended 19-33-53)	GV/TL	19	**31**	51
17	Peters Ridge	HH/SL	52	25	34
19	Swan Lake	SL	40	25	45
25	Crane Mountain	SL	32	59	27
31	Beaver Creek	SL	6	25	66
32	Doris Lost Johnny (amended 57-19-36)	HH	**57**	20	35
33	Wounded Buck Clayton (amended 27-30-65)	HH	**27**	**28**	63
35	Emery Firefighter	HH	20	27	38
36	Riverside Paint	HH	18	29	60
37	Jewel Basin Graves	HH	19	19	63
38	Wheeler Quintonkon (amended 25-19-68)	HH/SB	**25**	17	62
39	Logan Dry Park	HH/SB	30	34	50
40	Lower Twin	SB	9	2	91
41	Twin Creek	SB	0	0	100
42	Moccasin Crystal	HH	8	1	81
43	Stanton Paola	HH	8	3	81
44	Dickey Java	HH	9	0	81
45	Long Dirtyface	HH	0	0	100

Table A-1 Continued

#	BMU Subunit	RD	OPEN Route Density	TOTAL Route Density	Security CORE
46	Tranquil Geifer	HH	0	2	85
47	Skyland Challenge	HH	20	17	63
48	Plume Mtn Lodgepole	HH/SB	0	0	97
49	Flotilla Capitol	HH/SB	0	0	99
50	Ball Branch	SB	8	4	84
51	Kah Soldier	SB	20	18	68
52	Spotted Bear Mtn	SB	19	18	68
53	Big Bill Shelf	SB	11	2	80
54	Jungle Addition	SB	20	17	68
55	Bunker Creek	SB	5	3	92
56	Gorge Creek	SB	0	0	90
57	Harrison Mid	SB	1	0	95

Source: USFS 2010a

Subunits meet LMRP A19 objective.

Subunits meet proposed LMRP A19 objective.

Table A-2. Status of NCDE BMU subunits managed in part by the Flathead National Forest, where national forest ownership is less than 75 percent.

#	BMU Subunit	RD	OPEN Route Density	TOTAL Route Density	Security CORE
9	State Coal Cyclone	GV	31	25	59
13	Cedar Teakettle	GV	25	23	25
18	Noisy Red Owl	SL	22	17	52
20	South Fork Lost Soup	SL	25	47	40
21	Goat Creek	SL	23	59	37
22	Lion Creek	SL	18	46	41
23	Meadow Smith	SL	21	53	41
24	Buck Holland	SL	25	40	41
26	Porcupine Woodward	SL	28	72	15
27	Piper Creek	SL	19	43	52
28	Cold Jim	SL	18	56	41
29	Hemlock Elk	SL	6	30	64
30	Glacier Loon	SL	23	43	42
34	Coram Lake Five	HH	27	46	14

Subunits meet LMRP A19 objective.

(Source: USFS unpubl. rep. 3/25/2010).

Table A-3. Status of CYE BMUs for the 2010 Bear Year.

BMU	2010 OMRD Percent	Proposed OMRD Standards	2010 TMRD Percent	Proposed TMRD Standards	Proposed Core Standard	2010 % Core	% Federal Land
1 Cedar	15.0%	15.0%	11.0%	15.0%	80%	81%	99
2 Snowshoe	20.0%	20.0%	16.0%	18.0%	75%	76%	94
3 Spar	28.0%	33.0%	26.0%	26.0%	59%	62%	95
4 Bull	37.0%	36.0%	29.0%	26.0%	63%	62%	84
5 St. Paul	27.0%	30.0%	23.0%	23.0%	60%	58%	97
6 Wanless	33.0%	34.0%	34.0%	32.0%	55%	53%	85
7 Silver Butte-Fisher	32.0%	26.0%	23.0%	23.0%	63%	63%	92
8 Vermillion	33.0%	32.0%	24.0%	21.0%	55%	55%	93
9 Callahan	27.0%	33.0%	26.0%	26.0%	55%	59%	90
10 Pulpit	45.0%	44.0%	30.0%	34.0%	52%	51%	95
11 Roderick	28.0%	28.0%	28.0%	26.0%	55%	54%	96
12 Newton	42.0%	45.0%	29.0%	31.0%	55%	58%	92
13 Keno	33.0%	33.0%	25.0%	26.0%	59%	59%	99+
14 NW Peaks	28.0%	31.0%	26.0%	26.0%	55%	56%	99+
15 Garver	34.0%	33.0%	25.0%	26.0%	55%	55%	94
16 E Fk Yaak	32.0%	33.0%	27.0%	26.0%	55%	54%	96
17 Big Creek	30.0%	33.0%	16.0%	26.0%	55%	58%	99
18 Boulder	33.0%	33.0%	35.0%	29.0%	55%	50%	92
19 Grouse	61.0%	59.0%	59.0%	55.0%	37%	32%	54
20 North Lightning	38.0%	35.0%	20.0%	20.0%	61%	61%	94
21 Scotchman	33.0%	34.0%	25.0%	26.0%	62%	67%	81
22 Mt. Headley	38.0%	33.0%	37.0%	35.0%	55%	51%	89

MONTANA DNRC HCP

BIOLOGICAL OPINION

PART III – LYNX

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PART III. CANADA LYNX

A. DESCRIPTION OF THE PROPOSED ACTION SPECIFIC TO LYNX

The Montana DNRC proposes to implement an HCP for the conservation of grizzly bears, Canada lynx, bull trout, westslope cutthroat trout, and Columbia redband trout within 540,500 acres of state forested trust lands. The DNRC manages lands in the project area under several programs. This biological opinion (BO) addresses the forest management program and associated forestry activities that have the potential to affect the HCP covered species. This part of the BO addresses potential effects on lynx.

Proposed Project Area

The HCP project area is located in western Montana as described in Part I of this BO (Figure I-1). To establish the most meaningful approach to lynx conservation, DNRC sought the expert advice of Dr. John Squires, lynx research biologist in Montana. Dr. Squires identified those areas on DNRC lands where he believes conservation is the most warranted and would result in the greatest benefits (Squires, USFS, personal communication, 2005). These are areas on DNRC lands where female lynx are known to have established home ranges and have reproduced, or are areas that have been productive in the past and hence may become productive areas again in the future. DNRC mapped these areas as lynx management areas (LMAs) and applied greater conservation emphasis and HCP commitments in these areas. Within the LMAs, DNRC identifies lynx habitat on trust lands in a manner similar to that used for delineating lynx habitat on federal lands in western Montana, i.e., lynx analysis units (LAUs). The role of LAUs is described further in this in Section E. The LMAs include Stillwater East, Stillwater West, Coal Creek, Swan, Seeley and Garnet (Figure III-1). The LMAs are primarily located on blocked lands, with the exception of the Garnet and Seeley LMAs which are comprised of scattered parcels. All but the Stillwater LMAs encompass portions of larger LAUs. The LMAs range in size from 38,044 acres to 54,580 acres, which includes all lands within the LMA regardless of ownership. In general, DNRC owns all lands in LMAs that occur on blocked lands, but for two LMAs that are comprised of scattered parcels, the LMA encompasses non-DNRC lands. The total potential lynx habitat on DNRC lands within the LMAs varies as well, from approximately 3,900 acres to 36,600 acres (see Table III-5 in Section D below). This compares to federal guidelines that suggest LAUs be between 16,000 to 25,000 acres, with at least 6,400 acres in primary lynx vegetation types (i.e., total potential habitat. Outside the LMAs, DNRC manages about 402,400 acres of land on scattered parcels, mostly square mile sections, which are also used by lynx. DNRC applies a suite of general lynx habitat commitments on its scattered parcels.

The DNRC HCP Conservation Strategy for Lynx

The lynx conservation strategy consists of two sets of commitments associated with the two habitat areas: (1) lynx habitat within the greater HCP project area and (2) lynx habitat within LMAs.

DNRC's conservation approach for lynx emphasizes conservation in LMAs because these areas are of primary importance for lynx on DNRC lands. Further, LMAs are generally comprised of blocked lands or groups of important scattered parcels. Thus, DNRC actions have the greatest potential to exert adverse effects on lynx and also have the greatest potential to effectively conserve functional lynx habitat. Because DNRC owns more lands in these locations, it has greater ability and it is more cost-effective to apply enhance conservation and monitoring. DNRC lands outside the LMAs is comprised of scattered parcels surrounding by various landownerships and land uses. These areas may support lynx when DNRC lands lie within adjacent LAUs, (that is the broader area is specifically managed for lynx, but most often likely serve as habitat for dispersing lynx.

The HCP will be applied within habitat types (Pfister et al. 1977) that are preferred by lynx and that include structural conditions denoted as (1) winter foraging habitat, (2) summer foraging habitat, (3) other suitable habitat, and (4) temporary non-suitable habitat. The goal of the HCP for lynx is to support lynx conservation efforts on adjacent federally-managed lands by providing habitat elements important for lynx and their prey that contribute to the landscape-scale occurrence of lynx, particularly in key locations for resident populations. The specific biological objectives for lynx include the following:

1. Within preferred habitat types in the HCP project area (Pfister et al. 1977), maintain maps of potential lynx (1) winter foraging, (2) young foraging, (3) other suitable, and (4) temporary non-suitable, habitats.

2. Ensure that adequate amounts of lynx foraging habitat are maintained in defined LMAs by providing stand structures or attributes that provide habitat for prey species, particularly in winter.

3. Maintain suitable lynx habitat in LMAs and on DNRC scattered parcels outside LMAs. Limit conversion of suitable lynx habitat to temporary non-suitable habitat per decade in key geographic areas of notable importance for lynx (LMAs).

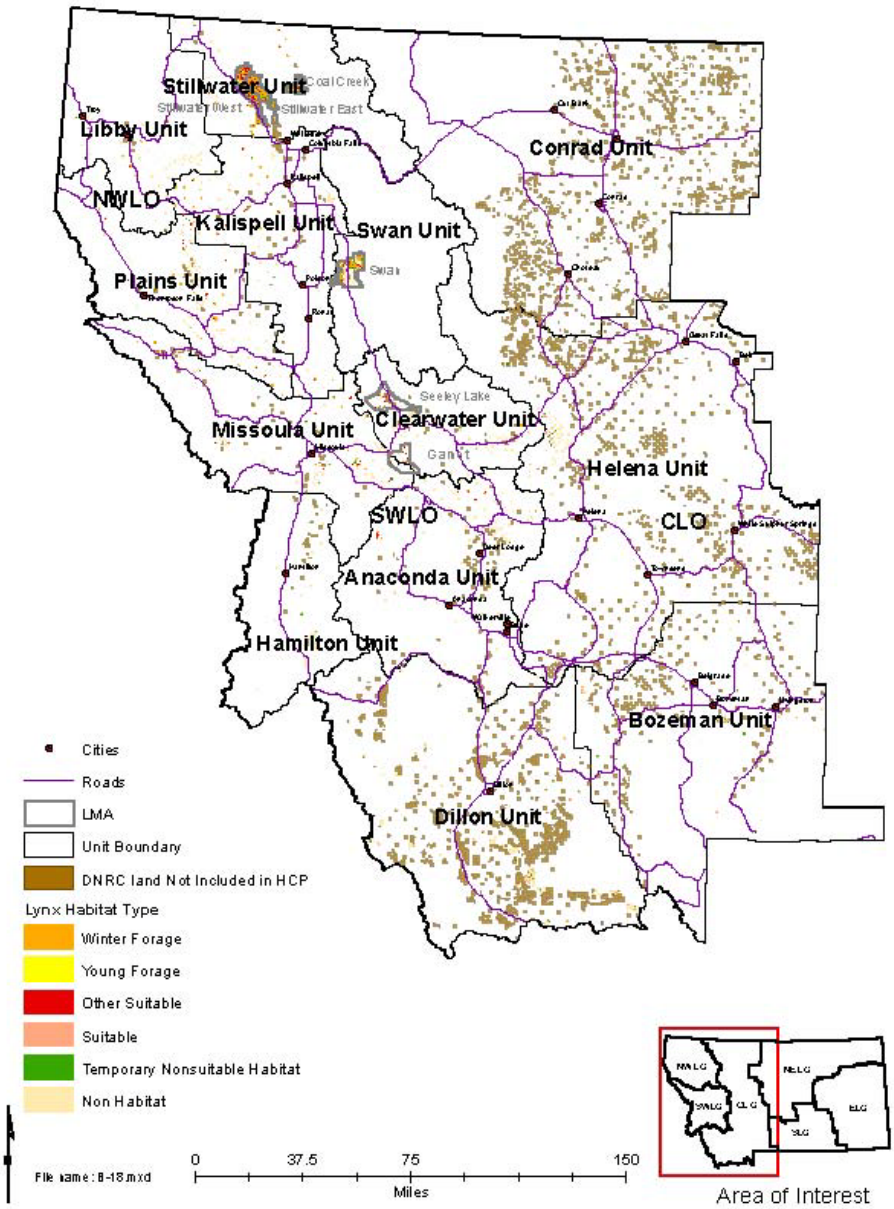
4. Provide for habitat connectivity on the landscape where vegetation and ownership patterns allow.

5. Retain coarse woody debris (CWD) and other denning attributes.

6. Minimize potential for disturbance to known active den sites.

The DNRC HCP also includes a Transition Lands Strategy to address the addition and removal of lands from the HCP project area. This strategy is described in Part I.3.d. Briefly, the strategy caps the number of acres that can be removed from the HCP and Permit over the Permit term and describes various programs through which DNRC may apply conservation to lands that are ultimately removed from the HCP. The strategy also allows DNRC to add lands to the HCP and describes the process for land additions.

Figure III-1. Location of lynx management areas (LMAs) and lynx habitat in the HCP project area.



Lynx Commitments as Described in the HCP

The individual commitments associated with each of the six biological objectives are listed in Table III-1 and described/summarized in the subsections below. For our analysis, we used the complete description and rationale for the Commitments contained in the Final EIS / HCP 2010, Appendix A, Chapter 2.

Table III-1. Biological objectives of the DNRC HCP for lynx and commitments to be implemented to minimize/mitigate impacts on lynx.

Biological Objective	Conservation Commitment[1]
Map potential lynx suitable habitat	LY-HB1 – Establish and maintain a lynx habitat map.
Ensure adequate amounts of foraging habitat in LMAs and provide attributes for prey species	LY-LM3 – Maintain 20 percent of total habitat as winter foraging habitat. LY-LM3 – Retain 20 percent of pre-commercial thinning projects in an unthinned condition. LY-HB2 – Retain CWD in timber sale designs. LY-HB4 – Retain foraging habitat during pre-commercial thinning activities and commercial timber harvest.
Maintain suitable habitat and limit conversion of suitable habitat in LMAs	LY-LM1 – Maintain lynx habitat in LMAs in a 65/35 percent suitable/temporary non-suitable habitat ratio. LY-HB6 – Maintain lynx habitat in a 65/35 percent suitable/temporary non-suitable habitat ratio on scattered parcels at the land office scale. LY-LM2 – Limit habitat conversion in LMAs from potential to non-suitable to 15 percent per decade.
Provide for habitat connectivity	LY-HB5 – Design timber harvest units to maintain habitat connectivity.
Retain CWD and other denning attributes	LY-HB2 – Retain CWD in timber sale designs and on blowdown salvage units, leave 1 percent unsalvaged.
Minimize den site disturbance	LY-HB3 – Prohibit activities near active den sites.

[1] Commitments are numbered and coded according to the category of commitment under which they fall as described in the Final EIS/HCP 2010, Appendix A Chapter 2 (e.g., LY – means the commitment applies to lynx; HB commitments will be implemented for all DNRC projects within lynx habitat in the HCP project area and LM commitments will be implemented for all DNRC projects within lynx management areas).

Commitment for Lynx Habitat within the HCP Project Area

These commitments will apply on lynx habitat in the HCP project area on both scattered parcels and within the LMAs. These commitments address biological objectives 1 through 6.

Commitment LY-HB1 - Mapping lynx habitats (Biological Objective 1)
DNRC will establish and maintain a lynx habitat map following habitat definitions, protocols, and modeling procedures identified in the DNRC HCP lynx habitat mapping protocols (see Final EIS/HCP 2010, Appendix B, Document B-3, Lynx Habitat Mapping Protocols).

Commitment LY-HB4 - Provide Stand Structures and Attributes for Prey Species, particularly in winter (Biological Objective 2)

1. In thinned portions of pre-commercial thinning units within mapped lynx habitat, DNRC will retain small, shade-tolerant trees (species such as grand fir [*Abies grandis*], subalpine fir [*Abies lasiocarpa*], and Englemann spruce [*Picea engelmanii*]) that do not pose substantial competition risks to desired crop trees.

2. DNRC will retain patches of advanced regeneration of shade-tolerant trees (grand fir, subalpine fir, and spruce), as a component of commercial harvest prescriptions in winter foraging habitat. DNRC anticipates that canopy cover of the retained patches would not exceed 10 percent of the stand area through implementation of this measure.

Commitment LY-HB6 – Maintain Suitable Lynx Habitat (Biological Objective 3)
Of the total potential lynx habitat in the HCP project area on scattered parcels outside the LMAs, DNRC will maintain at least 65 percent of the area as suitable lynx habitat and no more than 35 percent as temporary non-suitable habitat at the land office scale.

Commitment LY-HB5 - Provide for Habitat Connectivity (Biological Objective 4)
At the project level, DNRC will design harvest units to maintain a connected network of suitable lynx habitat along riparian management zones (RMZs), ridge tops, and saddles.

Commitment LY-HB2 - Retain Denning Attributes (Biological Objective 5)

1. DNRC will follow Graham et al. (1994) or other publications as mutually agreed to by the USFWS and DNRC to provide for CWD retention. DNRC will emphasize the retention of downed logs of 15-inch diameter or larger where they occur.

2. For CWD recruitment, DNRC will retain an average of two snags and two live snag recruitment trees of greater than 21 inches diameter at breast height (dbh) per acre on the warm and moist habitat type group and the wet habitat type group (Green et al. 1992; Pfister et al. 1977). DNRC will retain an average of one snag and one live snag recruitment tree of greater than 21 inches dbh per acre on all other habitat type groups.

3. On blowdown salvage projects, 1 percent of the blowdown area will be left unsalvaged. The material will preferably be retained in a nonlinear patch or patches.

Commitment LY-HB3 - Protecting Den Sites (Biological Objective 6)
DNRC will prohibit motorized activities and prescribed burning within 0.25 mile of known active den sites from May 1 through July 15.

Lynx Management Areas Commitments

By applying the LMA commitments in combination with the commitments on lynx habitat in the HCP project area, additional conservation emphasis is applied in geographic locations where resident lynx populations are known to occur or where there is a high probability of periodic lynx occupancy over time. These commitments address biological goals 2 and 3 and include:

Commitment LY-LM3 – Provide Adequate Amounts of Foraging Habitat in LMAs (Biological Objective 2)

1. DNRC will maintain 20 percent of total potential lynx habitat as winter foraging habitat within an LMA.
2. DNRC will retain 20 percent of pre-commercial thinning units targeting saplings in lynx habitat in an unthinned condition.

Commitment LY-LM1 and LM2 – Maintain Suitable Lynx Habitat and Limit Conversion of Suitable Lynx Habitat (Biological Objective 3)

1. DNRC will maintain 65 percent of total potential lynx habitat as suitable habitat and no more than 35 percent as temporary non-suitable habitat within an LMA.
2. DNRC will convert no more than 15 percent of the total potential lynx habitat to temporary non-suitable habitat per decade within an LMA.

Monitoring and Adaptive Management Commitments

This section describes the implementation and effectiveness monitoring proposed for the lynx commitments as well as the adaptive management program for lynx.

Implementation Monitoring Commitments
Monitoring of the lynx conservation strategy is focused on implementation monitoring, because the commitments are based on best available science and are expected to meet the biological goals when implemented properly. DNRC anticipates gathering and reporting a variety of information for implementation monitoring on the lynx conservation commitments

Implementation monitoring for the lynx commitments is described in the DNRC HCP (Final EIS/HCP 2010, Appendix A, Chapter 4: Table 4-4). Key among the commitments is the maintenance of DNRC's lynx habitat maps throughout the permit term. Every 5 years, DNRC

will report to the USFWS the acres of lynx habitat by habitat category for each administrative unit and LMA.

Effectiveness Monitoring Commitments

The lynx habitat categories (i.e., suitable habitat, winter forage, etc.) contained in the commitments are defined based on the characteristics of timber stands as described in the stand level inventory (SLI) database maintained by DNRC. DNRC's ability to provide the required amounts of lynx habitat relies on the SLI database's ability to accurately characterize conditions on the ground. Therefore, to monitor the effectiveness of the strategy for achieving desired amounts of lynx habitat, DNRC will evaluate the accuracy of the database at characterizing stand conditions as they actually exist on the ground for the queried stand. Additionally, DNRC will evaluate post-harvest stand conditions to determine prevalence of potential future dens sites (large logs, piles of small logs, root wads, etc.). This monitoring is being conducted to ensure that HCP commitments for snags, snag recruits, and CWD are leaving material suitable for lynx den sites. The monitoring program for verifying the SLI database and future den sites is described in the Final EIS/HCP 2010, Appendix B, Document B-12, Monitoring Methods to Assess Accuracy of DNRC SLI Data and HCP Habitat Mapping Protocols for Describing Lynx Habitat.

Adaptive Management Commitments

Based on the results of effectiveness monitoring, DNRC and the USFWS will assess if the procedures and protocols for mapping lynx habitat and ensuring retention of potential future den sites are necessary. Once new procedures or protocols are in place, at least one additional monitoring run using these monitoring methods will be conducted within one year to ensure that accuracy has improved.

Changed Circumstances Commitments

When a natural disturbance, such as a fire, insect/disease outbreak, or wind event occurs on trust lands, DNRC is typically required to respond in accordance with MCA Section 77-5-207 Salvage Timber Program, which provides for the timely salvage logging of dead and dying timber that is threatened by insects, disease, fire, or wind-throw. At times, these harvests are emergency situations requiring an accelerated schedule, but more commonly they are processed as a timber sale within the usual timelines of the DNRC Montana Environmental Policy Act (MEPA) process. DNRC conducts a MEPA analysis for all salvage projects typically ranging from an environmental checklist to an environmental assessment, and develops site-specific measures to reduce or mitigate project effects on wildlife and aquatic species when warranted.

When conducting a salvage harvest, DNRC would apply the HCP commitments unless conditions render a commitment inapplicable. If a commitment cannot practicably be applied,

DNRC would document the circumstances in the MEPA analysis and potentially implement alternative measures if warranted.

When an LMA or land office (for scattered parcels) no longer meets the required habitat percentages because of a fire, insect or disease outbreak, or wind event, a changed circumstance would be triggered for lynx. Potential effects on individual lynx or their habitats resulting from mass movements or floods are expected to be minimal and do not warrant additional mitigation measures beyond those identified in the conservation strategies. Therefore, no triggers or responses were developed for lynx in the event of a mass movement or flood. When a changed circumstance does occur, DNRC will follow the changed circumstance process outlined in the Final EIS/HCP 2010, Appendix A Chapter 6, Section 6.2.1.5 and develop project mitigation measures for conducting the salvage harvest. Prior to implementing the salvage harvest, DNRC will submit a contingency plan developed in conjunction with the environmental analysis to the USFWS. This plan will identify all lynx commitments to be implemented, as well as those that are impracticable along with alternative measures if warranted. The plan will also describe silvicultural objectives and efforts planned for regenerating habitat converted to a temporary non-suitable condition by the disturbance. The contingency plan will contain pre-disturbance and post-disturbance lynx habitat maps and an assessment of habitat acres by type for the affected LMA or area.

If a fire, insect or disease outbreak, or wind event affects the amounts of lynx suitable, foraging, and habitat conversion in an LMA, DNRC may forgo timber harvest until the required lynx habitat conditions are again available in the LMA to support a subsequent green harvest (i.e., live tree harvest). However, given the DNRC trust mandate, deferral of all green harvest for an extended period until the habitat ratios are achieved may not be feasible. When a green harvest proposal includes removal of winter foraging habitat where an LMA has fallen below the minimum 20 percent winter foraging habitat requirement due to a large fire or other event, DNRC would track the amount of winter foraging habitat harvested. The treated acres would be subtracted from the 2,320 total acres identified for this purpose over the 50 year term, following approval by the USFWS. To mitigate the potential effects of the additional loss of winter foraging habitat, DNRC would develop a contingency plan subject to the USFWS's review and concurrence.

Measures that would be considered when a green harvest would affect DNRC's ability to meet the 65 percent suitable habitat commitment in an LMA or on scattered parcels or 20 percent winter foraging habitat commitment in LMAs may include the following. However, other undefined measures may also be viable options.

- Minimize any further reduction of winter foraging habitat and suitable habitat to the extent possible.

- Retain higher percentages of suitable habitat in other LMAs such that any reduction of suitable habitat in the affected LMA (attributed to natural disturbance and green harvest) is compensated in another LMA.

- Defer pre-commercial thinning in the affected LMA for 10 or more years after the natural disturbance event.

- Negotiate a new allowable harvest percentage for the LMA or land office given the circumstances.

- Negotiate a new allowable lynx habitat percentage for the LMA or land office given the circumstances.

- Negotiate a temporary deferral of other like lynx habitat acres in excess (if present) found within another nearby LMA.

- Provide 65 percent retention of post-fire suitable habitat within the LMA or scattered parcel where the harvest is proposed.

- Prepare a collaborative management/rehabilitation plan for the site (could include expeditious planting).

- For the Stillwater East and West LMAs, conduct an evaluation of the location of proposed harvests in the adjacent unaffected LMA relative to the loss of suitable habitat in the affected LMA. If feasible, examine opportunities to position harvest locations to conserve suitable habitat in areas adjacent to the affected area. The intent would not be to stop the planned harvests in the adjacent unaffected LMA. Rather, the intent would be to explore opportunities to create a buffer of suitable habitat around or adjacent to the area affected or conserve and maintain movement corridors in the remaining suitable habitat on the adjacent LMA.

B. STATUS OF THE SPECIES/CRITICAL HABITAT

Listing History

The lynx was added to the list of threatened species on March 24, 2000 (65 FR 16052). We concluded that the single factor threatening the contiguous United States distinct population segment (DPS) of lynx was the inadequacy of existing regulatory mechanisms, specifically the lack of guidance for conservation of lynx in National Forest Land and Resource Management Plans and Bureau of Land Management (i.e., Forest Service and BLM) Land Use Plans. On July 3, 2003, we published a clarification of findings in the Federal Register (68 FR 40076) determining that threatened species designation was appropriate for the lynx.

Lynx critical habitat was designated on November 8, 2006 (71 FR 66008). On February 24, 2009, we published a revised critical habitat designation for the Canada lynx (74 FR 8616). Additional information critical habitat is provided in Section B below.

Species Description

The lynx is a medium-sized cat with long legs; large, well-furred paws; long tufts on the ears; and a short, black-tipped tail (McCord and Cardoza 1982). The winter pelage of the lynx is dense and has a grizzled appearance with grayish-brown mixed with buff or pale brown fur on the back, and grayish-white or buff-white fur on the belly, legs, and feet. Summer pelage of the lynx is more reddish to gray-brown (Koehler and Aubry 1994). Adult males average 22 pounds in weight and 33.5 inches in length (head to tail), and females average 19 pounds and 32 inches (Quinn and Parker 1987). The lynx's long legs and large feet make it highly adapted for hunting in deep snow.

Life History

The USFWS's various listing rules provide a good resource for a more thorough discussion of life history information on lynx that is summarized below.

Home Range and Dispersal

Individual lynx maintain large home ranges (reported as generally ranging between 12 to 83 square miles (Koehler 1990; Aubry et al. 2000; Squires and Laurion 2000; Squires et al. 2004; Vashon et al. 2005a). The size of lynx home ranges varies depending on abundance of prey, the animal's gender and age, season, and the density of lynx populations (Koehler 1990; Poole 1994; Slough and Mowat 1996; Aubry et al. 2000; Mowat et al. 2000; Vashon et al. 2005a).

When densities of snowshoe hares decline, for example, lynx enlarge their home ranges to obtain sufficient amounts of food to survive and reproduce. Preliminary research supports the hypothesis that lynx home ranges at the southern extent of the species' range are generally large compared to those in the core of their range in Canada (Koehler and Aubry 1994; Apps 2000; Squires and Laurion 2000). In northwestern Montana, female home ranges average 34 square miles while male's average 83 square miles (Squires et al. 2004).

Lynx are highly mobile and have a propensity to disperse long distances, particularly when prey becomes scarce (Mowat et al. 2000). Lynx also make long distance exploratory movements outside their home ranges (Aubry et al. 2000; Squires et al. 2001; Moen et al. 2004). Areas or habitats used by lynx during dispersal or exploratory movements are poorly understood at this time. Evidently lynx are able to traverse

expanses of diverse habitat types and conditions during their movements. Dispersing lynx may colonize suitable but unoccupied habitats, augment existing resident populations, or disperse to unsuitable or marginal habitats where they cannot survive. Lynx are capable of dispersing extremely long distances (Mech 1977; Washington Department of Wildlife 1993); for example, a male was documented traveling 370 miles (Brainerd 1985). Lynx disperse primarily when snowshoe hare (*Lepus americanus*) populations decline (Ward and Krebs 1985; Koehler and Aubry 1994; O'Donoghue et al. 1997; Poole 1997). Subadult lynx disperse even when prey is abundant (Poole 1997), presumably as an innate response to establish home ranges. During the early 1960's and 1970's, numerous lynx were documented in atypical habitat, such as in North Dakota. In those years, harvest returns indicated unprecedented cyclic lynx highs for the 20th century in Canada (Adams 1963; Harger 1965; Mech 1973; Gunderson 1978; Thiel 1987; McKelvey et al. 2000a). Many of these unusual observations were probably dispersing animals that either were lost from the population or later returned to suitable habitat.

Cover is important to lynx when searching for food (Brand et al. 1976). Lynx have been observed (via snow tracking) to avoid large openings (Koehler 1990; Staples 1995) during daily movements within the home range, seeming to prefer to move through continuous forest, using the highest terrain available such as ridges and saddles (Koehler 1990; Staples 1995). Lynx often hunt along edges (Mowat et al. 2000). Kesterson (1988) and Staples (1995) reported that lynx hunted along the edges of mature stands within a burned forest matrix, and Major (1989) found that lynx hunted along the edge of dense riparian willow stands. In Montana, lynx preferentially foraged in spruce-fir forests with high horizontal cover, abundant hares, and large diameter trees during the winter (Squires et al. 2006). Lynx tended to avoid sparse, open forest and forest stands dominated by small-diameter trees during the winter.

The primary factor driving lynx behavior and distribution is the distribution of snowshoe hare, their primary prey. Snowshoe hares prefer boreal forest stands that have a dense horizontal understory to provide food, cover, and security from predators. Snowshoe hares feed on conifers, deciduous trees, and shrubs (Hodges 2000b). Snowshoe hare density is correlated to understory (horizontal) cover between approximately 3 to 10 feet above the ground or snow level (Hodges 2000b). Habitats most heavily used by snowshoe hares are stands with shrubs, stands that are densely stocked, and stands at ages where branches have more lateral cover (Hodges 2000b). Generally, earlier successional forest stages support a greater density of horizontal understory and more abundant snowshoe hares (Buehler and Keith 1982; Wolfe et al. 1982; Koehler 1990; Hodges 2000b; Homyack 2003; Griffin 2004). Mature, multistoried stands also can have adequate dense understory to support abundant snowshoe hares (Hodges 2000a; Hodges 2000b; Griffin 2004, Squires et al. 2006).

Snowshoe hares are the primary prey of lynx, comprising 35 to 97 percent of the diet throughout the range of the lynx (Koehler and Aubry 1994). Other prey species include red squirrel (*Tamiasciurus hudsonicus*), grouse (*Bonasa umbellus*, *Dendragopus* spp., *Lagopus* spp.), flying squirrel (*Glaucomys sabrinus*), ground squirrel (*Spermophilus parryii*, *S. Richardsonii*), porcupine (*Erethrizon dorsatum*), beaver (*Castor canadensis*), mice (*Peromyscus* spp.), voles (*Microtus* spp.), shrews (*Sorex* spp.), fish, and ungulates as carrion or occasionally as prey (Saunders 1963; van Zyll de Jong 1966; Nellis et al. 1972; Brand et al. 1976; Brand and Keith 1979; Koehler 1990; Staples 1995). Winter food items in Montana included snowshoe hare (96 percent), red squirrel, and grouse (Squires and Ruggiero 2007).

During the cycle when hares become scarce, the proportion and importance of other prey species, especially red squirrel, increases in the diet (Brand et al. 1976; Apps 2000; Mowat et al. 2000). However, a diet of red squirrels alone might not be adequate to ensure lynx reproduction and survival of kittens (Koehler 1990).

Most research has focused on the winter diet. Summer diets are poorly understood throughout the range of lynx. Mowat et al. (2000) reported through their review of the literature that summer diets have less snowshoe hare and more alternate prey species, possibly because of a greater availability of other species.

In northern regions, when hare densities decline, the lower quality diet causes sudden decreases in the productivity of adult female lynx and decreased survival of kittens, which causes the numbers of breeding lynx to level off or decrease (Nellis et al. 1972; Brand et al. 1976; Brand and Keith 1979; Poole 1994; Slough and Mowat 1996; O'Donoghue et al. 1997). Relative densities of snowshoe hares at southern latitudes are generally lower than those in the north, and differing interpretations of the population dynamics of southern populations (measured from Quebec east to the Maritimes and south within the United States) of snowshoe hare have been proposed (Hodges 2000b).

Snowshoe hares have evolved to survive in areas that receive deep snow (Bittner and Rongstad 1982). Primary forest types that support snowshoe hare are subalpine fir, Englemann spruce, Douglas fir, and lodgepole pine in the western United States, and spruce/fir, pine, and deciduous forests in the eastern United States (Hodges 2000b). Within these habitat types, snowshoe hares prefer stands of conifers with shrub understories that provide forage, cover to escape predators, and protection during extreme weather (Wolfe et al. 1982; Monthey 1986; Koehler and Aubry 1994). Hares' use of habitat is correlated with understory cover (Hodges 2000a). Early successional forest stages generally have greater understory structure than do mature forests and therefore support higher hare densities (Hodges 2000a,b). Mature forests also provide snowshoe hare habitat as openings are created in the canopy when trees succumb to disease, fire,

wind, ice, or insects, and the understory develops (Squires et al. 2006). In northwest Montana, connectivity of dense patches of boreal forests interspersed with open habitat, within the forest matrix benefited snowshoe hares (Ausband and Baty 2005).

Den Site Selection

Lynx use a variety of types of large woody debris, such as downed logs, root wads, and windfalls, to provide denning sites with security and thermal cover for kittens (McCord and Cardoza 1982; Koehler 1990; Koehler and Brittell 1990; Mowat et al. 2000; Squires and Laurion 2000; Squires et al. 2006; Merrill and Schenk 2006; Mark McCollough, U.S. Fish and Wildlife USFWS, pers. comm. 2007 as cited in USFWS 2007:19; Squires et. al. 2008). During the first few months of life, kittens are left alone at these sites when the female lynx hunts. Downed logs and overhead cover provide protection of kittens from predators, such as owls, hawks, and other carnivores during this period.

The age of the forest stand does not seem as important for denning habitat as the amount of horizontal structure available, e.g. downed, woody debris (Mowat et al. 2000; M. McCollough, pers. comm. 2007, as cited in USFWS 2007:19), which provides hiding cover and shelter for kittens. Den sites may be located within older regenerating stands (>20 years since disturbance) or in mature conifer or mixed conifer-deciduous (typically spruce/fir or spruce/birch) forests. In Montana, lynx selected den sites with higher horizontal cover than elsewhere in the animal's home range (Squires et al. 2006). Seventy-three percent of lynx dens were found in mature, mesic forests. Dens were also located in regenerating mesic forests (18 percent) and boulder fields (7 percent). More recently, Squires et al. (2008) found dens in Montana primarily within mature forest stands (80 percent), mid-seral regenerating forests (13 percent), young regenerating stands (5 percent) and thinned stands (2 percent). In Montana, dens were also found in topographically concave or drainage-like areas away from forest edges (Squires et al. 2008). In Washington, lynx used *Pinus contorta* (lodgepole pine), *Picea* spp. (spruce), and *Abies lasiocarpa* (subalpine fir) forests older than 200 years with an abundance of downed woody debris for denning (Koehler 1990). A den site in Wyoming was located in a mature subalpine fir/ lodgepole pine forest with abundant downed logs and a high amount of horizontal cover (Squires and Laurion 2000). In the northeast United States, lynx dens were found in a several stand types including softwood mid/late regeneration, mature forest mixed regeneration, mature softwood, other regeneration, and hardwood/softwood mid/late regeneration. The structural components of lynx den sites are common features in managed (logged) and unmanaged (spruce budworm damaged areas, wind-throw) stands. Tip-up mounds (root wads) were the most common predictor of den sites in Maine (M. McCullough, pers.comm. 2007, as cited in USFWS 2007:19). A key component for suitable lynx denning habitat appears to be horizontal structural.

Denning habitat in or near foraging habitat is likely to be most functional and selected by females. The hunting range of females is restricted at the time of parturition, and their need to feed kittens requires an abundance of prey. Lynx, like other felids, frequently move their kittens until they are old enough to hunt with their mother. Multiple nursery sites are used that provide kittens with overhead cover and protection from predators and the elements. Downed logs and overhead cover throughout the home range provides security when lynx kittens are old enough to travel (Bailey 1974).

Recruitment

Breeding occurs through March and April in the north (Quinn and Parker 1987). Kittens are born in May to June in southcentral Yukon (Slough and Mowat 1996). The male lynx does not help with rearing young (Eisenberg 1986). Slough and Mowat (1996) reported yearling females giving birth during periods when hares were abundant; male lynx may be incapable of breeding during their first year (McCord and Cardoza 1982).

In northern study areas during the low phase of the hare cycle, few if any live kittens are born, and few yearling females conceive (Brand and Keith 1979; Poole 1994; Slough and Mowat 1996). However, Mowat et al. (2000) suggested that in the far north, some lynx recruitment occurs when hares are scarce and this may be important in lynx population maintenance during hare lows.

During periods of hare abundance in the northern taiga, litter size of adult females averages four to five kittens (Mowat et al. 1996). In Montana, the average litter size in the Seeley Lake study area was 2.3 kittens and 3.2 kittens in the Purcell Mountains (Squires et al. 2006). Koehler (1990) suggested that the low number of kittens produced in northcentral Washington was comparable to northern populations during periods of low snowshoe hare abundance. In his study area, two radio-collared females had litters of three and four kittens in 1986, and one kitten in 1987 (the actual litter size of one of the females in 1987 was not determined) (Koehler 1990). Of the known-size litters in Washington, one kitten survived the first winter. In Wyoming, one female produced four kittens in 1998, but snow tracking indicated that the kittens were not with the female in November and were presumed dead (Squires and Laurion 2000). The same female produced two kittens in 1999.

Mortality

Reported causes of lynx mortality vary between studies. The most commonly reported causes include starvation of kittens (Quinn and Parker 1987; Koehler 1990), and human-caused mortality, mostly fur trapping (Ward and Krebs 1985; Bailey et al. 1986). In a Montana study, 49 lynx mortalities were recorded, 29 percent due to starvation, 18

percent due to trapping or shooting, 31 percent due to predation (primarily mountain lion [*Puma concolor*]), and 22 percent due to unknown causes (Squires et al. 2006).

Significant lynx mortality due to starvation has been demonstrated in cyclic populations of the northern taiga, during the first 2 years of hare scarcity (Poole 1994; Slough and Mowat 1996). Various studies have shown that, during periods of low snowshoe hare numbers, starvation can account for up to two-thirds of all natural lynx deaths. Trapping mortality may be additive rather than compensatory during the low period of the snowshoe hare cycle (Brand and Keith 1979). Hunger-related stress, which induces dispersal, may increase the exposure of lynx to other forms of mortality such as trapping and highway collisions (Brand and Keith 1979; Carbyn and Patriquin 1983; Ward and Krebs 1985; Bailey et al. 1986).

Paved roads have been a mortality factor in lynx translocation efforts within historical lynx range. In New York, 18 translocated lynx were killed on highways (Brocke et al. 1990). Translocated animals may be more vulnerable to highway mortality than resident lynx (Brocke et al. 1990). Nine lynx were killed on 2- and 4-lane Colorado highways following their release as part of a reintroduction effort (CDOW 2005).

Other than translocated animals, two highway mortalities have been documented in Wisconsin (Theil 1987) and Minnesota (Don Carlos, unpubl. report 1997, as cited in USFWS 2007:21). Twelve resident lynx were documented being killed on highways in Canada and Alaska (Staples 1995; Gibeau and Heur 1996; T. Clevenger, pers. comm. 1999; Alexander, pers. comm. 1999, as cited in USFWS 2007:21). Lynx were killed on graveled, high-speed forest roads in flatter terrain in Maine (Mark McCollough, U.S. Fish and Wildlife Service, pers. comm. 2006, as cited in USFWS 2007:21).

Predation on lynx by mountain lion, coyote (*Canis latrans*), wolverine (*Gulo gulo*), gray wolf (*Canis lupus*), and other lynx has been confirmed (Berrie 1974; Koehler et al. 1979; Poole 1994; Slough and Mowat 1996; O'Donoghue et al. 1997; Apps 2000; Squires and Laurion 2000; Squires et al. 2006). Squires et al. (2006) reported 15 lynx mortalities in their Montana study area, greater than 90 percent of which were due to mountain lion predation. Observations of such events are rare, and the significance of predation on lynx populations is unknown.

Interspecific Relationships with Other Carnivores

The two major competition impacts to lynx are likely exploitation (competition for food) and interference (avoidance). Several predators (birds of prey, coyote, gray wolf, mountain lion, bobcat [*Lynx rufus*], and wolverine) consume snowshoe hares and therefore compete at some level with lynx for prey. Lynx have adaptations for surviving in areas that have cold winters with deep, fluffy snow for extended periods; these

adaptations provide lynx a competitive advantage in hunting snowshoe hare over a number of potential competitors, such as bobcats or coyotes (McCord and Cardoza 1982; Buskirk et al. 2000; Ruediger et al. 2000; Ruggiero et al. 2000a). In one paper, coyotes were theorized to most likely pose local or regionally important exploitation impacts to lynx, and coyotes and bobcats were deemed to possibly impart important interference competition effects on lynx (Buskirk et al. 2000). Mountain lions have been identified as potential interference competitors, possibly impacting lynx during summer and in areas lacking deep snow in winter, or when high elevation snow packs develop crust in the spring. Long-term snow conditions presumably limit the winter distribution of potential lynx competitors such as bobcats (McCord and Cardoza 1982) or coyotes. Further, bobcats and coyotes have a higher foot load (more weight per surface area of foot), which causes them to sink into the snow more than lynx. Therefore, bobcats and coyotes cannot efficiently hunt in fluffy or deep snow and are at a competitive disadvantage to lynx.

It has been theorized that coyotes may use packed snow trails and roads that are maintained for winter recreation and forest management, thereby giving coyote or other species access to lynx habitat and a limited snowshoe hare prey base. Coyote use of packed snow trails that occur in winter habitats of lynx are a concern as a potential lynx competitor for snowshoe hares in winter. However, no clear evidence demonstrates that competition between coyotes and lynx have negatively affected contiguous U.S. lynx populations. A study conducted by Kolbe et al. (2007) in Seeley Lake region of Montana found (1) coyotes remained in lynx home ranges throughout the winter despite a deep snow pack; (2) coyotes were primarily scavengers during winter and rarely preyed on hares; (3) despite an abundance of compacted roads and trails in the study area only a small proportion of coyotes' travel was on compacted snow surfaces and they only traveled on them for a short distance at a time. The study concluded that it was unlikely that compacted snowmobile trails increased exploitation competition between coyotes and lynx during winter in the study area.

Exploitation competition may contribute to lynx starvation and reduced recruitment. During periods of low snowshoe hare numbers, starvation accounted for up to two-thirds of all natural lynx deaths in the Northwest Territories of Canada (Poole 1994). As described previously, major predators of snowshoe hare include lynx, northern goshawk (*Accipiter gentilis*), great horned owl (*Bubo virginianus*), bobcat, coyote, red fox (*Vulpes vulpes*), fisher (*Martes pennanti*), and mountain lion. In southern portions of snowshoe hare range, predators may limit hare populations to lower densities than in the taiga (Dolbeer and Clark 1975; Wolff 1980; Koehler and Aubry 1994).

Based on only anecdotal evidence, Parker et al. (1983) discussed competition between bobcats and lynx on Cape Breton Island. Lynx were found to be common over much of

the island prior to bobcat colonization. Concurrent with the colonization of the island by bobcats, lynx densities declined and their presence on the island became restricted to the highlands, the one area where bobcats did not become established.

Population Dynamics

Lynx populations in the contiguous United States occur at the southern periphery of a widely-distributed metapopulation whose core is located in the northern boreal forest of central Canada (McCord and Cardoza 1982; Quinn and Parker 1987; McKelvey et al 2000b). The boreal forest of central Canada is vast and extends into Alaska. Lynx in the contiguous United States are at the southern margins, or periphery, of its range. Here, the southernmost extent of the boreal forest that supports lynx occurs in the Northeast, western Great Lakes, northern and southern Rockies, and northern Cascades (Ruediger et al. 2000).

The center of North American lynx range is in north-central Canada. Lynx occur in mesic coniferous forests that have cold, snowy winters and provide a prey base of snowshoe hare (Ruggiero et al. 2000b). These forests are generally described as boreal forests. Boreal forests provide optimal habitat for snowshoe hares. In North America, the distribution of lynx is nearly coincident with that of snowshoe hares (Bittner and Rongstad 1982; McCord and Cardoza 1982). Lynx survivorship, productivity, and population dynamics are closely related to snowshoe hare density in all parts of its range. In the extensive boreal forests of Canada, snowshoe hare densities reach peak densities of roughly four to six hares per hectare (or 1.6 to 2.4 per acre) and decline to about 0.1 to 1 per hectare (0.04 to 0.4 per acre) during cyclic lows (Krebs et al. 1995, Slough and Mowat 1996, Hodges 2000a). A minimum density of snowshoe hares (greater than 0.5 hares per hectare or 1.2 hares per acre (Ruggiero et al. 2000b)) distributed across a large landscape is necessary to support survival of lynx kittens and recruitment into and maintenance of a lynx population.

In Canada and Alaska, lynx populations undergo extreme fluctuations in response to the cycling of snowshoe hare, enlarging or dispersing from their home ranges and ceasing the recruitment of young into the population after hare populations decline (Mowat et al. 2000). However, in the contiguous United States, the boreal forest transitions into other vegetation communities and becomes more patchily distributed. As a result, the southern boreal forests generally support lower snowshoe hare densities, hare populations do not appear to be as highly cyclic as snowshoe hares further north, and lynx densities are lower compared to the northern boreal forest. Although snowshoe hare populations in the southern portion of the range (i.e. in the contiguous United States) may fluctuate, they do not show strong, regular population cycles as in the north (Hodges 2000b). In the

contiguous United States, the degree to which regional local lynx population fluctuations are influenced by local snowshoe hare population dynamics is unclear.

In the contiguous United States, the boreal forest transitions into other vegetation communities and becomes more naturally patchily distributed (fragmented), and provides much less productive hare habitat. Thus lynx populations here are naturally limited by the low availability of snowshoe hares, as suggested by large home range size, high kitten mortality due to starvation, and greater reliance on alternate prey. These characteristics appear to be similar to those exhibited by lynx populations in Canada and Alaska during the low phase of the population cycle (Quinn and Parker 1987, Koehler 1990, Aubry et al. 2000). This is likely due to the inherently patchy distribution of lynx and hare habitat in the contiguous United States and correspondingly lower densities of hares.

In the United States, lynx inhabit conifer and conifer-hardwood habitats that support their primary prey, snowshoe hares. Both timber harvest and natural disturbance processes, including fire, insect infestations, catastrophic wind events, and disease outbreaks, can provide foraging habitat for lynx when resulting understory stem densities and structure provide the forage and cover needs of snowshoe hare (Keith and Surrendi 1971; Fox 1978; Conroy et al. 1979; Wolff 1980; Parker et al. 1983; Litvaitis et al. 1985; Bailey et al. 1986; Monthey 1986; Koehler 1990; Agee 2000). These characteristics also include a dense, multi-layered understory that maximizes cover and browse at both ground level and at varying snow depths throughout the winter (crown cover within the lower 4.5 meters [15 feet] in order to provide cover and food for snowshoe hares to 2 meters (6 feet) high at maximum snow depths). Despite the variety of habitats and settings, good snowshoe hare habitat has a common denominator – dense, horizontal vegetative cover 1 to 3 meters (3 to 10 feet) above the ground or snow level (Hodges 2000b). Multi-layered forests provide this structure, as well as high levels of cover preferred by lynx.

Lynx population dynamics may emanate from the core in Canada to the southern periphery in the contiguous United States, as evidenced by a lagged correlation of lynx trap records and observations in the United States (related to cyclic highs in lynx populations in Canada) (McKelvey et al. 2000a; Mowat et al. 2000). In Canada, the Hudson Bay Company maintained fairly accurate annual lynx pelt data across the range of lynx, which reflect dramatic population cycles. In the Great Lakes Geographic Area, population dynamics in recent decades appear to be strongly driven by immigration from Canada (McKelvey et al. 2000a). However, in other areas and time periods it is not known to what extent the correlation is due to immigration from Canada, population responses to the same factors controlling northern populations, or a combination of the two. A lack of accurate historic data limits our understanding of lynx population dynamics in the contiguous United States and precludes drawing definitive conclusions

about lynx population trends. Historically, formal surveys designed specifically to detect lynx were rarely conducted. Many reports of lynx (e.g., visual observations, snow tracks) have been collected incidentally to other activities, but cannot be used to infer population trends. Long-term trapping data have been used to estimate population trends for various species. In the United States however, trapping returns are strongly influenced by trapper effort, which varies between years and, therefore, may not accurately reflect population trends. Another important problem to note is that trapping records of many States did not differentiate between bobcats and lynx, referring to both as "lynxcats." Overall, the available data are too incomplete to infer much beyond simple occurrence and distribution of lynx in the contiguous United States (McKelvey et al. 2000a)

Lynx are highly mobile and have a propensity to disperse long distances, particularly when prey becomes scarce (Mowat et al. 2000). Lynx also make long distance exploratory movements outside their home ranges (Aubry et al. 2000; Squires et al. 2001; Moen et al. 2004). Areas or habitats used by lynx during dispersal or exploratory movements are poorly understood at this time. Dispersing lynx may colonize suitable but unoccupied habitats, augment existing resident populations, or disperse to unsuitable or marginal habitats where they cannot survive. Numerous lynx mortality records exist from anomalous habitats or habitats where no records support evidence (either current or historical) of a reproducing population (McKelvey et al. 2000b). Many of these records correspond to post-population peaks in Canada, with some lag time for immigration (McKelvey et al. 2000b). We find no evidence of lynx populations becoming established in such areas.

We suspect that some areas in the contiguous United States naturally act as "sources" of lynx (recruitment is greater than mortality) that are able to disperse and potentially colonize other patches (McKelvey et al. 2000b). Other areas may function as "sinks" (mortality is greater than recruitment) where lynx are lost from the overall population. Sink habitats are most likely those places on the periphery of the southern boreal forest where habitat becomes more fragmented and more distant from larger lynx populations. Fluctuations in prey populations may cause some habitat patches to change from being sinks to sources, and vice versa. The ability of naturally dynamic habitat to support lynx populations may change as the habitat undergoes natural succession following natural or manmade disturbances (i.e., fire, clearcutting).

Individual lynx maintain large home ranges (reported as generally ranging between 31 to 216 km^2 [12 to 83 mi^2]) (Koehler 1990; Aubry et al. 2000; Squires and Laurion 2000; Vashon et al. 2005a). Thus, a lynx population can only persist in a large boreal forested landscape that contains appropriate forest types, snow depths and high snowshoe hare densities. In the Northeast, lynx were most likely to occur in areas that support deep

snow (greater than 268 centimeters [106 inches] annual snowfall) associated with regenerating boreal forests in landscapes 100 square kilometers (40 square miles) or greater in area (Hoving 2001; Hoving et al. 2004). We assume areas with smaller patches of boreal forest are unlikely to provide a sufficient amount of habitat suitable to support a lynx population.

Lynx populations in the contiguous United States seem to be influenced by lynx population dynamics in Canada (Thiel 1987; McKelvey et al. 2000b,c). Many of these populations in Canada are directly interconnected U.S. populations, and are likely a source of emigration into contiguous United States lynx populations. Therefore, we assume that retaining connectivity with larger lynx populations in Canada is important to ensuring long-term persistence of lynx populations in the U.S. We assume that, regionally, lynx within the contiguous United States and adjacent Canadian provinces interact as metapopulations and, therefore, assessments of population viability must be made at this larger scale and not solely based on populations within the contiguous United States.

Based on our examination of historical and recent evidence, lynx habitat and occurrence within the contiguous U.S can be categorized as: 1) core areas, 2) secondary areas, and 3) peripheral areas (USFWS 2005). Core areas are those with the strongest long-term evidence of the persistence of lynx populations within the contiguous United States, having both persistent, verified records of lynx occurrence over time and recent evidence of reproduction.

Status and Distribution

The historical and present range of the lynx north of the contiguous United States includes Alaska and that part of Canada that extends from the Yukon and Northwest Territories south across the United States border and east to New Brunswick and Nova Scotia. In the contiguous United States, lynx historically occurred in the Cascades Range of Washington and Oregon; the Rocky Mountain Range in Montana, Wyoming, Idaho, eastern Washington, eastern Oregon, northern Utah, and Colorado; the western Great Lakes Region; and the northeastern United States region from Maine southwest to New York (McCord and Cardoza 1982; Quinn and Parker 1987). A thorough discussion and interpretation of lynx records through time is found in the USFWS's final rule (March 24, 2000, 65 FR 16052) and clarification of our findings (July 2003; 68 FR 40076).

The distribution of lynx in North America is closely associated with the distribution of North American boreal forest (Agee 2000). In Canada and Alaska, lynx inhabit the classic boreal forest ecosystem known as the taiga (McCord and Cardoza 1982; Quinn and Parker 1987; Agee 2000; McKelvey et al. 2000a). The range of lynx extends south

from the classic boreal forest zone into the subalpine forest of the western United States, and the boreal/hardwood forest ecotone in the eastern United States (Agee 2000; McKelvey et al. 2000a). Forests with boreal features (Agee 2000) extend south into the contiguous United States along the Cascade and Rocky Mountain Ranges in the west, the western Great Lakes Region, and along the Appalachian Mountain Range of the northeastern United States. Within these general forest types, lynx are most likely to persist in areas that receive deep snow, to which the lynx is highly adapted (Ruggiero et al. 2000a). Lynx are rare or absent from the wet coastal forests of Alaska and Canada (Mowat et al. 2000).

At its southern margins in the contiguous United States, forests with boreal features, or southern boreal forests, become naturally fragmented as they transition into other vegetation types. Southern boreal forest habitat patches are small relative to the extensive northern boreal forest of Canada and Alaska, which constitutes the majority of lynx range. Many southern boreal forest habitat patches within the contiguous United States cannot support resident populations of lynx and their primary prey species.

The complexities of lynx life-history and population dynamics, combined with a general lack of reliable population data for the contiguous United States, make it difficult to ascertain the past or present population status of lynx in the contiguous United States. It is difficult to determine with certainty whether reports of lynx in many States were (1) animals dispersing from northern populations that were effectively lost because they did not join or establish resident populations, (2) animals that were a part of a resident population that persisted for many generations, or (3) a mixture of both resident and dispersing animals.

The final rule determining threatened status for the lynx in the contiguous United States summarized lynx status and distribution across four regions that are separated from each other by ecological barriers consisting of spans of area lacking lynx habitat (March 24, 2000, 65 FR 16052). These distinct regions are the Northeast, the Great Lakes, the Northern Rocky Mountains/Cascades, and the Southern Rocky Mountains. The recovery outline for the species split these regions into six “core” areas for lynx, with the southern Rocky Mountains area designated as an additional “provisional core” area (USFWS 2005). While these regions are ecologically unique and discrete, the lynx is associated with only the southern boreal forest in each and, with the exception of the Southern Rocky Mountains Region, each area is geographically connected to the much larger population of lynx in Canada.

The following summarizes status and distribution information of the lynx DPS in the contiguous United States:

Northeast Region (Maine, New Hampshire, Vermont, New York)

Based on an analysis of cover types and elevation zones containing most of the lynx occurrences, McKelvey et al. (2000a) determined that, at the broad scale, most lynx occurrence records in the Northeast were found within the "Mixed Forest-Coniferous Forest-Tundra" cover type at elevations ranging from 250 to 750 meters (820 to 2,460 feet). This habitat type in the northeast United States occurs along the northern Appalachian Mountain range from southeastern Quebec, western New Brunswick, and western Maine, south through northern New Hampshire. This habitat type becomes naturally more fragmented and begins to diminish to the south and west, with a disjunct segment running north-south through Vermont, an extensive patch of habitat in the Adirondacks of northern New York, and with a few more distant and isolated patches in Pennsylvania (see Figure 8.23 in McKelvey et al. 2000a).

In the northeast, information on the presence of lynx was limited at the time of listing in 2000. In 1999, 6 lynx were radio-collared in northern Maine (March 24, 2000; 65 FR 16052). As of 2004, Maine Department of Inland Fisheries and Wildlife had radio-collared 43 lynx and documented 30 litters (Vashon et al. 2005b) Records show lynx currently to be distributed throughout northern Maine (November 9, 2005; 70 FR 68294). Lynx in Maine currently have high productivity; 91 percent of available adult females older than 2 years produced litters averaging 2.83 kittens (Vashon et al. 2005b). This area is the only area in the northeastern region of the lynx's range within the contiguous United States that currently supports breeding lynx populations and likely acts as a source or provides connectivity for peripheral portions of the lynx's range in the Northeast.

The preponderance of lynx habitat in this region occurs on private lands in the State of Maine. Federal agencies manage a minor amount of lynx habitat in this region. The White River National Forest has amended or revised its Plan and so addressed in part, on National Forest lands, the major factor threatening the lynx: inadequacy of existing regulatory mechanisms, specifically the lack of guidance for conservation of lynx in National Forest Plans and BLM Plans. The revised final rule for critical habitat summarizes private land conservation efforts for lynx in Maine (February 25, 2009, 74 FR 8616).

Great Lakes Region (Minnesota, Wisconsin, Michigan)

The majority of lynx occurrence records in the Great Lakes Region are associated with the "mixed deciduous-coniferous forest" type (McKelvey et al. 2000a). Within this general forest type, the highest frequency of lynx occurrences were in the *Acer saccharum* (sugar maple), *Tilia spp.* (basswood), *Pinus banksiana* (jack pine), *P. strobus* (white pine), and *P. resinosa* (red pine) forest types (McKelvey et al. 2000a). These

types are found primarily in northeastern Minnesota, northern Wisconsin, and the western portion of Michigan's upper peninsula.

Mixed deciduous-coniferous forest covers an extensive area in this region, but much of this area is considered marginal habitat for lynx because it is a transitional forest type at the edge of the snowshoe hare range. Habitat at the edge of hare range supports lower hare densities (Buehler and Keith 1982) that may not be sufficient to support lynx reproduction. Snow depths within appropriate habitat that allow lynx a competitive advantage over other carnivores (i.e., coyotes) occur only in limited areas in northeastern Minnesota, extreme northern Wisconsin, and Michigan's upper peninsula.

At the time of listing, we were unsure of whether the Great Lakes Region supported resident populations of lynx or if lynx documented in these areas were simply dispersing from Canada (March 24, 2000; 65 FR 16052) (McKelvey et al. 2000b; R. Sando, Minnesota Department of Natural Resources, in litt. 1998, as cited in USFWS 2007:27). Since that time, numerous lynx have been verified from northeastern Minnesota through DNA analysis, radio- and GPS-collared animals, and documentation of reproduction (November 9, 2005; 70 FR 68294). Northeastern Minnesota is the only area in the Great Lakes region for which we have evidence of recent lynx reproduction; as such, it likely acts as a source or provides connectivity for more peripheral portions of the lynx's range in this region.

The Forest Service in Minnesota manages a preponderance of lynx habitat in this region. All National Forests in the region have amended or revised their Plans, and so addressed in part, on National Forest lands, the primary factor threatening the lynx: inadequacy of existing regulatory mechanisms, specifically the lack of guidance for conservation of lynx in National Forest Plans and BLM Plans. These include the Chippewa, Superior, Hiawatha, and Ottawa National Forests. Voyageurs National Park in Minnesota was designated as lynx critical habitat in 2006. This designation will ensure that lynx habitat within the park will be managed to conserve lynx.

The final rule for critical habitat summarizes other private land conservation efforts for lynx in the region (November 9, 2006, 71 FR 66009).

Northern Rocky Mountain/Cascades Region (Washington, Oregon, Montana, Idaho, Wyoming, Utah)

In this region, the majority of lynx occurrences are associated at a broad scale with the "Rocky Mountain Conifer Forest;" within this type, most of the occurrences are in moist Douglas fir (*Pseudotsuga menziesii*) and western spruce/fir forests (McKelvey et al. 2000a). Most of the lynx occurrences are in the 1,500-2,000 meters (4,920-6,560 feet) elevation class (McKelvey et al. 2000a). These habitats are found in the Rocky

Mountains of Montana, Idaho, eastern Washington, and Utah, the Wallowa Mountains and Blue Mountains of southeast Washington and northeastern Oregon, and the Cascade Mountains in Washington and Oregon. The majority of verified lynx occurrences in the United States and the confirmed presence of resident populations are from this region. The boreal forest of Washington, Montana, and Idaho is contiguous with that in adjacent British Columbia and Alberta, Canada.

Northwestern Montana and the north Cascades in Washington currently have resident lynx populations, and strong evidence exists to support the presence of resident lynx distributed throughout much of the forest types considered lynx habitat in Montana and Washington (November 9, 2005; 70 FR 68294). Resident lynx populations exist in contiguous habitats in Idaho, Montana and northwestern Wyoming in the Greater Yellowstone Area (e.g., Murphy et al. 2004). Lynx have probably always occurred only intermittently in peripheral areas of Oregon and Utah, although the historical or current presence of resident populations in either of these States has not been confirmed.

The North Cascades, Yellowstone and Glacier National Parks manage substantial amounts of lynx habitat in this region. Lynx occur in all three National Parks. Through National Park Service management, lynx habitat is generally managed in ways that promotes natural ecological processes, which benefits lynx. Glacier National Park provides a large expanse of lynx habitat that is contiguous with lynx habitat in Canada. Of the three Parks, Glacier and North Cascades were determined to meet the habitat criteria requirements for critical habitat, and were designated critical habitat in 2006 and retained their critical habitat designation in the 2009 revised designation of critical habitat. This designation will further ensure that lynx habitat within the Parks will be managed to conserve lynx.

The BLM Spokane District in Washington manages lynx habitat. Its Resource Management Plan was modified in 2003 to incorporate the provisions of the Lynx Conservation Assessment Strategy (LCAS) (Ruediger et al. 2000). On November 30, 2006, we completed consultation with the BLM for the revision of their Coeur d'Alene Resource Management Plan in which lynx were addressed. The Cottonwood BLM in southern Idaho recently issued its Resource Management Plan (March 2010) which includes provisions for lynx; they are at the Draft Environmental Impact Statement (EIS) stage, with a biological assessment and request for consultation expected later in 2010. The Missoula BLM district has also amended their plan to abide by the standards and guides in the LCAS.

The Forest Service manages the preponderance of lynx habitat in the Northern Rocky Mountain/Cascades region. Through the Northern Rockies Lynx Management Direction (NRLMD), 18 National Forests addressed in part on National Forest lands, the primary

factor threatening the lynx: inadequacy of existing regulatory mechanisms, specifically the lack of guidance for conservation of lynx in National Forest Plans and BLM Plans. These include the Custer, Flathead, Gallatin, Helena, Kootenai, Lewis and Clark, Lolo, Bitterroot, and Beaverhead-Deerlodge National Forests in Montana; the Clearwater, Nez Perce, Idaho Panhandle, Salmon-Challis, and Targhee National Forests in Idaho; the Ashley National Forest in Utah; and the Bridger Teton, Shoshone, and Bighorn National Forests in Wyoming. The Boise, Payette, and Sawtooth National Forests of Idaho have amended or revised their plans to address this factor, as have the Uinta and Wasatch-Cache National Forests in Utah. Region 6 of the Forest Service in Washington intends to address this factor through Forest Plan revision, which has started for the Okanogan-Wenatchee and Colville (all occupied by lynx), and the Malheur, Wallowa-Whitman, Umatilla (unoccupied) National Forests. The Mount Baker National Forest Plan is not yet in revision.

The final rule for critical habitat and the revised designation of critical habitat summarizes other private land conservation efforts for lynx in the region (November 9, 2006, 71 FR 66009; February 25, 2009, 71 FR 8616).

Southern Rocky Mountains Region (Colorado, southeastern Wyoming)

Colorado represents the extreme southern edge of the range of the lynx. A majority of the lynx occurrence records in Colorado and southeastern Wyoming were associated with the "Rocky Mountain Conifer Forest" type. The occurrences in the Southern Rockies were generally at higher elevations (8,000-12,000 feet) than were all other occurrences in the West (Ruediger et al. 2000).

A resident lynx population may have occurred historically in the Southern Rocky Mountains Region, based on a small number of lynx records from Colorado. If this population existed it was extirpated by the early 20th century. In 1999, the Colorado Division of Wildlife (CDOW) began a reintroduction effort that that concluded in 2010. From 1999 to 2006 218 adult lynx were released 115 mortalities (including both released lynx and their progeny) have been documented (CDOW 2009a). Reproduction was documented in the years 2003- 2006, and again in 2009 (CDOW 2009b).

The southern boreal forest of Colorado and southeastern Wyoming is isolated from boreal forest in Utah and northwestern Wyoming by the Green River Valley and the Wyoming basin (Findley and Anderson 1956 in McKelvey et al. 2000a). We believed that these areas likely reduce opportunities for genetic interchange with the Northern Rocky Mountains/Cascades Region and Canada (Halfpenny et al. 1982; Koehler and Aubry 1994). However, although habitats in the Southern Rockies are far from source populations and more isolated, it is still possible that dispersers could arrive in the

Southern Rocky Mountains during highs in the population cycle. A number of lynx from the reintroduced population in Colorado have recently dispersed great distances, with occurrences located in Kansas, Nevada, South Dakota, Arizona, Idaho, Nebraska, Montana, Wyoming and New Mexico (T. Shenk, pers. comm. 2007, as cited in USFWS 2007:29). Thirty-three different individuals were located in Wyoming, seven in Montana and six in Nebraska. Such information indicates that dispersing lynx are able to traverse long distances across extremely variable terrain.

The Forest Service manages the preponderance of lynx habitat in this region. All National Forests in the region addressed through amending or revising their Plans, on National Forest lands, the primary factor threatening the lynx: inadequacy of existing regulatory mechanisms, specifically the lack of guidance for conservation of lynx in National Forest Plans and BLM Plans. The Forests completed a Final Environmental Impact Statement and Record of Decision for the Southern Rocky Lynx Amendment in 2008. The USFWS prepared a biological assessment for consultation under section 7(a)2 in 2008. The Forests included the Medicine Bow, Routt, Arapaho-Roosevelt, Pike and San Isabel, Rio Grande, White River, Grand Mesa, Uncompahgre, Gunnison, and the San Juan National Forests.

Reports from Other Locations

During the early 1960's, concurrent with an unprecedented cyclic high in Canada, lynx moved into the Great Plains and the Midwest Region of the United States (Gunderson 1978; Mech 1980; DeStefano 1987; South Dakota Natural Heritage Program, in litt. 1994, as cited in USFWS 2007:29). These records are outside of the southern boreal forests where most lynx occurrences are found (McKelvey et al. 2000b). We consider lynx observations in Nevada, North Dakota, South Dakota, Iowa, Nebraska, Indiana, Ohio, and Virginia to be individuals dispersing subsequent to periods of cyclic high lynx numbers in Canada (Hall and Kelson 1959; Burt 1954 in Brocke 1982; McKelvey et al. 2000a; S. Johnson, Indiana Department of Natural Resources, in litt. 1994, as cited in USFWS 2007:29; P. Jones, Ohio Department of Natural Resources, in litt. 1994, as cited in USFWS 2007:29; W. Jobman, U.S. Fish and Wildlife Service, in litt. 1997, as cited in USFWS 2007:29; Smithsonian Institute, in litt. 1998, as cited in USFWS 2007:29). We do not consider these States to be within the contiguous United States range of lynx (65 FR 16052, March 24, 2000).

<u>Recovery Outline</u>

We developed a recovery outline for lynx in the contiguous United States (USFWS 2005). The purpose of the outline is to serve as an interim strategy to guide recovery efforts until a final recovery plan is completed. The lynx recovery outline has not been

revised since 2005 and, therefore, depicts our understanding of the distribution, ecology, and population dynamics of lynx at that time. Since that time, the critical habitat designation refined this data to delineate the areas we consider to have the physical and biological features essential to lynx in sufficient quantity and spatial arrangement, as evidenced by consistent occupancy and reproduction by lynx. The objectives of the recovery outline are still relevant to lynx conservation today, but the area where they might best apply was refined by the more recent critical habitat designation. The critical habitat designation represents a refinement of the core area that delineates the lynx habitat within the core and thus where we expect populations of lynx to occur.

The outline introduces concepts regarding the relative importance of different geographic areas to the persistence of lynx in the contiguous United States, identifying areas as either core, provisional core, secondary or peripheral based on lynx records over time and evidence of reproduction. Six broad core areas were identified in the recovery outline, along with a provisional core area within the Southern Rockies (Colorado and southern Wyoming). The recovery outline provides four preliminary recovery objectives, which are accompanied by recovery actions needed to attain objectives.

The lynx recovery outline stratified lynx habitat in the contiguous United States into **core, provisional core, secondary, and peripheral areas: "**Based on our examination of historical and recent evidence, lynx habitat and occurrence within the contiguous U.S. can be categorized as: 1) core areas, 2) secondary areas, and 3) peripheral areas. The areas with the strongest long-term evidence of the persistence of lynx populations within the contiguous United States are defined as **core areas**" (USFWS 2005).

Core areas have both persistent verified records of lynx occurrence over time and recent evidence of reproduction. Six core areas and one "provisional" core area are identified within the contiguous United States. The provisional core area in the Southern Rockies was identified because it contains a reintroduced population. Reproduction has been documented in this introduced population; however, it is too early to determine whether a self-sustaining lynx population will result. Focusing lynx conservation efforts on these core areas will ensure the continued persistence of lynx in the contiguous U.S. by addressing fundamental principles of conservation biology."

The recovery outline continues, "At this time, the role of areas outside of **core areas** in sustaining lynx populations in the contiguous United States is unclear. The fluctuating nature of lynx population dynamics and the ability of lynx to disperse long distances have resulted in many individual occurrence records outside of core areas, without accompanying evidence of historic or current presence of lynx populations. Areas classified as **secondary areas** are those with historical records of lynx presence with no record of reproduction; or areas with historical records and no recent surveys to

document the presence of lynx and/or reproduction. If future surveys document presence and reproduction in a secondary area, the area could be considered for elevation to core. We hypothesize that secondary areas may contribute to lynx persistence by providing habitat to support lynx during dispersal movements or other periods, allowing animals to then return to core areas. In **peripheral areas** the majority of historical lynx records is sporadic and generally corresponds to periods following cyclic lynx population highs in Canada. There is no evidence of long-term presence or reproduction that might indicate colonization or sustained use of these areas by lynx. However, some of these peripheral areas may provide habitat enabling the successful dispersal of lynx between populations or subpopulations. At this time, we simply do not have enough information to clearly define the relative importance of secondary or peripheral areas to the persistence of lynx in the contiguous United States (USFWS 2005).

The recovery outline provides four preliminary recovery objectives, which are accompanied by recovery actions needed to attain objectives. A discussion of the how the proposed action relates to the recovery outline can be found later in this BO, in Section D.

Objective 1: Retain adequate habitat of sufficient quality to support the long-term persistence of lynx populations within each of the identified core areas.

Objective 2: Ensure that sufficient habitat is available to accommodate the long-term persistence of immigration and emigration between each core area and adjacent populations in Canada or secondary areas in the United States.

Objective 3: Ensure that habitat in secondary areas remains available for continued occupancy by lynx.

Objective 4: Ensure that threats have been addressed so that lynx populations will persist in the contiguous United States for at least the next 100 years.

Objectives 1 and 2 described above and the following actions as identified in the recovery outline are most relevant to this project.

1. Establish management commitments in core areas that will provide for adequate quality and quantity of habitat such that there is a reasonable expectation that persistent lynx populations can be supported in each of the core areas for at least the next 100 years.

1.2. On non-Federal lands in the core areas, develop and implement best management practices and long-term management agreements for lynx with key State, private and/or Tribal forest managers.

4. Identify habitat facilitating movement between each core area and lynx populations in Canada.

4.1. Develop and implement long-term management commitments with key Canadian, United States Federal, State, Tribal, and private forest landowners to conserve these habitats.

Other Factors

Measures That Addressed Threats to Lynx Identified at the Time of Listing

The final rule listing lynx as a threatened species (March 24, 2000; 65 FR 16052) concluded that the primary factor threatening the lynx DPS is the inadequacy of existing regulatory mechanisms, specifically, the lack of guidance for conservation of lynx in federal land management Plans. The USFS manages the vast majority of lynx habitat in the U.S. The USFWS concluded that the lack of Forest Plan guidance for conservation of lynx, as evidenced by the fact that, at the time of listing, Plans allowed or directed actions that cumulatively adversely affect lynx, was a significant threat to the contiguous United States DPS of lynx. Our remanded determination in our clarifications of findings of our final rule (July 2003; 68 FR 40076) affirmed the findings in the final rule.

The Lynx Conservation and Assessment Strategy (LCAS) (Reudiger et al. 2000) established habitat-related standards for federal lands to address potential risk factors to lynx (see list in FR Notice p 8639). BLM continues to manage lynx habitat under the LCAS standards. The NRLMD (USFS 2007a) amended 18 U.S. Forest Service (USFS) Northern Region Forest Plans to address the "lack of guidance for conservation of lynx in federal land management Plans." The NRLMD includes standards and guidelines intended to avoid or reduce the potential for projects proposed under Forest Plans to adversely affect lynx. A suite of standards and guidelines in the NRLMD promote and conserve the habitat conditions needed to produce adequate snowshoe hare (lynx primary prey) densities to sustain lynx home ranges, and thus sustain lynx populations.

The Final Biological Opinion for the NRLMD (USFWS 2007) concluded that the programmatic and project-level objectives, standards, and guidelines in the amended Forest Plans provide comprehensive conservation direction adequate to reduce adverse effects to lynx from Forest management and to preclude jeopardy to the lynx DPS. Similar Forest Plan amendments or revisions have been completed in the Southern Rockies and the Great Lakes regions, where lynx occur. Hence, the primary threat to lynx at the time of listing has been addressed in these regions.

Climate Change

As discussed in Part I.D of this BO climate changes have been characterized at the global, national, regional and local level and are expected to continue into the future (Karl et al. 2009; Final EIS/HCP 2010). We assume, for purposes of this BO, the climate changes characterized in Part I.D of this BO will continue through the 50-year permit term. Thus, climate change will likely affect lynx habitat throughout the 50-year period of the HCP and Permit.

Climate change trends in western Montana and the Pacific Northwest, which includes the Northern Rocky Mountain/Cascades Region of lynx distribution, will be important with respect to how these trends may affect characteristics of suitable lynx habitat. Lynx distribution and its habitat, i.e. denning, cover, and forages species habitat, in the western United States is closely associated with the distribution of boreal and subalpine forests; found along the Cascade and Rocky Mountain Ranges (Agee 2000). The dependence of lynx on winter snow and boreal forest renders the species vulnerable to climate change. Based on modeled decreases in snow cover and a northward shift in the distribution of boreal forest, Gonzalez et al. (2007) found that potential lynx habitat could decrease by approximately 60 percent in the lower 48 states by the year 2100, including the loss of almost all potential lynx habitat in Montana. That is, as temperatures rise with global warming, the snowpack and forests that lynx rely on are predicted to move upward in altitude and northward in latitude (Gonzalez et al. 2007).

As a result of the anticipated shift of lynx distribution or habitat upward in elevation due to climate change, the USFWS included higher-elevation habitats in the designation of critical habitat for lynx (USFWS 2009). One of the primary constituent elements for lynx critical habitat is winter snow conditions that are generally deep and fluffy for extended periods of time (USFWS 2009a). Gonzalez et al. (2007) found that lynx require nearly continuous snow cover for four months (December through March), and at least a 75 percent probability of snow in January for a 5 percent probability of finding lynx, and a 100 percent probability of snow in January for a 95 percent probability of finding lynx. Thus, anticipated changes in climate, i.e. temperature increases that result in a decrease in snow cover, snow depth or longevity of snow cover could decrease the presence of lynx habitat at lower elevations.

Warming temperatures and decreasing precipitation are also likely to cause larger and more frequent insect outbreaks, as well as increased frequency of forest fires. These conditions may accelerate the reduction of older forests. While insect outbreaks may result in more woody debris, creating more potential for den sites, the downed wood will add more fuel for the increasing wild fires that are predicted to occur. Thus, overall,

climate change, is expected to reduce the availability of older forest habitat structures used by lynx and their primary prey, the snowshoe hare.

While changes in the fire regime associated with climate change may decrease denning habitat, in some areas, these conditions may increase the availability of suitable foraging habitat for lynx. In areas characterized by low-frequency, high-intensity wildfire, an increase in fire frequency could possibly lead to a greater abundance of brushy, early successional habitat (foraging habitat) (McKenzie et al. 2004). Lynx foraging habitat includes areas where snowshoe hare densities are likely to be greatest. Snowshoe hares inhabit various successional stages and vegetation communities; however, they appear to prefer stands (young or older) that possess dense conifer or conifer and shrub understory vegetation (Hodges 1999).

Both timber harvest and natural disturbance processes, including fire, insect infestations, catastrophic wind events, and disease outbreaks, can provide foraging habitat for lynx when resulting understory stem densities and structure provide the forage and cover needs of snowshoe hare (Keith and Surrendi 1971; Fox 1978; Conroy et al. 1979; Wolff 1980; Parker et al. 1983; Litvaitis et al. 1985; Bailey et al. 1986; Monthey 1986; Koehler 1990; Agee 2000). Thus, timber harvest may provide foraging habitat while concurrently reducing carbon sequestration capabilities of the forest, adding to GHG emissions.

Decreased snowfall may affect lynx through decreased prey vulnerability and decreased competitive advantage over sympatric carnivores in the northern Appalachian Mountains (Carroll 2007). Based on predicted decreases in snowfall, climate change influenced modeled declines in lowland populations of lynx, which suggests that contraction may occur in the core of their current regional range as well as among smaller peripheral populations.

Other authors have suggested that lynx prey may become more vulnerable to predation as a result of climate change, with potentially beneficial results for lynx. Schmitz et al. (2003) speculated that environmental warming that produces anomalously warm temperatures and little snowfall may lead to more efficient predation by lynx, possibly resulting in a chronic decline in snowshoe hare abundance. Ruggiero et al. (2008) suggested that the timing of when hares have their winter coat may no longer match the timing or duration of the winter snow pack, rendering the hares more susceptible to predation.

In summary, lynx are fairly specialized carnivores whose habitat requirements in the western United States are closely tied to boreal and subalpine forests. Lynx require a matrix of forest characteristics that provide cover habitat, horizontal structure, i.e. down woody debris, continuous snow cover for extended periods of time, and prey species

habitat. It is difficult to accurately predict how this specialize species would respond to environmental changes associated with climate change, although it is anticipated that required snow conditions may move lynx distribution upward in elevation and northward in latitude. Such a habitat shift is likely to reduce the aerial extent and distribution of lynx habitat with generally adverse impacts to the lynx DPS. However, the scope and scale of such changes are uncertain, and the effects (positive or negative) on lynx would likely be variable across the landscape.

Status of Designated Critical Habitat

The USFWS published a revised designation of critical habitat for the contiguous United States distinct population segment of the Canada lynx. The final rule was published on February 25, 2009 and became effective on March 27, 2009 (74 FR 8616). In total, approximately 39,000 square miles fall within the boundaries of the revised critical habitat designation, in five units in the states of Maine, Minnesota, Montana, Wyoming, Idaho and Washington (see Table III-2). Our recovery outline identified those areas with the strongest evidence of persistence of lynx populations as core areas. Therefore, under the recovery outline, we considered core areas to be occupied by lynx. However, this characterization did not consider what areas contain the physical and biological features necessary to conserve lynx. In designating critical habitat we identified the areas containing the physical and biological features necessary to conserve lynx as those with verified records of lynx persistence into the present time and with verified evidence of reproduction. Hence, for the purposes of this BO, we now consider critical habitat to demark the boundary of occupied lynx habitat.

Table III-2. Critical habitat units designated for lynx (74 FR 8616).

Critical Habitat Units	Area Designated (mi^2)	Land Ownership
Unit 1: Maine	9,497.2	Private, State, Federal
Unit 2: Minnesota	8,065.1	Federal, Private, State
Unit 3: Northern Rocky Mountains (MT and ID)	10,101.6	Federal, Private, State
Unit 4: North Cascades	1,835.9	Federal, Private
Unit 5: Greater Yellowstone Area (MT and WY)	9,500.5	Federal, State, Private
TOTAL	**39,000.3**	

The five units contain the physical and biological features essential to the conservation of the lynx as they are comprised of the primary constituent element and its components laid out in the appropriate quantity and spatial arrangement. The units are discussed below with information taken from the final rule revising designated critical habitat for lynx (74 FR 8616) followed by a discussion on the primary constituent element and its components.

Unit 1 is located in northern Maine in portions of Aroostook, Franklin, Penobscot, Piscataquis, and Somerset Counties. This area was occupied by the lynx at the time of listing and is currently occupied by the species. This area is the one area in the northeastern region of the lynx's range within the contiguous United States that currently supports breeding lynx populations and may serve as a source of lynx, or provide connectivity for more peripheral portions of the lynx's range, in the Northeast.

Unit 2 is located in northeastern Minnesota in portions of Cook, Koochiching, Lake and St. Louis Counties. This area was occupied by the lynx at the time of listing and is currently occupied by the species. Lynx are currently known to be distributed throughout northeastern Minnesota. This area is essential to the conservation of lynx because it is the only area in the Great Lakes region for which there is evidence of recent lynx reproduction. It likely acts as a source or provides connectivity for more peripheral portions of the lynx's range in the region. Critical habitat on National Forest land in Unit 2 is managed under Forest Plans that have incorporated management direction similar to the NRLMD, which reduces or eliminates adverse effects on lynx, by reducing adverse effects on lynx habitat.

Unit 3 is located in northwestern Montana and a small portion of northeastern Idaho in portions of Flathead, Glacier, Granite, Lake, Lewis and Clark, Lincoln, Missoula, Pondera, Powell and Teton Counties in Montana and Boundary County in Idaho. This area is approximately 10,000 square miles, was occupied by the lynx at the time of listing and is currently occupied by the species. Lynx are known to be widely distributed throughout this unit and breeding has been documented in multiple locations. This area is essential to the conservation of lynx because it appears to support the highest density lynx populations in the Northern Rocky Mountain region of the lynx's range. It likely acts as a source for lynx and provides connectivity to other portions of the lynx's range in the Rocky Mountains, particularly the Yellowstone area. Timber harvest and management is a widespread land use, and so special management is required depending upon the silvicultural practices conducted. Timber management practices that provide for a dense understory are beneficial to lynx and snowshoe hares (50 FR 8643). All critical habitat on National Forest lands in Unit 3 is managed according to the NRLMD (USFS 2007b). The NRLMD includes a suite of management directives that enhance, maintain and conserve dense understories.

Unit 4 is located in north-central Washington in portions of Chelan and Okanogan Counties and includes BLM lands in the Spokane District. This area was occupied by the lynx at the time of listing and is currently occupied by the species. This unit supports the highest densities of lynx in Washington. This area is essential to the conservation of lynx because it is the only area in the Cascades region of the lynx's range that is known to support breeding lynx populations. All critical habitat on National Forest lands in Unit 4 is managed under the 2006 Conservation Agreement (USFS and USFWS 2006), which defers any projects that adversely affect lynx until Forest Plans are amended to consider the conservation needs of lynx and lynx habitat.

Unit 5 is located in Yellowstone National Park and surrounding lands in southwestern Montana and northwestern Wyoming in portions of Gallatin, Park, Sweetgrass, Stillwater and Carbon Counties in Montana and Park, Teton, Fremont, Sublette and Lincoln Counties in Wyoming. This area was occupied by the lynx at the time of listing and is currently occupied by the species. The Greater Yellowstone Area is inherently marginal lynx habitat with highly fragmented foraging habitat (snowshoe hare habitat). For this reason lynx home ranges in this unit are likely to be larger and incorporate large areas of non-foraging matrix habitat. All critical habitat on National Forest lands in Unit 5 is managed under either the NRLMD (USFS 2007b) or the Southern Rockies Lynx Management Direction (USFS 2008), which provides management direction similar to the NRLMD.

Conservation Needs of the Species

The physical and biological features that are essential to the conservation of the species have been identified within the geographical area occupied by the lynx at the time of listing. These physical and biological features are the primary constituent elements (PCEs) laid out in a specific quantity and spatial arrangement to be essential to the conservation of the species. Based on this and the current knowledge of the life history, biology and ecology of the species, the PCE for lynx critical habitat is:

1. Boreal forest landscapes supporting a mosaic of differing successional forest stages and containing:

    a. Presence of snowshoe hares and their preferred habitat conditions, which include dense understories of young trees, shrubs or overhanging boughs that protrude above the snow, and mature multistoried stands with conifer boughs touching the snow surface;

    b. Winter snow conditions that are generally deep and fluffy for extended periods of time;

    c. Sites for denning that have abundant coarse woody debris, such as downed trees and root wads; and

    d. Matrix habitat (e.g., hardwood forest, dry forest, non-forest, or other habitat types that do not support snowshoe hares) that occurs between patches of boreal forest in close juxtaposition (at the scale of a lynx home range) such that lynx are likely to travel through such habitat while accessing patches of boreal forest within a home range.

The final rule also described three types of actions that may adversely affect critical habitat. Briefly, these are:

1. Actions that would reduce or remove understory vegetation within boreal forest stands on a scale proportionate to the large landscape used by lynx….These activities could significantly reduce the quality of snowshoe hare habitat such that the landscape's ability to produce adequate densities of snowshoe hares to support persistent lynx populations is at least temporarily diminished.

2. Actions that would cause permanent loss or conversion of the boreal forest on a scale proportionate to the large landscape used by lynx….Such activities could eliminate and fragment lynx and snowshoe hare habitat.

3. Actions that would increase traffic volume and speed on roads that divide lynx critical habitat….These activities could reduce connectivity within the boreal landscape for lynx, and could result in increased mortality of lynx.

In matrix habitat, activities that change vegetation structure or condition would not be considered an adverse effect to lynx critical habitat unless those activities would create a barrier or impede lynx movement between patches of foraging habitat and between foraging and denning habitat within a potential home range, or if they adversely affect adjacent foraging or denning habitat.

Analysis of the Species/Critical Habitat Likely to be Affected

This section summarizes the previous discussion in the Status, and identifies the species and critical habitat likely to be adversely affected by the proposed action. These will be considered further in the remaining sections of the BO.

Analysis of the Species

Lynx are a wide-ranging species requiring large, interconnected areas of suitable habitat. Habitat connectivity within geographic areas and with Canada may be important for long-term lynx population viability and maintenance of the contiguous United States DPS. While blocks of lynx habitat occurs across broad areas of the west, certain areas appear more capable of, and important for, supporting a viable resident lynx population.

In 2000, the final rule (65 FR16052) described broad distinct geographic regions to describe the historic and present range of lynx in the U.S. The HCP project area is within the Northern Rocky Mountain/Cascades Region in Washington, Oregon, Idaho, Montana, Wyoming, Utah.

In 2005, the USFWS developed a recovery outline for lynx. A recovery outline by its nature is a preliminary recovery planning tool. The lines dividing different areas in the Recovery Outline map were not intended to be exact depictions of the division between land categories, rather they were meant to highlight the general areas where the categories may apply until further refinement could be undertaken. The USFWS examined lynx habitat and designated broad areas according to their known or projected quality and importance in lynx recovery. These included core, provisional core, secondary and peripheral areas (as explained earlier). Core areas have persistent verified records of lynx over time, and recent evidence of reproduction. Core areas were delineated at a relatively course scale in areas with the strongest evidence of the persistence of lynx populations. The USFWS has not yet completed a recovery plan for lynx, which would delineate final recovery units, if appropriate.

In 2009, the USFWS published a designation of critical habitat for lynx (74 FR 8616), in five distinct units. This characterization was based on the areas of strongest evidence for persistent lynx populations, similar to core areas. However, critical habitat went further to refine lynx habitat, by considering not only the areas with verified records of lynx

persistence into the present time and verified evidence of reproduction, but also identified the areas that contain the specific physical and biological features necessary to conserve lynx (i.e. lynx habitat). Thus we consider critical habitat occupied by resident lynx.

For the purposes of this BO we we are using the critical habitat mapped area for our jeopardy analysis, and will define the core area that lies within critical habitat as "occupied" lynx habitat (74 FR 8616). Note however, although we are using the critical habitat mapped area as one scale of analysis for our jeopardy analysis, we are looking at the impacts to the species (reproduction, number, and distribution) within that area and not elements of critical habitat (PCEs). The analysis for critical habitat PCEs is done separately in the destruction or adverse modification analysis.

that Critical Habitat Units affected by the proposed action are Unit 3, Northern Rocky Mountains (MT and ID) and Unit 5 Greater Yellowstone Area (MT and WY) (see discussion below). Lynx on HCP lands in occupied habitat may be adversely affected by management activities that reduce or degrade essential habitat elements used by lynx for denning, foraging, and recruitment, or that increase habitat fragmentation. Adverse effects may occur and/or continue without appropriate management direction at broad scales.

We consider "secondary areas" as portrayed in the recovery outline, to lack long-term resident, reproducing lynx. Habitat in these areas does not contain the elements needed to support lynx reproduction, such as snowshoe hare habitat in great enough proportions to support reproduction. However, lynx may occasionally traverse these areas during dispersal movements, or other periods, allowing animals to return to core. Lynx are not dependent upon secondary areas to persist, rather these are areas used by lynx to make exploratory movements outside of occupied habitat. Secondary areas are places where lynx habitat may occur but is more fragmented, occurs in smaller patches, and so does not support the high hare densities needed to support female home ranges or lynx reproduction. Lynx may use these areas occasionally for dispersal or exploratory movements, but do not rely on the habitat or snowshoe hares for home range or residency. Thus, management activities conducted under the HCP in secondary areas are not likely to adversely affect lynx. Thus management activities under the HCP outside critical habitat are not likely to adversely affect lynx. In this BO we consider unoccupied lynx habitat to include 1) core areas outside critical habitat and 2) secondary areas.

Analysis of Critical Habitat

As mentioned above, this BO analyzes critical habitat for lynx habitat in Critical Habitat Units 3 and 5. There are 813 acres of critical habitat in Unit 5 in the HCP project area and 174,344 acres of critical habitat in Unit 3 in the HCP project area.

We have determined that the proposed HCP would likely adversely affect designated critical habitat for lynx by management activities that reduce or degrade the PCE (see Section B) used by lynx for denning, foraging, and recruitment, or that increase habitat fragmentation. Adverse effects may occur and/or continue without appropriate management direction at broad scales.

C. ENVIRONMENTAL BASELINE

Regulations implementing the ESA (50 CFR 402.02) define the "environmental baseline" as the past and present impacts of all Federal, State, or private actions and other human activities in the action area. Also included in the environmental baseline are the anticipated impacts of all proposed Federal projects (in the action area) that have undergone Section 7 consultation and the impacts of State and private actions that are contemporaneous with the consultation in progress.

Action Area

Action area, as defined by the ESA, includes the entire area that would be affected directly or indirectly by the action and not merely the immediate area involved in the action. For the purposes of this BO, we have defined the action area to include those DNRC lands included in the HCP project area, as well as lands within federal LAUs that are adjacent to or overlap the DNRC LMAs (Table III-3 and Figure III-3). In other words, the HCP commitments are applied on the DNRC HCP project area, but may have effects on adjacent lands in overlapping LAUs. We note that there are additional DNRC trust lands in western Montana that are not included in this HCP. This HCP only covers forest management activities. The excluded trust lands are either 1) managed for purposes other than commercial forestry (i.e., grazing, real estate, etc.) or 2) are forested trust lands that DNRC chose not to include in the HCP as discussed in the Final HCP/EIS 2010, Chapter 1.

The action area encompasses 1,151,300 acres in western Montana. The primary land owners in the action area include DNRC, USFS, and industrial forest lands (Table III-3).

We note that between 2008 and 2010, within western Montana, Plum Creek Timber Company sold 310,000 acres of industrial forested lands to The Nature Conservancy (TNC) through the Montana Legacy Project. These lands have subsequently been disposed primarily to state or federal ownership or retained by TNC. These actions occurred during the development of the Draft and Final EIS/HCP and land ownership changes as a result of the Legacy Project are not reflected in the depiction of land ownership in the Final EIS/HCP. These changes are captured in the land ownership in the action area in Table III-3. The changes in landownership affect two primary areas within the lynx action area: the Seeley LMA and the Swan River State Forest.

Table III-3. Landownership in the DNRC HCP action area.

Landowner	Action Area (Acres)
Federal Lands	
US Forest Service	344,200
US Bureau of Land Management	55,800
National Park Service	100
Subtotal	**400,100**
State Lands	
DNRC - HCP Lands in Scattered Parcels	400,700
DNRC - HCP Lands in LMAs	147,800
DNRC - Non-HCP Lands	6,400
Other State lands	16,400
Subtotal	**571,300**
Other Lands	
Salish and Kootenai Tribal Lands	300
Private Industrial Forest Lands	99,600
Non-Industrial Private Lands	75,200
Other and Water	4,800
Subtotal	**179,900**
Total	**1,151,300**

Acres rounded to the nearest hundred.

Within the Seeley LMA, approximately 5 additional sections of former Plum Creek land have been acquired by the USFS and numerous additional parcels in the surrounding area are now owned and managed by TNC. The USFS manages these sections of forest lands in accordance with the NRLMD. Currently, TNC continues to conduct forest management activities on their parcels in order to meet the Fiber Supply Agreement that accompanied the disposal of these lands. TNC is also actively seeking conservation buyers for these lands including DNRC and other state agencies. These land ownership changes are considered in our analysis contained in Section D.

Within the vicinity of the Swan River State Forest, 12,900 acres of former Plum Creek lands are owned by the USFS and managed under the NRLMD; 2,660 acres are owned by MFWP; 14,620 acres are owned by TNC but include a conservation easement held by MFWP; and 8,320 acres are owned by TNC. All TNC lands (8,320 acres) as well as the acres now owned by the USFS (12,900) are subject to management to meet TNC's Fiber Supply Agreement with Plum Creek. Additionally, DNRC recently acquired 1,917 acres on 4 parcels in the Swan River State Forest and has a one-year purchase agreement for an

additional 14,630, but has secured no funds to complete the transaction. The 1,917 acres are not included in the HCP project area and are not reflected in Table III-3. Until such time that they are added to the HCP, they will continue to be managed under the ARMs. The remaining 14,630 acres are under TNC ownership and are managed in accordance with the Fiber Supply Agreement that accompanied the disposal of these lands as well as in compliance with the 1995 Swan Valley Grizzly Bear Conservation Agreement.

Status of the Lynx Within the Action Area

Currently, we lack population data for large portions of the action area occupied by lynx. However, within the action area, research efforts are ongoing through the Canada Lynx Study led by Dr. John Squires, USDA Forest Service, Rocky Mountain Research Station. This research informs us that reproducing female lynx are present in five of the six LMAs. There are no reproducing lynx in the Swan LMA.

The proposed action is located in two core areas described in the Recovery Outline (USFWS 2005): Northwestern Montana and the Greater Yellowstone Area. The proposed HCP also includes secondary areas (Figure III-2). All DNRC LMAs (147,831 acres) lie within the Northwestern Montana core area (Table III-4), of which 127,938 acres lie within critical habitat and as such we consider LMAs to be occupied by lynx (74 FR 8616). Approximately 20,000 acres in the LMAs occur outside of designated critical habitat. These portions of the LMAs were not considered to have the principal component elements of critical habitat at the time of designation because they were used by big game as winter range. Use by big game animals in winter suggests that these areas did not have the deep fluffy snow required by lynx. These areas do have other lynx habitat attributes and DNRC has opted to provide protection to these areas in an effort to be conservative in its treatment of lynx habitat. For the purpose of this BO, we will refer to all lands in LMAs as occupied despite our uncertainty that some areas adjacent to critical habitat may support all of the life history needs of the species. An additional 245,500 acres of scattered parcels in the HCP project area lie within this core area and 1,759 acres of scattered parcels in the HCP project area fall within secondary areas (Table III-4). Of the acreages in scattered parcels in core areas, we consider approximately 47,300 acres to be occupied by lynx; these acres are also in critical habitat (see Section B for explanation) (Table III-4). As explained in Section B we do not consider secondary areas to be occupied by resident lynx.

Figure III-2. Location of DNRC lynx management areas, DNRC HCP project area, and Federal lynx recovery areas (USFWS 2005).

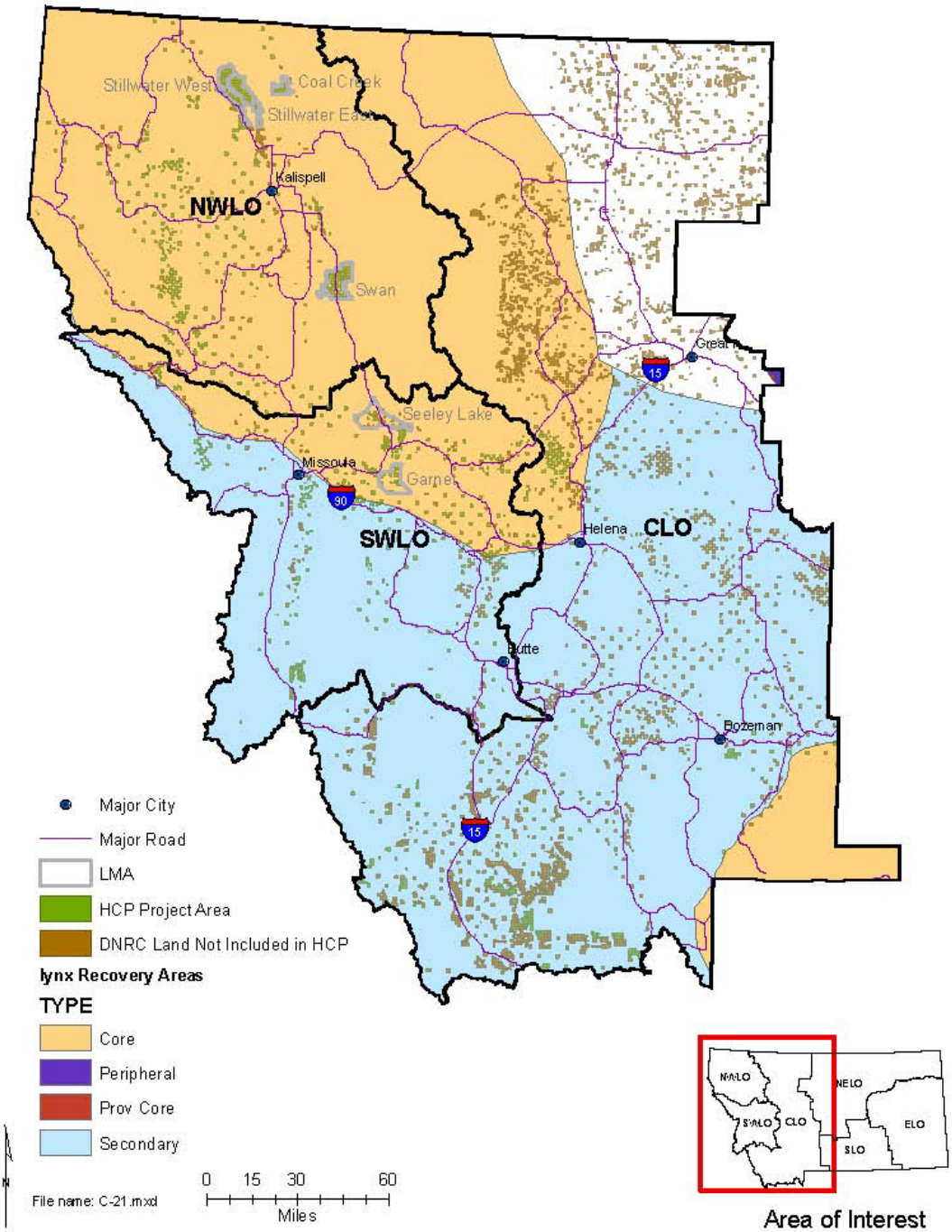


Table III-4. Relationship of the DNRC HCP project area to the Recovery Outline (USFWS 2005) and designated critical habitat (74 FR 8616).

Location in the HCP Project Area	Core Area		Secondary Areas	Critical Habitat
	NW MT	Yellowstone		
DNRC LMAs				
Stillwater East	36,706	0	0	36,709
Stillwater West	38,741	0	0	33,948
Coal Creek	15,236	0	0	15,223
Swan	39,700	0	0	31,150
Seeley Lake	9,938	0	0	3,398
Garnet	7,510	0	0	7,510
Subtotal	**147,831**	**0**	**0**	**127,938**
Scattered Parcels by Land and Unit Office				
Northwest Land Office				
Kalispell Unit	41,654	0	0	8,038
Libby Unit	28,452	0	0	1,350
Plains Unit	53,556	0	0	0
Stillwater Unit	19,356	0	0	8,552
Swan Unit	0	0	0	0
Southwestern Land Office				
Anaconda Unit	19,698	0	24,236	3,794
Clearwater Unit	28,313	0	0	8,690
Hamilton Unit	0	0	20,913	0
Missoula Unit	28,625	0	22,693	16,141
Central Land Office				
Bozeman Unit	0	1,759	16,483	785
Conrad Unit	0	0	0	0
Dillon Unit	0	0	70,593	0
Helena Unit	25,908	0	198	28
Subtotal	**245,562**	**1,759**	**155,117**	**47,378**

Figure III-3a. Location of the DNRC HCP action area in the Northwest Land Office in relationship to Federal LAUs (i.e., the numbered polygons).

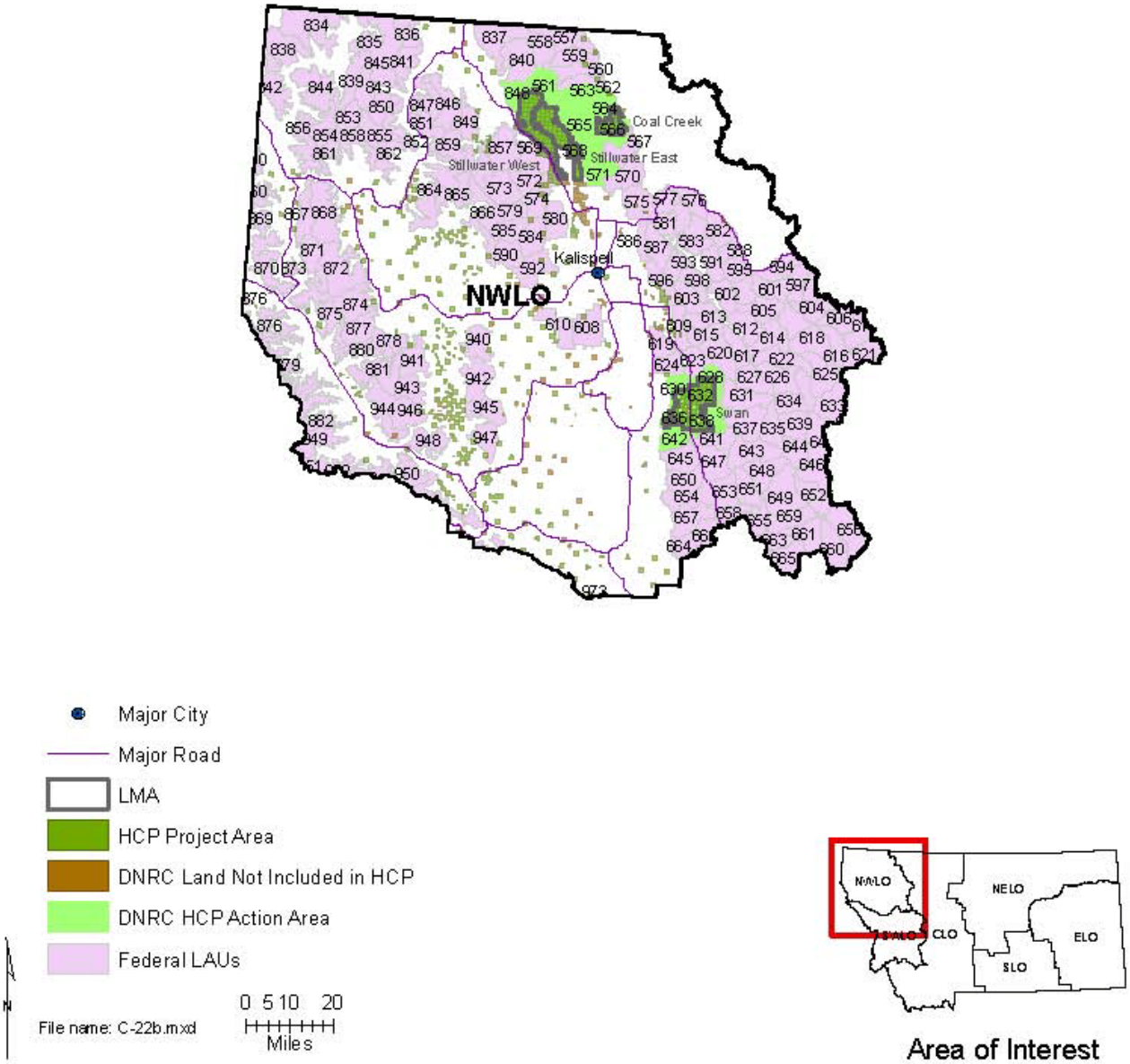


Figure III-3b. Location of the DNRC HCP action area in the Southwest Land Office in relationship to Federal LAUs (i.e., the numbered polygons).

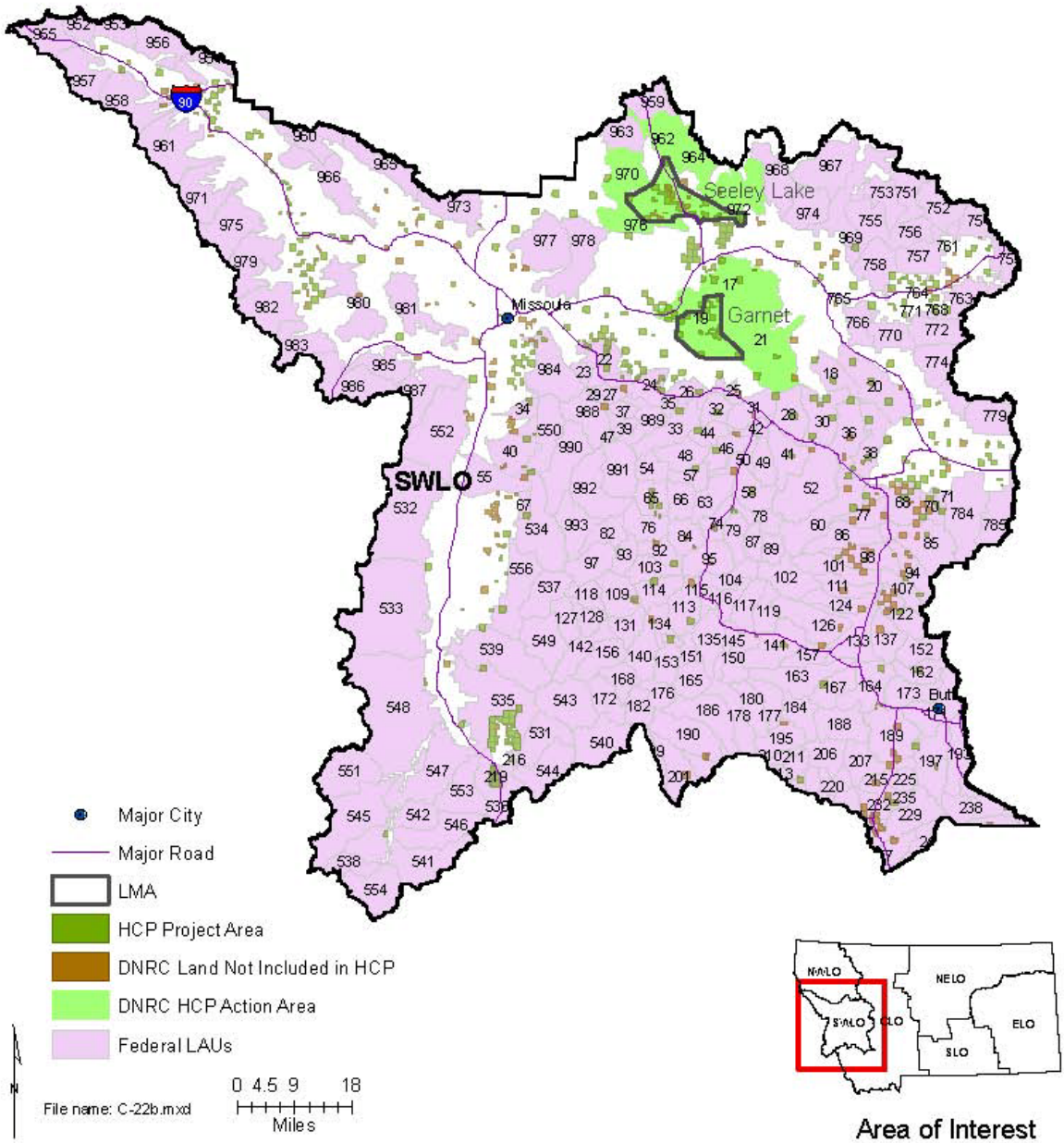
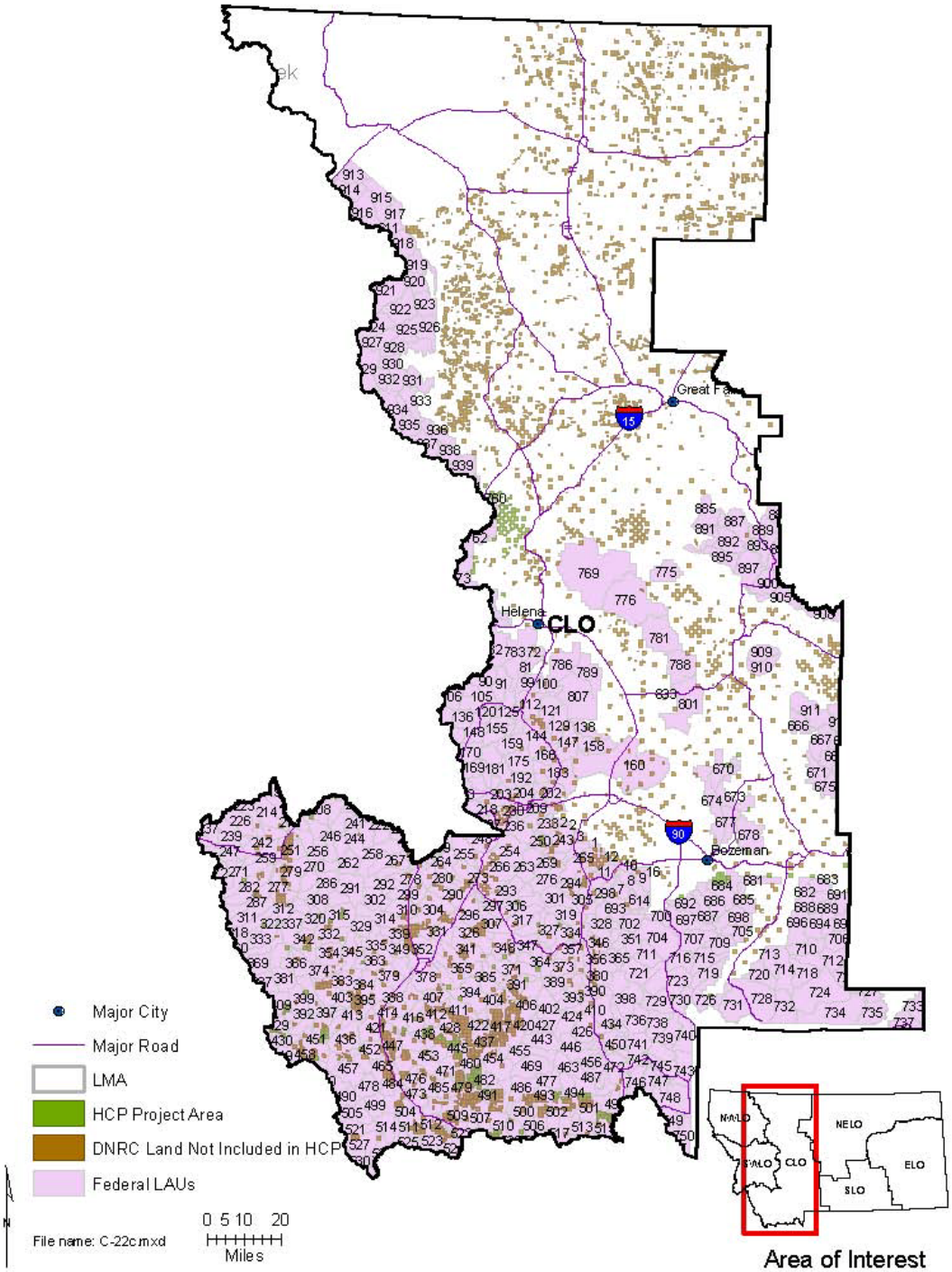


Figure III-3c. Location of the DNRC HCP action area in the Central Land Office in relationship to Federal LAUs (i.e., the numbered polygons).



Within the action area, approximately 50 percent of the lands are owned and managed by the DNRC for forest management (Table III-3). Currently, these lands are managed under the forest management ARMs, which require DNRC to implement conservation commitments for lynx as described below. Other state non-trust lands include Montana Fish Wildlife and Parks (MFWP) wildlife management areas and the Lubrecht Experimental Forest; both areas providing matrix habitat for lynx. Federal land comprises the other primary landownership and land manager in the action area (35 percent). The other primary landowners in the action area include both private industrial and non-industrial forested lands (15 percent) (Table III-3). Private industrial forested lands contribute to the mosaic of habitats required by lynx but do not implement conservation plans specifically for lynx. Private non-industrial forest lands are typically residential areas at low elevations with some amount of forested lands. These lands may be periodically managed for timber harvest and may serve as matrix habitat but are not managed for lynx.

This section provides an overview of the status of lynx habitat and key factors affecting habitat in the action area for the primary landowners, DNRC and the USFS, and private industrial forest.

Management of Lynx Habitat on Federal Lands in the Action Area

As discussed above in Section B, Federal lands in the action area (about 400,000 acres) are managed in accordance with the NRLMD for USFS lands; BLM lands are managed under the LCAS. The biological opinion for the NRLMD (USFWS 2007) concluded that the programmatic and project-level objectives, standards, and guidelines in the amended Forest Plans provide comprehensive conservation direction adequate to reduce adverse effects to lynx from forest management on national forest lands and do not result in jeopardy to the lynx DPS.

Since implementation of the NRLMD in 2007, the USFS in Montana (including Forests outside the action area) has conducted six projects that may have adverse effects on lynx, affecting a total of about 3350 acres (USFS 2009). This is well below the levels anticipated in the no-jeopardy biological opinion on the amendments. Since 2007, the BLM in Montana has not conducted any vegetation management or timber harvest resulting in adverse effects to lynx.

Management of Lynx Habitat on DNRC Lands in the Action Area

DNRC has addressed lynx habitat needs in its forest management program for the past 12 years beginning with the establishment of lynx management guidelines for the State

Forest Land Management Plan (SFLMP) in 1998. In 2003, DNRC developed and implemented the Administrative Rules of Montana (ARMs) for Forest Management (36.11.401 through 456) that apply to lynx under its current program, reflected in ARMs 36.11.435, 36.11.411, and 36.11.414. These rules require lynx habitat management on scattered parcels where specific habitat elements and habitat types for lynx occur, as well as within the Stillwater Block and Swan River State Forest. The ARMs include provisions for denning habitat, foraging habitat, coarse woody debris, and connectivity of habitat. Specifically, in the Stillwater Block and Swan River State Forest, DNRC must maintain a minimum of 5 percent of the total potential lynx habitat as denning habitat and 10 percent as foraging habitat. On scattered parcels, DNRC is required to maintain a minimum of 5 acres of foraging habitat where appreciable amounts of lynx habitat occur. Overall, DNRC management has maintained between 63 and 91 percent of total potential lynx habitat in a suitable habitat condition in LMAs and between 75 and 93 percent of total potential lynx habitat in a suitable habitat condition on scattered parcels in the HCP project area (see Tables III-5 and III-6). However, the amount of suitable habitat in a given area is anticipated to vary over time as some stands grow into or out of suitable lynx habitat condition.

The HCP would change the conservation approach for lynx by focusing DNRC's conservation measures in LMAs, which are high priority areas for lynx conservation as described in Section A. Under the HCP, the lynx habitat commitments would apply to all lands in the HCP project area supporting lynx habitat and additional commitments would apply in the LMAs. For lynx habitat outside the HCP project area, DNRC would continue to apply the existing Forest Management ARMs for lynx (listed above). For implementation of the proposed HCP, DNRC revised its lynx habitat mapping protocol to determine the presence of lynx habitat and habitat class in the HCP project area based on the lynx habitat definitions used in the HCP. For mapping protocol for these habitats, refer to Document B-3, Appendix B, Final EIS/HCP 2010. Lynx habitats in the DNRC HCP are described later in Section D.

The status of lynx habitat in the HCP project area portion of the action area is described below. Six LMAs were delineated in the HCP project area, and these encompass approximately 148,000 acres of trust lands in the NWLO and SWLO supporting approximately 130,000 acres of total potential lynx habitat. These are the Stillwater East, Stillwater West, Coal Creek, and Swan LMAs in the NWLO and the Seeley and Garnet LMAs in the SWLO (see Figure III-2). Lynx are known to be present in all LMAs except the Swan. Acreage of lynx habitat in the LMAs is provided in Table III-5. Table III-5 shows that of the total potential lynx habitat in LMAs in the HCP project area, 83 percent is currently in suitable habitat condition. Acreage of lynx habitat on scattered parcels in the HCP project area is provided in Table III-6.

Table III-5. Composition of existing lynx habitat within DNRC lynx management areas (LMAs).

	LMAs						
	Stillwater West	**Stillwater East**	**Coal Creek**	**Swan**	**Seeley Lake**	**Garnet**	**Total**
Habitat Class	Acres (%)	Acres (%)	Acres (%)	Acres (%)	Acres (%)	Acres (%)	Acres (%)
Winter Foraging Habitat[a]	21,975 (62)	26,065 (76)	5,103 (36)	23,798 (65)	2,556 (57)	1,079 (28)	80,576 (62)
Summer Foraging Habitat[a]	6,556 (18)	2,398 (7)	1,954 (14)	2,588 (7)	278 (6)	210 (5)	13,984 (11)
Other Suitable Habitat[a]	3,268 (9)	663 (2)	1,832 (13)	3,632 (10)	1,206 (27)	2,100 (54)	12,701 (10)
Suitable Habitat Subtotal[a,b]	31,799 (89)	29,126 (85)	8,889 (63)	30,018 (82)	4,040 (91)	3,389 (86)	107,261 (83)
Temporary Non-Suitable Habitat[a]	3,783 (11)	5,342 (16)	5,299 (37)	6,636 (18)	426 (10)	534 (14)	22,020 (15)
Total Potential Lynx Habitat[c,d]	35,582 (92)	34,468 (94)	14,188 (93)	36,654 (92)	4,466 (45)	3,923 (52)	129,281 (87)
Non Habitat[d]	3,159 (8)	2,238 (6)	1,048 (7)	3,046 (8)	5,472 (55)	3,586 (48)	18,549 (13)
DNRC Total Acre[e]	38,741 (100)	36,706 (100)	15,236 (100)	39,700 (100)	9,938 (100)	7,509 (100)	147,830 (100)
LMA Total Acres	39,239	36,820	15,236	54,580	51,337	38,044	235,256

[a] Percentages for these habitat classes describe habitat amounts proportional to total potential lynx habitat.

[b] The Suitable Habitat Subtotal is the sum of Winter Foraging Habitat, Summer Foraging Habitat, and Other Suitable Habitat, which are all presumed to currently provide habitat.

[c] Total Potential Lynx Habitat is the sum of Suitable Habitat and Temporary Non-suitable Habitat acres. This category represents all lands potentially supporting lynx preferred climax vegetation types over time regardless of their current structural condition.

[d.] Percentages for these classes describe amounts proportional to DNRC Total Acres.

[e] DNRC Total Acres is the sum of Total Potential Lynx Habitat and Non-habitat.

Source: Final HCP/EIS 2010, Table 4.9-20.

Table III-6. Acreages of existing lynx habitat on scattered parcels in the HCP project area by land office.

Habitat Class	HCP Project Area (%)						
	NWLO		SWLO		CLO		TOTAL
Winter Foraging Habitat[a]	43,205	(68)	9,256	(34)	12,953	(34)	65,414
Summer Foraging Habitat[a]	4,169	(7)	3,147	(12)	NA	NA	7,316
Other Suitable Habitat[a]	11,781	(19)	7,858	(29)	27,928	(75)	47,567
Suitable Habitat Subtotal[a,b]	59,155	(93)	20,261	(75)	27,928	(75)	107,344
Temporary Non-Suitable Habitat[a]	4,661	(7)	6,936	(26)	9,111	(25)	20,708
Total Potential Lynx Habitat[c]	63,816	(45)	27,196	(19)	37,039	(33)	128,052
Non Habitat[d]	79,202	(55)	117,283	(81)	76,143	(67)	272,628
Total Acres[e]	143,018	(100)	144,479	(100)	113,182	(100)	400,679

a Percentages for these habitat classes describe habitat amounts proportional to total potential lynx habitat.

b The suitable habitat subtotal is the sum of winter foraging habitat, summer foraging habitat, and other suitable habitat, which are all presumed to currently provide habitat.

c Total potential lynx habitat is the sum of suitable habitat and temporary non-suitable habitat acres. This class represents all lands potentially supporting lynx-preferred climax vegetation types over time regardless of their current structural condition.

d Percentages for these classes describe amounts proportional to DNRC Total Acres.

e Total acres is the sum of total potential lynx habitat and non-habitat.

f. DNRC was not able to estimate winter foraging habitat in the CLO due to stand level inventory database limitations (see DNRC HCP, Appendix B, Document B-3). For the purposes of this analysis, we presumed that winter foraging habitat comprises an additional 12,953 acres in the CLO[1].

Source: Final HCP/ EIS 2010, Table 4.9-21.

Risk Factors within the Action Area

The LCAS identified 17 potential risk factors for lynx or lynx habitat within the authority and jurisdiction of Federal land management agencies to control, some of which occur within the action area. Where applicable to DNRC lands within the action area, we will use these risk factors as part of the framework for our analysis of the effects. We have also updated information on risk factors for consistency with the NRLMD.

[1] This value represents 34 percent of the total potential habitat in the CLO and was calculated using the values in EIS Table 4.9-21such that the CLO represents the same proportion of winter foraging habitat to total potential habitat as found in the Southwestern Land Office. This is considered a fair assessment of acres of winter foraging habitat since the habitat in the CLO is expected to be less suitable than that found in the SWLO.

Risk Factors within the Action Area Related to Federal Authority and Jurisdiction (from LCAS)

Factors Affecting Lynx Productivity

A. Timber Management
B. Wildland Fire Management
C. Recreation
D. Forest / Backcountry Roads and Trails
E. Livestock Grazing
F. Other Human Developments (Oil and Gas Leases, Mines, Reservoirs, Agriculture)

Factors Affecting Lynx Mortality

A. Trapping (legal and non-target)
B. Predator Control
C. Incidental or Illegal Shooting
D. Competition and Predation as Influenced by Human Activities
E. Highways (vehicular collisions)

Factors Affecting Lynx Movements

A. Highways, Railroads and Utility Corridors
B. Land Ownership Pattern
C. Ski Areas and Large Resorts

Other Large-Scale Risk Factors

A. Fragmentation and Degradation of Lynx Refugia
B. Lynx Movement and Dispersal Across Shrub-Steppe Habitats
C. Habitat Degradation by Non-native Invasive Plant Species

The LCAS (Reudiger et al. 2000) established habitat-related standards for federal lands typically applied at the LAU scale to address potential risk factors to lynx (see list in FR Notice p 8639). . The NRLMD (USFS 2007a) updated these standards based on more recent information on risk factors for lynx. The 18 USFS Northern Region Forest Plan amendments included standards and guidelines intended to avoid or reduce the potential for projects proposed under Forest Plans to adversely affect lynx. Some standards from the LCAS were changed to guidelines when it was determined that the risk factors were not negatively affecting the lynx DPS. Additionally, other standards were eliminated when there was a lack of scientific or reliable information to indicate that the measures were needed to avoid adverse effects for lynx. The suite of standards and guidelines in the NRLMD promote and conserve the habitat conditions needed to produce adequate snowshoe hare (lynx primary prey) and sustain lynx in the action area.

Risk Factors within Action Area Related to the DNRC Forest Management Program

Forest management risk factors addressed by the DNRC HCP include:

- Linkages and Habitat Connectivity,
- Vegetation Management,
  - Foraging Habitat,
  - Habitat Conversion,
- Land Disposal and Acquisition,
- Den Site Protection,
- Den Site Attributes,
- Forest Roads, and
- Grazing.

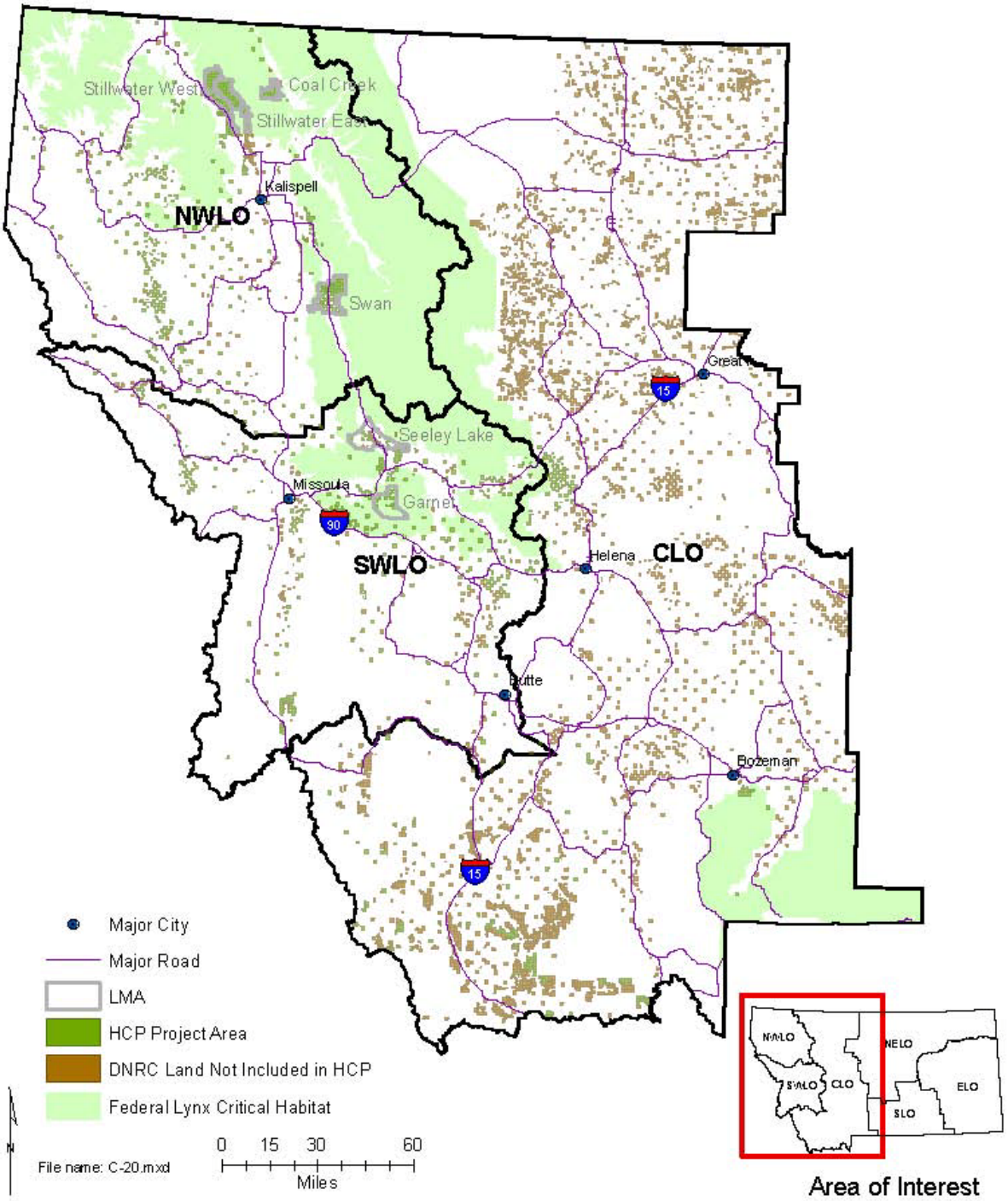
Environmental Baseline of Critical Habitat

The action area is within Units 3 and 5 of designated lynx critical habitat and contains physical and biological features essential for the conservation of the species, including the PCE and its components (Figure III-4). In our revised final rule we state the conservation role of lynx critical habitat is to support viable core area populations. Unit 3 was occupied by lynx at the time of the listing and is currently occupied by lynx (74 FR 8616). Lynx are known to be widely distributed throughout this unit and breeding has been documented in multiple locations. Table III-7 illustrates the preponderance of federal lands, which are primarily National Forest system lands, within Unit 3. All critical habitat on National Forest lands in Unit 3 is managed according to the NRLMD (USFS 2007b). The NRLMD includes a suite of management directives that enhance, maintain and conserve dense understories. Since implementation of the NRLMD, the USFS in Montana has conducted six projects that may have adverse effects on lynx critical habitat, affected a total of about 3350 acres (USFS 2009). The BLM has not conducted projects that resulted in adverse effects on critical habitat.

Table III-7. Square miles of lynx critical habitat per ownership per State in Unit 3: Montana and Idaho (74 FR 8616).

	Federal (mi^2)	**State (mi^2)**	**Private(mi^2)**	**Tribal (mi^2)**	**Other(mi^2)**
Montana	8,627	307	1,086	0	46
Idaho	51	0	0	0	0

Figure III-4. Location of DNRC HCP project area and designated federal lynx critical habitat.



Lynx critical habitat on DNRC trust lands was explained under *Management of Lynx Habitat on DNRC Lands in the Action Area* above. All of the LMAs in the HCP project area fall within Unit 3 and contain lynx critical habitat (Table III-4). About 46,565 acres of critical habitat occur on scattered parcels in the HCP project area in Unit 3 (Table III-4). All LMAs, with the exception of the Swan, currently support reproducing lynx.

Unit 5 was occupied by the lynx at the time of listing and is currently occupied by the species (74 FR 8616). The Greater Yellowstone Area is inherently marginal lynx habitat with highly fragmented foraging habitat (snowshoe hare habitat). The HCP project area includes 813 acres of critical habitat on scattered parcels within Unit 5. These acres fall within the Bozeman and Helena Units of the Central Land Office

D. EFFECTS OF THE ACTION

Under section 7(a)(2) of the Act, "effects of the action" refers to the direct and indirect effects of an action on the species or critical habitat, with the effects of other activities interrelated or interdependent with that action. Indirect effects are those caused by the proposed action and are later in time, but still are reasonably certain to occur (50 CFR 402.02). The effects of the action are added to the environmental baseline to determine the future baseline and to form the basis for the determination in this opinion. Should the federal action result in a jeopardy situation and/or adverse modification conclusion, the USFWS may propose reasonable and prudent alternatives that the federal agency can take to avoid violation of section 7(a)(2). The effects discussed below are the result of direct and indirect impacts of implementing the proposed project. The DNRC proposes to implement an HCP with conservation measures for lynx on 540,500 acres of state forested trust lands.

Factors to be Considered

DNRC's ability to mitigate potential risk factors for lynx varies with its land base. The DNRC HCP would apply greater conservation emphasis in its LMAs, which are primarily blocked lands where 1) lynx are known to be present or may occur in the future and 2) it owns larger areas of land and has greater control over the actions on those lands. Conservation on these lands is also enhanced by their proximity to federal lands where active recovery efforts are ongoing. Four of the six LMAs lie across or within portions of federal LAUs managed under the NRLMD.

DNRC focuses its conservation in LMAs because these areas are of primary importance for lynx on DNRC lands. Because LMAs are generally on blocked lands, DNRC actions have the greatest potential to exert adverse effects on reproducing lynx but also the greatest potential to apply measures that effectively create and maintain functional lynx habitat. Further, because DNRC owns more contiguous lands in LMAs, it has greater ability and it is more cost-effective to apply enhanced conservation and monitoring in these areas. DNRC lands outside the LMAs are comprised of widely scattered parcels surrounded by various landownerships and land uses.

Lack of habitat and management information for many of the surrounding parcels makes it difficult to ascertain the effects of DNRC actions in these areas and the effects will vary based on site-specific conditions. However, DNRC's scattered parcels also have a role in meeting the HCP biological goals and objectives, particularly on scattered parcels in occupied habitat. When these scattered parcels occur in occupied habitat within a federal LAU, they contribute suitable habitat and prey to the surrounding LAU and potential lynx home range. In unoccupied lynx habitat, the HCP also applies measures to conserve habitat. These measures would benefit lynx during dispersal and by maintaining connectivity between populations. However, determining the appropriate mitigation for actions whose effects vary based on site-specific conditions is difficult. Therefore, the HCP focused its primary conservation in LMAs and applies other commitments on scattered parcels to retain suitable habitat and habitat connectivity in these areas.

DNRC's commitments under the HCP acknowledge the abundance of lynx habitat, particularly winter foraging habitat, on its landscape today that may be affected over time by an active forest management program required to sustainably manage Montana's forested trust lands and generate revenue for its trust beneficiaries. Potential adverse effects are likely to occur primarily as a result of decreases in lynx foraging habitat/snowshoe hare habitat from: (1) pre-commercial thinning and (2) removal of mature, multi-storied stands that comprise winter foraging habitat. Hence, DNRC applied greater conservation of winter foraging habitat in its LMAs through requirements to retain at least 20 percent of total potential habitat as winter foraging habitat in these areas and retention of at least 20 percent of dense sapling patches in pre-commercial thinning areas.

The following analysis pertains to the effects and the proposed HCP on lynx, in conjunction with DNRC's forest management program. The following sections analyze the effects of the measures contained in the proposed action (DNRC HCP) on lynx for the risk factors identified above in Section D.

Analysis of Effects of Vegetation Management under the DNRC HCP

The LCAS required identification of lynx habitat and establishment of LAUs throughout the lynx's range on federal lands to provide a meaningful scale of analysis within which to determine the effects of land management actions on lynx and snowshoe hare habitat. An LAU is a delineated area approximating the size of a lynx home range (16,000 to 25,000 acres), with at least 6,400 acres of primary vegetation present capable of supporting lynx.

To give context to the contribution of DNRC lands to lynx conservation, within Montana, there are about 5.5 million acres of lynx critical habitat, or occupied habitat, on federal lands as compared to 175,000 acres on trust lands (see Table III-4). Thus, DNRC trust lands makes up about 3 percent of the occupied lynx habitat in Montana. Using the values for total potential

lynx habitat from Tables III-5 and III-6 (129,281 in LMAs and 128,052 on scattered parcels, respectively) there are approximately 257,333 acres of total potential lynx habitat on DNRC lands in the HCP action area compared to approximately 8.4 million acres of lynx habitat on federal lands in Montana. We note that these figures include lynx habitat both within and outside lands occupied by lynx. Habitat on DNRC noted as "potential lynx habitat" is more or less synonymous with "primary vegetation" for lynx on federal lands.

Similar to the establishment of LAUs on federal land, DNRC established six LMAs within the HCP project area to provide enhanced conservation across their blocked lands and key scattered parcels in the areas known to support lynx. The LMAs include Stillwater East, Stillwater West, Coal Creek, Swan, Seeley and Garnet (Figure III-1). The LMAs are primarily located on blocked lands, with the exception of the Garnet and Seeley LMAs which are comprised of scattered parcels. The LMAs range in size from 38,044 acres to 54,580 acres, which includes all lands within the LMA regardless of ownership. In general, DNRC owns all lands in LMAs that occur on blocked lands, but the Seeley Lake and Garnet LMAs encompass non-DNRC lands. The total potential lynx habitat on DNRC lands within the LMAs varies as well, from approximately 3,900 acres to 36,600 acres (see Table III-5 in Section D above). This compares to the federal LAUs whose guidelines suggest LAUs be between 16,000 to 25,000 acres, and contain at least 6,400 acres of primary vegetation for lynx.

Description of DNRC Lynx Habitat Categories under the HCP

The DNRC HCP categorizes lynx habitat as follows:

- **Temporary non-suitable lynx habitat -** Seedling stands; sapling stands with less than180 trees per acre; or sapling, poletimber or mature age class stands with less than 40 percent total stand crown closure. Such stands may include recent clear-cuts, other even-aged harvest units, and stand-replacement burns that are less than or equal to 15 years old, which are likely to develop future habitat characteristics important to lynx through forest succession.

- **Total Potential Lynx Habitat** - The sum of acreages of suitable lynx habitat and temporary non-suitable lynx habitat.

- **Suitable habitat** - Poletimber and sawtimber size class stands with greater than 40 percent total stand crown density. Seedling/sapling size class stands are suitable habitat when they support greater than or equal to 180 trees per acre that are greater than or equal to 6 feet tall.

- **Winter foraging habitat** - Sawtimber stands within suitable lynx habitat that possess multi-layering of moderate or well-stocked coniferous vegetation and horizontal cover. These stands must exhibit the following minimum structural characteristics: 1) occur on preferred habitat types (Pfister et al. 1977), 2) have one or more of the following species

present, subalpine fir, grand fir and or Engelmann spruce, 3) at least 10 percent canopy closure in trees greater than or equal to 9 inches diameter at breast height (i.e., "sawtimber" stand size class category in the DNRC stand level inventory [SLI]), 4) a minimum of 40 percent total stand crown density in understory and overstory combined.

- **Summer foraging habitat** - Dense sapling stands and moderate to densely stocked poletimber stands within suitable lynx habitat that possess horizontal cover. These stands exhibit the following minimum structural characteristics: 1) occur on preferred habitat types, 2) one or more shade-tolerance tree species present, (subalpine fir, grand fir, and/or Engelmann spruce), 3) are either a sapling stand of average height at least 6 feet with greater than 1,500 stems per acre or a medium- to well-stocked poletimber stand.

- **Other suitable habitat** - Suitable lynx habitat stands that do not meet the criteria for winter foraging or summer foraging habitat.

- **Non lynx habitat** – Permanent non-forested areas such as dry forest types, rock, lakes, meadows, etc.

Effects of Vegetation Management under the DNRC HCP on Lynx Habitat

The primary factors driving lynx populations, behavior, and distribution is the abundance and distribution of their primary prey: snowshoe hare. In Montana, habitats that support snowshoe hare and lynx vary by season (Squires et al. 2010 in press). Older forested stands provide high quality winter habitat when they provide multi-story structure that provides forage and horizontal cover, for both lynx and snowshoe hare (Murray et al. 1994). In Montana, these stands are used consistently by both lynx and snowshoe hare during the winter (Squires and Ruggiero 2007; Squires et al. 2010 in press). This is in contrast to Alaska and Canada where mature forests are used in proportion to availability and where regenerating forests (approximately 20 years or older providing dense sapling stands that protrude above the snow until the trees reach heights where lower limbs self-prune and no longer reach the snow level) are highly selected in winter (Squires et al. 2010 in press). Regenerating forests providing dense sapling stands that protrude above the snow also provide important snowshoe hare habitat in Montana. Winter snowshoe habitat is considered a limiting factor in lynx populations in the contiguous states. Dense, young sapling stands (more than 2,000 trees per acre) can also provide habitat for concentrations of hares in western Montana (Griffin 2004). In summer, lynx broaden their habitat use to include younger forest stands with an abundance of shrub cover that support snowshoe hares (Squires et al. 2010 in press). Summer habitat is generally not considered a limiting factor for lynx. Lynx also require cover when searching for food (Brand et al. 1976). Lynx have been observed (via snow tracking) to avoid large openings (Koehler 1990; Staples 1995) during daily movements within the home range. Hence, mature stands, along with stands in an early successional stage and intervening successional stages, provide the landscape mosaic of habitat conditions needed

for snowshoe hare production and lynx foraging (hunting) habitat, and thus for recovery and survival of lynx.

Timber harvest, prescribed burns, thinning, and natural disturbance events can set back vegetation succession to an early seral stage, which may not immediately support snowshoe hare populations. The LCAS and NRLMD defined "lynx habitat in unsuitable condition" as those areas within mapped lynx habitat that are in these early successional stages as a result of recent fires or vegetation management, in which the vegetation has not yet developed sufficiently to support snowshoe hare populations during all seasons, specifically winter (Ruediger et al. 2000; USFS 2007a). However, eventually, these stands regenerate and provide high stem densities and horizontal structure extending above snowpack during the winter, and become high quality winter snowshoe hare habitat (USFS 2007). High quality lynx habitat contains an abundance of this early successional habitat in "unsuitable condition" (up to 30 percent) within a mosaic of mid- to late-seral stands (USFWS 2007). The NRLMD also recognized the importance of maintaining landscapes with high quality lynx habitat and included standards to defer harvest when 30 percent of an LAU was in the "stand initiation structural stage," which is considered synonymous with "lynx habitat in unsuitable condition" (as used in the LCAS). Through on-going research (Squires et al. 2006; Squires et al. 2010), the importance of spruce-fir forests with high horizontal cover, abundant hares, deep snow, and large-diameter trees during winter has been identified for lynx in Montana. Because these habitats may be a limiting factor for lynx, it is important to identify and maintain habitat that provides high levels of horizontal cover preferred by snowshoe hares and lynx in winter. The effects of vegetation management on the availability of suitable and foraging habitat under the HCP are analyzed below at the LMA scale, for scattered parcels at the land office scale, and for changed circumstances.

Effects of Vegetation Management on Lynx Habitat at the LMA Scale

<u>Effects on Suitable Habitat</u>

The DNRC HCP would implement a suite of commitments related to vegetation management to sustain adequate habitat for lynx at the LMA scale. These commitments include LY-LM1, LY-LM2, LY-LM3a,b, LY-HB4a,b, and LY-HB5 as described above. DNRC's HCP would retain 65 percent suitable habitat and 35 percent temporary non-suitable habitat within LMAs and on scattered parcels at the land office scale. This 65/35 percent habitat ratio was derived from the habitat needs of lynx, the scales and frequency of natural disturbance regimes, and DNRC's operational needs. In support of the development of the DNRC HCP, DNRC considered historical conditions (pre-forestry) in western Montana within cover types that were likely to support lynx. The analysis concluded that approximately 38 percent of the landscape was in non-stocked and seedling/sapling stands at any given time (i.e., temporary non-suitable habitat). Therefore, DNRC concluded that maintaining a range of 60 to 70 percent of total potential habitat as suitable habitat within occupied lynx habitat would provide adequate suitable habitat for lynx. DNRC also selected the 65/35 percent habitat ratio based on its operational needs and trust mandate. Justification for the habitat ratio is contained in Final EIS/HCP 2010, Appendix A, Chapter 2, pages 2-55 through 2-59.

Given the historical range of conditions present in habitat supporting lynx (as described in Final EIS/ HCP, Chapter 2, page 2-56, lines 1 through 8) and the large size of four of the 6 LMAs, maintaining 65 percent of potential lynx habitat as suitable habitat is expected to provide adequate suitable habitat for lynx in DNRC LMAs. Further, capping the amount of habitat that can be converted per decade ensures a continuum of young forest growing into suitable foraging habitat over time. These measures would ensure that DNRC LMAs provide the landscape mosaic of habitat conditions needed for snowshoe hare production and lynx foraging (hunting) habitat. The LCAS provides direction that "…at least 10 mile^2 (6,400 acres) of primary vegetation should be present within each LAU (lynx analysis unit) to support survival and reproduction" of lynx. In each of four of the DNRC LMAs there is more than 14,200 acres of total potential habitat (i.e., primary vegetation in the NRLMD), which would provide greater than 9,200 acres of suitable habitat based on the 65/35 percent habitat commitment. Two of the LMAs, Garnet and Seeley, are comprised of scattered parcels but were designated as LMAs for their importance to lynx. In these LMA's, DNRC commitment would provide 2,600 and 2,900 acres of suitable habitat, respectively. Additional suitable habitat is available on adjacent Federal lands managed under the LCAS and NRLMD, which require the BLM and USFS to retain 70 percent of the lynx habitat in a suitable condition. Thus, we conclude that implementation of the HCP is not likely to result in adverse effects on lynx from loss of suitable habitat. The HCP commitments combined with available habitat on adjacent Federal lands would retain adequate levels of suitable habitat to sustain lynx. Thus, we expect that adverse effects on lynx as a result timber harvest that could result in lack of suitable habitat (in general) would be avoided as a result of implementation of conservation commitment LY-LM1 and LY-LM2.

Effects on Lynx Winter Foraging Habitat

Management treatments that result in reductions of lynx foraging habitat and/or high quality snowshoe hare habitat may result in adverse effects on lynx because these habitat modifications may decrease production and density of snowshoe hares, their primary prey. Conservation commitment LY-LM3 addresses the conservation of winter foraging habitat.

Based on the allocation of the annual sustainable yield and the occurrence of lynx habitat, DNRC estimates it may harvest 1,850 acres of winter foraging habitat annually across all LMAs during the Permit term. We note that Final EIS/HCP 2010, Appendix A, Chapter 7, Table 7-10 provides an annual estimated harvest for the LMAs, spread equally across years. However, while the table shows that DNRC may harvest an estimated 50 acres annually in the Seeley and Garnet LMAs, this is unlikely. Rather, the timber harvest and the associated effects are likely to occur in pulses whereby a few hundred acres of foraging habitat are treated at one time every few years (Baty, DNRC, personal communication, September 2010 and Final EIS/HCP 2010, Appendix B, Document B-14, Table 2, page B-72).

To limit adverse effects on lynx from loss of winter foraging habitat, the DNRC HCP would retain at least 20 percent of total potential lynx habitat as winter foraging habitat in each LMA

(LY-LM3). The commitment specifically requires DNRC to maintain mature stands meeting the cover type and structural characteristics of winter foraging habitat. These are generally characterized as mature, multi-storied stands. Thus, the mosaic of habitat in potential lynx habitat within LMAs would contain at least 20 percent, or more, of high quality winter foraging habitat. Further, the 65 percent suitable habitat requirement, snag recruitment and retention ARMs and CWD commitments (LY-HB2) would also provide valuable horizontal cover and structure required by snowshoe hares and lynx.

Additionally, through commitment LY-HB4, DNRC would require that commercial harvest prescriptions in winter foraging habitat retain patches of advanced regeneration of shade-tolerant tree species (including grand fir, subalpine fir, and Englemann spruce) where operationally feasible. This measure is intended to help expedite the development of future foraging habitat. For example, if a mature stand is clearcut, this commitment helps ensure that shade tolerant trees will persist on site and become a part of the developing forest. The requirement for patches of shade tolerant trees retained would be up to 10 percent of the treated stand area. Therefore, where mature stands are harvested, this commitment may provide localized benefits such as limiting sight distances and providing limited horizontal hiding (security) cover for lynx and snowshoe hares, and retaining some forest structural attributes (forage, shelter and hiding cover) preferred by snowshoe hares.

DNRC indicates that it has several stands with high potential to grow into winter foraging habitat within 5 to 30 years of HCP implementation (Baty, DNRC, personal communication, November 2011). Additionally, some stands on productive sites treated within the first 10 years of permit issuance could grow into winter foraging habitat before the end of the permit term (Baty, DNRC, personal communication, November 2011). Thus, as winter foraging habitat is harvested, it is likely that other stands will grow into winter foraging condition. However, without knowing the acres that may grow into winter foraging habitat over the permit term, we must rely on LY-LM3 as the commitment for maintaining winter foraging habitat. Thus, we conservatively assume that the current abundance of winter foraging habitat in DNRC LMAs (80,576 acres - averaging 62 percent of total potential habitat in all LMAs) could potentially be reduced to 25,856 acres - 20 percent of total potential habitat in the LMAs over the 50-year Permit term. The acres treated will be tracked and monitored for the permit duration. If DNRC reaches the 20 percent threshold for winter foraging habitat in LMAs it would seek non-lynx habitat stands for harvest.

Due to the large size of most of the LMAs and abundance of potential habitat within them (Table III-5), 20 percent of total potential habitat in LMAs maintained as winter foraging habitat would adequately sustain snowshoe hare densities to support lynx recruitment. High use by lynx in the Garnet LMA, which has 28 percent of total potential habitat in winter foraging habitat on HCP lands, lends further support that retention of 20 percent as winter foraging habitat would be sufficient to sustain lynx recruitment. As discussed earlier, for LMAs, the HCP requires that 65

percent of total potential habitat is retained as suitable habitat. Up to 35 percent of the forest in an LMA could be in early to mid seral conditions. This commitment supports a balance of stands in various structural stages, ensuring sustainability of lynx habitat within the HCP project area over the long term. Additionally, as described above, some existing harvested stands in the HCP permit area would continue to grow into winter foraging habitat throughout the Permit term, thereby replacing a portion of the annual loss of winter foraging habitat in some years. Finally, four of the LMAs lie within portions of LAUs and two (the Stillwater LMAs) are adjacent to federal LAUs. Reduction in winter foraging habitat is largely prohibited by the NRLMD, which contributes to the adequacy of winter foraging habitat in these broader areas. The juxtaposition of LAUs and LMAs, and the lynx habitat management on both, would provide connectivity and larger expanses of suitable lynx habitat across which lynx would find habitat to establish home ranges.

Given the constraints on annual harvest, retention of winter foraging and suitable habitat, and the expectation that a proportion of treated acres would be replaced by acres growing into winter foraging habitat over the 50-year term, we do not expect that every project would result in adverse effects to lynx. However, the current abundance of winter foraging habitat in DNRC LMAs (averaging 62 percent of total potential habitat in all LMAs) could be reduced to 25,856 acres, 20 percent of total potential habitat across the six LMAs, over the 50-year term. Therefore, we expect individual projects that treat substantial amounts of multistoried winter foraging habitat in LMAs and/or the cumulative reduction in winter foraging habitat over the permit term would result in adverse effects on lynx accustomed to the abundance of winter foraging habitat in the area. The severity of the impact is dependent on site-specific conditions, including the amount of remaining winter foraging habitat in the LMA and in the surrounding areas. We do not expect significant negative impacts on male lynx, as they have larger home ranges and thus more options to find prey. They also do not have the physiological/energetic needs of reproductive-aged females. However, the abrupt reduction in winter snowshoe hare habitat could reduce snowshoe hare numbers, such that post-harvest at various times throughout the permit term, a female in the affected area would fail to reproduce or find adequate prey to feed kittens.

Effects on Lynx Summer Foraging Habitat

Young, forested stands with high horizontal cover from abundant shrubs, abundant small-diameter trees, and dense spruce-fir saplings provide summer foraging habitat for snowshoe hares and lynx. These stands may be subject to pre-commercial thinning in order to reduce densely stocked stands to concentrate growth on the more desirable trees. It is well documented that such thinning in hare habitat results in a corresponding decrease in the abundance of snowshoe hares (Griffin 2004; Griffin and Mills 2007). Thinning dense stands of young trees would adversely affect lynx by reducing the capacity of these stands to produce snowshoe hares, both at the time of treatment or in the future.

Summer foraging habitat for hares is not limiting in the action areas. However, pre-commercial thinning would also affect regenerating stands with high stem densities and horizontal structure extending above snowpack during the winter, which provide winter snowshoe hare habitat. Lynx typically do not successfully forage in these areas given the high stem densities, but these areas are important for their contribution to overall snowshoe hare productivity on the landscape. Thus thinning these stands may also adversely affect lynx by reducing the availability of snowshoe hares on the landscape at the time of treatment. Thinning younger stands could reduce the amount of dense stands that will grow to supply winter forage and cover in the future.

DNRC operational constraints would limit pre-commercial thinning on lynx habitat to approximately 1,500 acres in the HCP project area (including all LMAs and scattered parcels) annually (averaged over a 5-year period). This represents less than 1 percent of the total potential lynx habitat in the HCP project area (including all LMAs and scattered parcels). Therefore, the overall level of effect from pre-commercial thinning would likely be low.

To limit adverse effects on lynx from pre-commercial thinning, the HCP commitments will: 1) retain 20 percent of thinning units in LMAs in an unthinned condition (LY-LM3; LYHB4), and 2) retain a component of shade tolerant tree species important for developing horizontal cover in regenerating stands and accelerating development of multi-storied stands in LMAs and on scattered parcels (LY-LM3; LYHB4). We expect that the first commitment would maintain snowshoe hare use in unthinned portions of the stand (Griffin and Mills 2007), and result in about 1,200 acres pre-commercially thinned annually. The latter commitment would also maintain some level of snowshoe hare use and help expedite the development of future foraging habitat by always retaining a component of shade tolerant tree species important for the development of horizontal cover. Under this commitment, snowshoe hare are expected to continue to use dense clumps of unthinned trees (Griffin 2004; Griffin and Mills 2007).

DNRC indicated that given their past management, it is likely that they have many stand types that provide summer foraging habitat or stands in temporary unsuitable condition that will soon provide summer foraging habitat. Additionally, if DNRC clearcuts 1,000 acres annually in productive lynx habitat types, it is likely that after a decade or so, these stands would become summer foraging habitat. Therefore, DNRC estimated that the acres treated annually would likely be replaced by habitat growing into summer foraging habitat across the HCP project area annually (Baty, DNRC, personal communication, November 2011). Overall, adverse effects on lynx from pre-commercial thinning would be limited under the HCP because of the limited number of acres affected, the retention of 20 percent of the affected stand as unthinned habitat in LMAs, and the fact that these harvested acres are likely replaced annually as a result of forest management practices and/or natural processes. We expect the level of adverse effects on lynx from pre-commercial thinning would be low due to DNRC operational constraints and the HCP commitments. Nevertheless, depending upon site-specific conditions (e.g. where snowshoe hare

habitat is lacking or densities are low), pre-commercial thinning could reduce dense young stands that protrude above the snowpack and provide winter habitat for snowshoe hares, or reduce the amount of stands growing into winter snowshoe hare habitat. A reduction in the availability of snowshoe hares in an LMA could mean that a female lynx fails to reproduce or is less successful in finding adequate prey resources needed to ensure maximum survival for kittens. This effect would be limited, as the 1500 acres of trees that potentially thinned would be distributed across both occupied and non-occupied habitat.

Effects of Vegetation Management on Lynx Habitat at the Scattered Parcel Scale

Effects on Suitable Habitat

Timber harvest would reduce the overall amount of suitable lynx habitat in the HCP project area. However, the DNRC HCP would maintain at least 65 percent of total potential habitat on scattered parcels at the land office scale as suitable habitat (LY-HB6), including both lands in occupied lynx habitat and unoccupied lynx habitat.

Because lynx occur at low densities and occupy large home ranges within occupied areas it can be difficult to achieve home-range scale conservation objectives on small parcels of land alone (USFWS 2007:47). The impact of vegetation treatments on a scattered parcel in lynx habitat (70 percent of which average 640 acres or less) would often be relatively low, given the large size of lynx home ranges. Further about 90 percent of occupied lynx habitat on scattered parcels is adjacent to or within federal LAUs of 25,000 to 30,000 acres, which are managed to conserve lynx habitat (Table III-8). For the reasons stated for LMAs, we believe retention of 65 percent suitable habitat on scattered parcels, combined with the availability of suitable habitat on adjacent Federal LAUs, would contribute adequately to providing suitable lynx habitat and to the prey base on scattered parcels in occupied lynx habitat. Therefore, reduction of suitable habitat on scattered parcels is limited and not likely to result in adverse effects on lynx.

Lynx habitat in unoccupied areas is more fragmented, often highly so, and occurs in smaller patches and so does not support the high hare densities across the large landscape needed to support resident lynx or female home ranges. Lynx may occasionally traverse these areas during dispersal movements, or other periods, allowing animals to return to occupied habitat – i.e., areas capable of supporting reproductive lynx. Thus, maintenance of suitable habitat on these lands would provide some varying level of benefit to dispersing lynx or lynx occasionally moving through unoccupied habitat. The anticipated reduction of suitable habitat on unoccupied scattered parcels is not likely to result in adverse effects on lynx.

Effects on Lynx Winter Foraging Habitat

The effect of reduction of winter foraging habitat on a female lynx using scattered parcels in occupied lynx habitat is difficult to determine as it would depend upon site-specific conditions,

including the amount of winter foraging on the scattered parcel and surrounding lands as well as land uses on adjacent lands.

Based on the allocation of the annual sustainable yield, operational constraints, and the occurrence of lynx habitat, DNRC estimated that it would harvest up to 230 acres of winter foraging habitat annually (averaged over a 5-year period) on scattered parcels in occupied habitat and an additional 905 acres annually in unoccupied habitat.

To limit adverse effects on lynx from timber harvest in winter foraging habitat within occupied and unoccupied habitat, HCP commitment (LY-HB4) would retain patches of advanced shade-tolerant trees in commercial harvest units. Several other HCP commitments also help ensure that a proportion of the treated stands remain viable for some level of snowshoe hare productivity. These include commitment LY-HB5 to maintain lynx habitat connectivity and LY-HB6 to retain 65 percent of total potential habitat as lynx suitable habitat on scattered parcels at the DNRC land office scale.

Table III-8. Acres of lynx habitat on scattered parcels in the HCP project area in occupied lynx habitat, in occupied lynx habitat in Federal LAUs, and in unoccupied habitat.

Habitat Class	Acres on Scattered Parcels in the HCP Project Area		
	Occupied Lynx Habitat	Occupied Lynx Habitat in or Adjacent to Federal LAUs	Unoccupied Lynx Habitat
Winter Foraging Habitat[a]	11,584	10,462	40,848
Summer Foraging Habitat[a]	1,699	1,544	8,753
Other Suitable Habitat[a]	4,610	3,454	15,016
Suitable Habitat Subtotal[a,b]	18,430	15,460	88,879
Temporary Non-Suitable Habitat[a]	2,353	1,839	18,354,
Total Potential Lynx Habitat[c]	20,783	17,834	107,232
Non Habitat[d]	26,552	16,025	246,084
Total Acres[e]	47,335	33,859	353,317

[a].Percentages for these habitat classes describe habitat amounts proportional to total potential lynx habitat.
[b].The suitable habitat subtotal is the sum of winter foraging habitat, summer foraging habitat, and other suitable habitat, which are all presumed to currently provide habitat.
[c].Total potential lynx habitat is the sum of suitable habitat and temporary non-suitable habitat acres. This class represents all lands potentially supporting lynx-preferred climax vegetation types over time regardless of their current structural condition.
[d].Percentages for these classes describe amounts proportional to DNRC Total Acres.
[e].Total acres is the sum of total potential lynx habitat and non-habitat.

In many cases, information regarding lynx habitat and lynx habitat condition on lands surrounding scattered parcels is not always available to DNRC. Thus, it is often difficult to ascertain the impacts of DNRC actions on lynx at the scattered parcel scale and the application of

effective, meaningful conservation in these areas is more difficult (see Section D). Thus DNRC would focus on retaining at least 20 percent of total potential lynx habitat in winter foraging habitat conditions in LMAs, where measures are likely to provide the greatest benefit for lynx.

We expect that in many instances, removal of winter foraging habitat from scattered parcels in occupied habitat will not result in adverse effects on lynx for the following reasons: 1) scattered parcels in occupied lynx habitat support about 13 percent (11,600 acres) of the total winter foraging habitat in the HCP project area (see Table III-8), 2) the anticipated 230 acres of annual harvest of winter foraging habitat would be spread across these 11,600 acres of winter foraging habitat on scattered parcels in occupied habitat, 3) the amount of occupied habitat treated would likely represent a small proportion of a lynx home range and would not be enough to measurably reduce snowshoe hare productivity in the home range, and 4) viable lynx habitat would be retained through implementation of the HCP commitments combined with the availability of habitat on adjacent LAUs where standards on federal lands preclude treatments of winter foraging habitat in multi-storied stands.

Nevertheless, we anticipate that the reduction in winter foraging habitat on scattered parcels could on occasion adversely affect female lynx. The most likely scenario where adverse effects of this nature would occur would be if harvest units are large enough to abruptly reduce winter foraging habitat to levels that could impact a female home range. As mentioned earlier, the severity of the impact is dependent on site-specific conditions, including the amount of winter foraging habitat treated and its abundance in the surrounding areas. We do not expect adverse effects on male lynx, as they have larger home ranges and thus more options to find prey, and do require the resources needed for females to successfully reproduce and raise offspring. However, the abrupt reduction in winter snowshoe hare habitat could reduce snowshoe hare numbers, such that at times throughout the Permit term, we anticipate post-harvest adverse effects that cause a female lynx to fail to reproduce or be less successful in securing adequate prey to ensure maximum kitten survival. Because of the scattered parcel size and distribution, we expect these instances would be infrequent, but cannot entirely eliminate the possibility over the 50-year Permit term.

Scattered parcels in unoccupied habitat currently support approximately 40,800 acres of winter foraging habitat (Table III-8). We do not anticipate reduction in winter foraging habitat in unoccupied lynx habitat would result in adverse effects on lynx, because these areas are used only occasionally by dispersing or transient lynx. The HCP would help ensure that a proportion of the treated stands in these areas remain viable for some level of snowshoe hare productivity. Additionally, these lands would continue to provide habitat connectivity for dispersing lynx as described below in Section D.

Effects on Lynx Summer Foraging Habitat

The effects of pre-commercial thinning on scattered parcels on lynx in occupied habitat depends upon site-specific conditions, including the amount of overall foraging habitat available on the scattered parcel and surrounding lands as well as land uses on adjacent lands. As mentioned earlier, because of the difficulty in ascertaining the effects at the scattered parcel scale and applying meaningful conservation in these areas (see Section D), DNRC focuses its conservation efforts for foraging habitat in the HCP project area in LMAs, where measures are likely to provide the greatest benefit for lynx. As discussed above for the LMAs, we expect the potential effects to lynx of pre-commercial thinning in summer foraging habitat on scattered parcels to be limited. Summer foraging habitat for snowshoe hares is not considered a limiting factor to hare production, but older densely stocked stands provide the more important winter habitat for snowshoe hares. With application of the HCP commitments, DNRC typically will not pre-commercially thin more than 1,200 acres of summer foraging habitat in the HCP project area annually, including all LMAs and all scattered parcels in both occupied and unoccupied habitat. Additionally, most pre-commercial thinning actions will occur on blocked lands and only a few hundred acres of scattered parcels are expected to be treated annually (Baty, DNRC, personal communication, September 2010). Further, the impacts on scattered parcels within federal LAUs would be moderated by standards that preclude pre-commercial thinning. Nevertheless, we expect that some pre-commercial thinning actions on scattered parcels in occupied habitat may reduce snowshoe hare densities primarily by reducing the capacity of the thinned stand to eventually produce winter snowshoe hare habitat in the future. Thus, we expect some adverse effects on lynx as a result of thinning on scattered parcels, depending upon the size of the treatment, existing site-specific conditions, and lynx habitat conditions on surrounding lands. In limited instances, these adverse effects may result in reduced productivity of female lynx.

Effects of Vegetation Management on Lynx Habitat Under a Changed Circumstance

As described above in Section A, DNRC frequently conducts salvage harvest in response to a natural disturbance event. Fire-related salvage harvest is not likely to result in adverse effects on lynx because there would be no removal of suitable habitat for lynx. Similarly, salvage harvest from windfall is not likely to result in adverse effects on lynx. Through application of the HCP commitments and development of the contingency plan, we expect that salvage harvest in response to insect or disease outbreaks would result in effects similar to those described above for the effects of vegetation management in LMAs and on scattered parcels.

We acknowledge that large-scale natural disturbances such as a fire or insect/disease outbreak may reduce lynx habitat conditions below levels required in LMAs, i.e., at least 65 percent suitable lynx habitat in LMAs; at least 20 percent winter foraging habitat in LMAs. When this occurs, DNRC will develop a contingency plan associated with any planned salvage harvest. The plan will also describe the silvicultural objectives and efforts planned for regenerating stands converted to a temporary non-suitable condition by the disturbance. The contingency plan will

contain pre-disturbance and post-disturbance lynx habitat maps and an assessment of habitat acres by type for the affected LMA or area. Additional measures to be considered in the contingency plan are identified in Section A. Additionally, DNRC will make every effort to subsequently defer harvest in affected LMAs where the HCP commitments can no longer be attained (i.e., the habitat ratios are not met) (Final EIS/HCP 2010, Appendix B, Document B-14). Additional effects on winter foraging habitat due to green harvest following a changed circumstance would be limited to 2,320 acres over the permit term for all LMAs (Final EIS/HCP 2010, Appendix A, Chapter 7 and Appendix B, Document B-14). When a subsequent green harvest is proposed, DNRC would again develop a contingency plan requiring approval by the USFWS. DNRC would track the amount of winter foraging habitat harvested through changed circumstances when harvest is conducted in an LMA that has fallen below the minimum 20 percent foraging habitat due to fire, blow-down or insect infestation. These acres would be subtracted from the 2,320 acres identified for this purpose following approval by the USFWS.

The effects of a subsequent green harvest on lynx that further reduces winter foraging habitat would vary by the extent of the natural disturbance, the number of years following the event, the location of the event, and amount of and type of lynx habitat remaining on the affected landscape. In many instances, depending upon the extent of the disturbance, the habitat may no longer support lynx until such time that the mosaic of required habitats has returned. The additional acres to be treated following a large-scale fire or outbreak would be distributed across the six LMAs (although DNRC would prioritize deferral of harvest in the Garnet and Seeley LMA) and limited to 2,320 acres for the 50-year Permit term. We expect that in many circumstances, the potential additional adverse effects would be at least partially offset by the development of a contingency plan using the measures identified above in Section A.

However, in other instances any further reduction of winter foraging habitat may have adverse effects on lynx if the affected area retains a mosaic of burned and unburned areas. In this case, less habitat is available to lynx for denning, foraging, and raising young. Depending on the type of habitat affected and the extent it is affected by the natural disturbance, any subsequent green timber harvesting could result in additional reduced recruitment or mortality from starvation. This scenario is more likely to if the event occurs at a time in the permit term when DNRC is nearing its 20 percent limit on retention of winter foraging habitat.

<u>Summary</u>

The effects of reductions in foraging habitat on lynx would vary by year, location, and availability of habitat. Overall, DNRC operational constraints combined with the HCP commitments limit the acres of winter snowshoe hare habitat that can be affected so that the anticipated adverse effects would occur on no more than an annual average of 2,080 acres of winter foraging habitat in occupied habitat, distributed across LMAs and scattered parcels. Pre-commercial thinning may result in a low level of adverse effects in occupied habitat, but is

limited; on average 1,200 acres would be thinned annually, including lands in and outside occupied lynx habitat.

Despite these anticipated reductions in foraging habitat, we expect that the HCP commitments that limit this impact would maintain adequate foraging habitat and conditions for lynx in the action area, especially when considered along with the availability of habitat on adjacent LAUs in the action area.

The HCP commitments focus on the retention of winter foraging habitat in the areas of greatest importance to lynx, the LMAs. The suite of enhanced conservation measures in these areas (see Section D) would retain: 65 percent of total potential habitat as suitable habitat; 20 percent of total potential habitat as winter foraging habitat; 20 percent of thinned stands in an unthinned condition; and limit conversion of habitat by decade. All habitat conditions in LMAs would be monitored and tracked by DNRC. We conclude that this approach will maintain a mosaic of habitat conditions on LMAs that would support resident lynx on the landscape.

In scattered parcels in occupied habitat, we expect DNRC commitments (see Section D) would provide adequate conditions and suitable habitat levels to support lynx in the action area. The commitments would result in scattered parcels that would contribute to providing habitat for lynx and snowshoe hares across the broader landscape. The DNRC commitments and federal land management standards for lynx habitat would ensure that the action area provides the landscape mosaic of habitat conditions needed for snowshoe hare production and lynx foraging (hunting) habitat.

In unoccupied habitat, we expect the HCP commitments to maintain habitat connectivity and limited foraging opportunities suitable for dispersing and transient lynx.

Considering all factors, including the size of lynx home ranges, the amount of DNRC trust lands within occupied lynx habitat, the juxtaposition of DNRC lands and adjacent LAUs, the amount of potential lynx habitat, and the implementation of HCP commitments to minimize and mitigate effects of reductions in foraging habitat, we expect that in limited circumstances individual lynx may be adversely affected by these actions. As described previously, we expect a low number of females to suffer reduced fecundity and reduced kitten survival.

Effects of Vegetation Management on Other Aspects of Lynx Habitat

Other potential effects of vegetation management under the HCP on lynx and lynx habitat include habitat conversions, loss of den sites and attributes that contribute to den sites, as well as impacts on habitat connectivity and linkage.

Effects of Habitat Conversion under the HCP on Lynx Habitat

Forest management activities can result in conversion of cover types such that stands providing favorable snowshoe hare habitat may be converted to stands providing lower quality habitat for snowshoe hares. For example, silvicultural prescriptions might be designed to change species composition to favor western larch, which has a high economic value, at the expense of subalpine fir, which typically has lower economic value but provides better winter habitat for snowshoe hare. .

DNRC's mapping protocol is based on a current understanding of lynx ecology – that seral tree species can contribute to suitable habitat and foraging habitat conditions – while recognizing the importance of subalpine fir, spruce, and grand fir in providing horizontal cover. Therefore, DNRC's habitat mapping protocols require moderate to high tree densities in stands within habitat types preferred by lynx for stands to be classified as suitable lynx habitat. DNRC's habitat mapping protocols also require, among other criteria, the presence of subalpine fir, spruce, and grand fir for stands to be classified as foraging habitat. The Final EIS, Forest Vegetation, acknowledges that, at times, DNRC treats stands to favor seral cover types dominated by shade-intolerant species, sometimes at the expense of shade tolerant species that provide better winter habitat for snowshoe hare. In these managed stands, the quality of lynx habitat may decrease if the silvicultural prescription has the desired outcome (i.e., winter foraging habitat could be converted to suitable habitat that no longer provides snowshoe hare forage, but would be used for lynx movements). On the other hand, some prescriptions could result in positive impacts over time (i.e. non-foraging suitable habitat may be clear-cut, resulting in dense stands of regenerating shade intolerant species such as lodgepole pine, that within 5 to 10 years may begin providing quality snowshoe hare forage).

Under the HCP, habitat conversion (change in cover type) is addressed through several commitments. The amount of habitat that could be converted from one cover type to another over the permit term would be constrained by the HCP commitments LY-LM1 and LY-HB6 and LY-LM3. These commitments require DNRC to retain specified amounts of suitable habitat and foraging habitat and limit the extent of habitat conversion of cover types that provide lower quality lynx habitat in the HCP project area. Also, commitment LY-HB4, which requires the retention of some shade tolerant-tree species in thinning units and forest understories would provide a continual source of seed promoting the presence and successional development of trees that would provide high horizontal cover attributes even within stands with dominant overstory trees in shade-intolerant cover types.

With the application of the HCP commitments, the proposed action is not likely to adversely affect lynx via habitat conversions within the action area. The Final EIS concludes that some changes in cover types may occur for stands at the localized level, but that discernible differences at the landscape scale would not be evident. The HCP commitments limit the

amount of habitat that could be converted and require that certain amounts of important lynx habitat types are retained for the duration of the permit term (i.e., 20 percent winter foraging habitat in LMAs, 20 percent pre-commercial thinning units are unthinned and retention of 65/35 suitable to unsuitable condition).

Effects of HCP Implementation on Den Sites and Denning Habitat

Denning habitat is used for parturition and rearing of young. The common component of denning habitat is large amounts of coarse woody debris (CWD) (Koehler 1990; Staples 1995; Squires et al. 2008) and horizontal cover provided by low growing canopies of subalpine fir and Engelmann spruce trees (Squires et al. 2008). Squires et al. (2008) found that lynx selected den sites with higher horizontal cover and log volumes compared to the forests immediately surrounding dens. This structure is most valuable when it is distributed throughout the home range on or near foraging habitat (USFWS 2007:48). Denning habitat is found in a variety of forest conditions, and suitable den site attributes occur in small pockets scattered across the landscape at relatively high densities; lynx den site availability is not limiting for lynx (USFWS 2007:49; Squires et al. 2008; Squires et al. 2010 in press). Forest management activities including salvage harvesting dead and dying trees and prescribed fire may remove existing coarse woody debris and/or affect its recruitment. Timber harvest may also affect horizontal cover, which is a primarily derived from the presence of multiple canopy layers of shrubs and trees in the forest stand, but accumulations of woody debris also contribute.

The proposed HCP commitment LY-HB2 would require CWD recruitment at the project level in lynx habitat following the guidelines specified in Graham et al. (1994) or other agreed-to reference, for a range of 4 tons per acre up to 25 tons per acre, depending on the vegetation type. Commitment LY-HB2 also requires DNRC to emphasize the retention of downed logs greater than 15-inch dbh, where they occur. Commercial green tree logging and salvage logging operations would be required to provide for minimum snag, snag recruit, and CWD recruitment levels. Monitoring would require documentation of compliance with retention measures and reporting of results in the 5-year monitoring report. Under the HCP, commitment LY-HB2 item 3 would also require DNRC to leave 1 percent of blowdown salvage units in an un-salvaged condition. This would further contribute to CWD retention on the landscape since blowdown salvage sites are typically fewer than 100 acres and are encompassed in stands where CWD and snag recruitment commitments are applied. DNRC is currently monitoring the presence of potential den site features (e.g., large downed logs, large root wads, or piled log debris) to substantiate that the CWD and snag retention and recruitment ARMs are leaving adequate material suitable for lynx den sites. Based on preliminary findings, these practices result in conditions that provide adequate den sites for lynx on DNRC timber harvest units (Baty, DNRC, personal communication, July 2010). In most of the sites surveyed to date, den site features occur at a frequency of greater than 1 site per acre on forested and logged sites (Baty, DNRC,

personal communication, July 2010). Given that lynx den sites are not believed to be a limiting factor in Montana (USFWS 2007; Squires et al. 2008; Squires, USFS, personal communication; December 2009;Squires et al. 2010 in press), that at a minimum, den sites features appear to be present on DNRC lands at densities of several hundred per square mile, and that the provisions of the ARMs and DNRC HCP would continue to be incorporated into timber projects to provide addition den site features over time, we anticipate that adequate den sites for lynx would be available on the DNRC landscape throughout the permit term and no adverse effects are anticipated.

Prescribed burning under the proposed HCP may affect a minimal amount of CWD but is not expected to appreciably reduce den sites for lynx. This is because DNRC rarely uses prescribed fire as a management tool due to liability issues (Final EIS/HCP 2010, Appendix A, Chapter 1, Section 1.4.4.2, pages I-19 and I-20). Between 1996 and 2005 statewide, DNRC burned an average 285 acres annually and in 2006 statewide; DNRC burned 417 acres using broadcast burning. These acreages included habitat types preferred by lynx and those not preferred by lynx. At this continued level of treatment and considering snags and live recruitment trees are retained in burned units, which will eventually fall over, potential effects on coarse woody debris abundance and recruitment and thereby lynx would be discountable.

The other common component of denning habitat is horizontal cover. We do not expect that vegetation management under the proposed HCP would result in a lack of horizontal cover within LMAs. The DNRC HCP would retain 20 percent of total potential lynx habitat in an LMA as winter foraging habitat (LY-LM3). Winter foraging habitat is characterized as well-stocked forest stands with an abundance of large, mature trees in habitat important for lynx (Final EIS/HCP, Appendix B, Document B-3, DNRC Lynx Habitat Mapping Protocols). Additionally, within LMAs, the DNRC HCP would retain 20 percent of pre-commercial thinning units in an unthinned condition (LY-LM3). Commitments LY-LM1, LY-LM2, and LY-HB6 would indirectly promote development and retention of the structure needed for denning habitat distributed across the landscape through vegetation management that promotes a mosaic of stand types across the landscape. These measures would ensure that adequate horizontal cover for lynx denning would be available in LMAs in the HCP project area.

In most cases, denning habitat is not known to be limited within lynx habitat in the northern Rocky Mountains (USFWS 2007; Squires et al. 2008; Squires et al. 2010 in press), and the Forest Management ARMs (for snags and snag recruits) and HCP lynx commitments either directly or indirectly promote the development and retention of adequate amounts of attributes important for lynx denning (den site features and horizontal cover). Thus, the HCP commitments and Forest Management ARMs (snags and snag recruits) would contribute to the maintenance of adequate den site features and horizontal cover within lynx habitat in the HCP

project area, and impacts of the HCP on lynx related to lynx den site features and denning would be insignificant.

Effects of the DNRC HCP on Linkage and Habitat Connectivity

Habitat connectivity is an important consideration of lynx habitat (McKelvey et al. 2000a; Schwartz et al. 2002; Ruggiero et al. 2000b). Maintaining connectivity with lynx populations in Canada and between mountain ranges is important for lynx in western Montana and for populations farther south in the Rocky Mountains (Ruediger et al. 2000b).

Lynx use a variety of habitats for dispersal and are known to travel great distances to use suitable habitat patches (Ruggiero et al. 2000b). When dispersing, lynx have been documented to cross large, early-successional stage stands or very large openings, which would otherwise be considered unsuitable if located within breeding territories (Ruggiero et al. 2000b). Impediments to lynx dispersal include highways and areas of human settlement, (Apps 2000; USFWS 2005). No high-traffic road systems or highways are proposed under the HCP; thus, the effects of highways on habitat linkage and habitat connectivity for lynx will not be addressed further.

For the purposes of this analysis, the term "linkage" is used to refer to movements across highways or between populations or geographic areas (i.e. dispersal), and within defined linkage areas (USFS 2007b; USFWS 1995; Servheen et al. 2001). "Connectivity" refers to lynx movements within and between home ranges and is considered adequate where cover is abundant and forest openings are limited. Forest management activities may alter cover in uplands and riparian zones, which in limited instances, may reduce the effectiveness of habitat connectivity. This analysis examines the effects of the DNRC forest management on cover, disturbance, and forest openings as a measure of connectivity within identified linkage areas and within lynx habitat in general.

Effects on Linkages for Lynx

DNRC's ability to influence linkage zones in the action area is limited by the amount of land in the HCP project area and the distribution of those lands in western Montana, with the exception of the Stillwater State Forest and Swan River State Forest, where DNRC owns large expanses of lands and exerts extensive control over the activities on those lands. The Stillwater State Forest and the Swan River State Forest have high value for linkage and linkage zones have been formally identified within these areas (Servheen et al. 2003; USFWS 1995). While the HCP prescribes no specific commitments for maintaining the integrity of these linkages on DNRC lands, existing practices and commitments implemented through the HCP are expected to support effective linkage habitat in these areas. These practices and commitments are described below.

Currently, under ARM 36.11.415, all DNRC forest management projects consider forest patch size, shape, connectivity, and habitat fragmentation at the project level. This rule directs DNRC

to consider the effects of fragmentation and connectivity at the project level in designing projects and to emulate natural spatial patterns of patch size and shape to the extent practicable. This rule would continue to be implemented under the HCP. Also, under the HCP, commitment LY-HB5 requires all DNRC harvest units in lynx habitat to maintain a connected network of suitable lynx habitat along riparian management zones (RMZs), wetland management zones (WMZs), ridge tops, and saddles – high terrain areas where lynx seem to prefer to move (Koehler 1990; Staples 1995). Lynx habitat "connectivity" is defined in the HCP as stand conditions where sapling, pole, or sawtimber stands possess at least 40 percent crown canopy closure, in a patch greater than 300 feet wide. Such measures would provide adequate hiding cover and security to encourage lynx use and movement through such habitat, facilitating long-range or dispersal movements.

Additional measures that would be implemented within the Stillwater and Swan State Forests thereby sustaining mapped linkages in these areas include the following lynx, grizzly bear, and aquatic species commitments:

- (LY-LM1) requiring threshold levels of suitable habitat to be maintained in LMAs
- (LY-LM2) restricting the percentage of habitat within LMAs that could be converted to a non-suitable condition each decade
- (GB-PR6) requiring visual screening in RMZs and WMZs across the HCP project area
- (GB-NR4) restricting harvest unit size to ensure cover is available within 600 feet from any point within a clearing
- (GB-RZ2) requiring vegetative screening between open roads and clearcut or seed tree harvest units in grizzly bear recovery zones
- (AQ-RM1) requiring a 50-foot no harvest buffer within riparian management zones (RMZ) of class 1 streams, and additional cover retention required within the remainder of the RMZ beyond 50 feet.

In summary, the HCP commitments applied on blocked lands are expected to maintain the integrity of identified linkage zones in these areas, which encompass the Stillwater East, Stillwater West, and Swan LMAs. Therefore, implementation of the HCP is not likely to result in adverse effects on lynx related to impacts on linkage areas in the action area.

<u>Effects on Habitat Connectivity within Lynx Habitat</u>

The existing practices and HCP commitments described above for linkage (ARM 36.11.415, LY-HB5, LY-LM1, LY-LM2, GB-PR6, and AQ-RM1) would also maintain sufficient habitat connectivity for lynx to successfully move within their home ranges in all LMAs. Implementation of ARM 36.11.415 and commitments LY-HB5, GB-PR6, and AQ-RM1 would improve habitat connectivity on scattered parcels outside of LMAs as well. These measures on scattered parcels would facilitate lynx dispersal. Benefits of habitat retention could be realized for lynx when scattered parcels occur within lynx home ranges, or when lynx roam outside their

normal home range in search of food or when dispersing. DNRC expects that there will be situations where maintaining habitat connectivity and leaving travel corridors along ridge tops and saddles are not practicable (Final EIS/HCP 2010, Appendix A, Chapter 2, page 2-51). Examples of this would be on non-forested ridges; on non-forested saddles; on harvest units where cable systems are required; where habitat associated with scattered parcels is isolated by management on surrounding ownerships; where lynx habitat polygons are isolated within a parcel; where forest types not preferred by lynx bisect lynx habitat; or where silvicultural, fiduciary, or access objectives cannot be met (e.g., presence of lodgepole pine stands requiring stand-replacement harvest, locations with high potential for blowdown, sites with limited access).

We conclude that these instances of impracticability are not likely to result in adverse effects on lynx. Lynx use a wide variety of habitats for movements (Ruggiero et al. 2000b). While they may avoid moving directly through large openings within their home ranges, lynx typically use the forest edge to move around openings and for hunting. Therefore, DNRC's inability to maintain obvious connectivity in a given harvest unit is not expected to preclude lynx from moving within and between home ranges or making other dispersal movements. Given the other commitments in the HCP to provide cover for the HCP species including: providing a 50-foot no-harvest buffer and additional cover along class 1 streams (AQ-RM1), requiring vegetative screening between open roads and clearcut or seed tree harvest units in grizzly bear recovery zones (GB-RZ2), restricting harvest unit size in grizzly bear non-recovery occupied habitat and recovery zones to ensure cover is available within 600 feet from any point within a clearing (GB-NR4); and retaining 65 percent of total potential lynx habitat as suitable habitat within LMAs and on scattered parcels at the administrative unit level, adequate connectivity would be provided for lynx to move within and between home ranges and to disperse. These measures would benefit lynx both in occupied habitat and in unoccupied habitat where lynx may occur during dispersal movements.

For the reasons described in the paragraph above, the proposed action is not likely to result in adverse effects on lynx as a result of impacts on habitat connectivity.

Effects of HCP Implementation on Den Site Disturbance

Most investigations indicate that lynx do not alter their behavior to avoid human activities (Staples 1995; Roe et al. 1999; Aubry et al. 2000; Mowat et al. 2000). The exception may be activities that may cause abandonment of a den site, possibly affecting kitten survival (Ruggiero et al. 2000b). However, lynx do not readily abandon kittens. Further, females are able to move kittens, and typically move to several den sites over a denning period even without the occurrence of human disturbance (USFWS 2007:51).

In general, forest management activities are not expected to result in adverse effects on denning lynx because of the low likelihood of overlap between a harvest unit and an active lynx den site. Further, the denning period is likely to be completed (mid-July) in the Stillwater Block LMAs before conditions are highly suitable to initiate motorized forest management activities at upper elevations (due the presence of snow). In the Swan, Seeley, and Garnet LMAs conditions may be suitable to initiate motorized forest management activities at upper elevations by June 15. However, by this time stage of raising young, lynx are expected to readily move their kittens. If an active den is identified, under the HCP, commitment LY-HB3 would prohibit motorized forest management and prescribed burning within 0.25 mile of an active den site from May 1 through July 15. Given these factors combined with implementation of commitment LY-HB3, potential effects on den site disturbance, if any, as a result of DNRC's activities under the HCP, would be insignificant. Snowmobile use associated with forest management activities is unlikely to affect den sites because den sites are likely to be located in heavily forested areas that support fewer roads and snowmobile trails. In addition, snowmobile use occurs primarily during the winter and is mostly ended prior to the initiation of lynx denning (in early May) and is ended by April 1 in the Stillwater Block and Swan LMAs through grizzly bear commitments GB-RZ5 and GB-NR3. Thus, disturbance resulting from snowmobile use associated with forest management activities on denning lynx is expected to be discountable.

Effects of Forest Roads on HCP Lands on Lynx

Lynx are known to have been killed by vehicle-collisions in Colorado (reintroduced lynx population; paved, high-speed highways), in Minnesota (paved, high-speed highways) and in Maine (high-speed, relatively straight gravel roads on flatter terrain). However, the known occurrences of such collisions are rare. There is no evidence that forest roads negatively affect resident lynx populations (March 24, 2000; 65 FR 16052). Lynx mortality from vehicle strikes to date have not been documented on DNRC lands or adjacent National Forest lands in the action area and lynx mortality from vehicle strikes are unlikely given the relatively slow speeds at which vehicles on these roads travel (due to topography and road conditions) and generally low traffic volumes.

Unlike paved highways, Forest roads rarely receive motorized use at levels that create barriers or impediments to lynx movements. Lynx have been documented using less-traveled roadbeds for travel and foraging (Parker 1981; Koehler and Brittell 1990). Recreational, administrative, and commercial uses of forest roads are known to disturb many species of wildlife. However, most information suggests that lynx do not avoid roads, except at high traffic volumes (Apps 2000). In a Washington study, lynx showed no preference or avoidance of unpaved forest roads, and road density (ranging from 0 to 3,400 meters/square kilometer or 0 to 3.4 miles/square mile) did not appear to affect lynx habitat selection (McKelvey et al. 2000c). More recently, in Montana, (Squires et al. 2010 in press) found no evidence that lynx were sensitive to forest roads. Most

investigations indicate that lynx do not alter their behavior to avoid human activities, including roads (Staples 1995; Roe et al. 1999; Aubry et al. 2000; Mowat et al. 2000; Squires et al. 2008). Human access via DNRC roads can increase the potential for mortality or injury of lynx captured incidentally in traps set for other species or through illegal shooting. However, lynx harvest seasons in Montana closed due to listing in 2000 due to their Federal listing under the Act. Some trapping incidental to other fur bearer seasons occurs (Giddings MFWP, personal communication, September 2010). Road densities may contribute to this factor. Road density varies across the DNRC land depending upon resource needs (for forest management, gravel, recreation, or wildlife or fisheries conservation), topography (the ability of the landscape to support roads without excessive resource damage), and adjacent land ownerships (and agreements with those land owners for shared access).

The DNRC HCP includes numerous commitments to minimize roads and minimize the effects of roads on aquatic species and grizzly bears. Those that would potentially benefit lynx include commitments that require DNRC to: (1) adhere to a transportation plan for its blocked ownership (commitments GB-SW1 and GB-ST1); (2) minimize road miles (commitment AQ-SD2); and (3) restrict public and DNRC motorized access on roads in important habitat areas and seasons (commitments GB-SW1 and GB-ST2, GB-ST4, GB-SC1 and GB-CY4).

In the final listing rule (March 24, 2000; 65 FR 16052), coyote use of packed snowtrails in winter habitats of lynx was identified as a concern as a potential lynx competitor. Bunnell et al. (2006) concluded that coyotes used snowmobile trails to exploit habitat within the historic range of Canada lynx in Idaho, Utah, and Wyoming. However, the study did not determine whether coyote use of lynx habitat was affecting lynx. Whiteman (2008) noted that after an area was compacted by winter sports, (snowmobiles, snowshoes, or cross-country skis) coyotes favored these trails and followed them for greater distances. In Montana, Kolbe et al. (2007) found that coyotes used snowmobile trails, but it did not considerably affect coyote movements, nor did the trails increase competition with lynx for snowshoe hares. Kolbe et al. (2007) noted that coyotes in their study area were primarily scavengers, possibly because of ungulate carrion availability and low density of snowshoe hares. Thus research provides no conclusive evidence that snow compacted routes adversely affect lynx or their habitats. As described in Part I.C of this BO, snowmobile use on DNRC lands is mostly limited to existing roads and typically does not involve extensive use of snowmobiles within forested timber stands. Further, virtually no use of snowmobiles can occur in lynx habitat where stands exhibit high horizontal cover and contain coarse woody debris, because those habitat components are incompatible with snowmobile use. Given that there is little evidence that snow compaction from snowmobiles adversely affect lynx in Montana and DNRCs limited use of snowmobiles in lynx habitat in winter, the proposed HCP includes no commitments to address snow compaction from snowmobile use for forest management activities. Snowmobile use in lynx habitat is not expected to have a measurable effect on lynx. The HCP commitments to minimize roads and minimize the effects of roads on

aquatic species and grizzly bears would reduce potential indirect effects of forest roads on lynx, such that the effects would be insignificant or discountable.

Effects of Grazing Under the HCP on Lynx

Snowshoe hare densities and overwinter survival appear to be positively correlated with understory density (Adams 1959, Wolff 1980, Litvaitis et al. 1985). Livestock may compete with snowshoe hares for forage resources (Ruediger et al. 2000). Browsing or grazing also could impact plant communities that connect patches of lynx habitat within a home range. Conversely, appropriate grazing management can rejuvenate and increase forage and browse in key habitats such as riparian areas. We found no evidence that grazing was a factor threatening lynx, therefore, grazing was not addressed in the final listing rule (March 24, 2000; 65 FR 16052). There is no existing research that provides evidence of lynx being adversely affected by grazing within the action area or elsewhere, or of lynx movements within home ranges being impeded by grazing practices.

DNRC administers approximately 165,000 acres of grazing licenses in the HCP project area (Final EIS Table 4.8-5). Approximately 5,500 acres of grazing licenses occur on potential lynx habitat in the Seeley, Garnet, Coal, and Stillwater LMAs, comprising less than 1 percent of the total potential lynx habitat in the Coal and Stillwater LMAs but 40 percent of the total potential lynx habitat in the Seeley and Garnet LMAs (Table I-22 in Part I of this BO). Given that lynx use a wide variety of habitats for dispersal movements that might otherwise be considered unsuitable (Ruggiero et al. 2000b), it is unlikely that grazing would impede lynx movements for dispersal or breeding. However, heavy grazing could affect the ability of winter foraging habitat to support snowshoe hares thereby potentially reducing densities of this important prey for lynx. Cattle typically graze on grasses, forbs and deciduous leaves, as opposed to the coniferous needles and live stems preferred by snowshoe hares in the winter. Summer forage is not limiting to snowshoe hares, and so we expect no adverse impacts to summer foraging. Grazing could result cattle trampling young trees, shrubs or seedlings, which potentially could affect winter forage for hares.

The DNRC HCP does not include measures specific to lynx to avoid or minimize effects of grazing on lynx. The proposed HCP would reduce the potential for grazing on classified forest trust lands to adversely affect lynx through implementation of the HCP's aquatic strategy commitment AQ-GR1, which directs DNRC's inspection and renewal requirements for grazing licenses on forested trust lands, and through enhanced inspection, correction, and follow-up monitoring of the measures. Also, mapped habitat must meet certain criteria to be considered winter habitat and these evaluations would occur through lynx habitat monitoring as well as grazing license renewals. If mapped habitat did not meet the criteria as winter foraging habitat, it would not be counted toward the required amount in the LMA or DNRC would address concerns through licenses renewal and corrective actions. Cattle are not likely to spend appreciable time

in stands classified as winter foraging habitat due to its poor inherent forage quality, high amounts of coarse woody debris, and relatively high amounts of spruce-fir horizontal cover. We expect most grazing occurs in inclusions of riparian areas, grassy uplands, and harvest units. Additionally, there is no existing research that provides evidence of lynx being adversely affected by grazing within the action area or of lynx movements within home ranges being impeded by grazing practices. Lastly, commitment GB- RZ4, which restricts small livestock grazing activities in grizzly bear recovery zones, would further minimize the potential for grazing activities to affect lynx or lynx habitat within the Stillwater, Coal Creek, and Swan LMAs which all fall within the NCDE grizzly bear recovery zone, because these LMAs account for 94 percent of total potential habitat in all LMAs combined. Therefore, with the grizzly bear commitment and the enhanced inspection of grazing licenses under the aquatic conservation strategy, and requirement for maintaining lynx habitat maps, the proposed action is not likely to adversely affect lynx as a result of grazing licenses within these LMAs. Effects of HCP Implementation on Land Disposal and Acquisition

The HCP includes conservation measures within the Transition Lands Strategy (DNRC HCP, Chapter 3) for the addition and removal of lands from the HCP project area. These measures are described in Part I.3.d. The effects of this strategy on lynx are described below.

Effects of Removal of Lands

The HCP allows DNRC to remove lands from the HCP project area and these lands may be subject to subsequent development or management that no longer provides habitat for lynx or snowshoe hares. However, effects associated with development on any HCP project area property sold, are not actions authorized or regulated by DNRC, nor would they be considered covered activities under this HCP. Similarly, should DNRC decide to develop and lease an HCP project area parcel, such DNRC actions would not be “covered activities” under this HCP. Upon transfer of deeds and ownership, the subsequent landowner would be required to comply with all state and federal laws during development of their property.

Removal of lands from the HCP could however affect the ability of the HCP to meet the biological goals and objectives established for lynx. These potential effects are analyzed below.

<u>Effects of Removal of Lands within LMAs</u>
Removal of lands from the provisions of the HCP within LMAs may have adverse effect on lynx because these lands support known populations of lynx or are high-priority areas to promote lynx conservation in the future. However, we anticipate the potential and magnitude of this effect to be extremely low for several reasons.

First, LMAs would be subject to the more restrictive cap on removing lands (5 percent of the baseline HCP project area, meaning no more than 10,880 acres total could be removed from LMAs, grizzly recovery zone, or bull trout core areas). Second, DNRC is less likely to sell its

lands within its blocked ownership (represented in 4 of the 6 LMAs) because these areas facilitate efficient management and increase opportunities for meaningful and effective landscape–scale conservation of wildlife habitat. Third, in determining the HCP project area, DNRC identified lands likely to be targeted for disposal and excluded those parcels from the HCP project area.

Fourth, through the process of removing lands from the HCP, DNRC is required to notify conservation buyers of proposed sales to provide opportunities for outright sale to a conservation entity or easement purchase. The USFWS also has the opportunity to request the attachment of deed restrictions to a proposed sale, although DNRC's decision to include deed restriction is discretionary.

Fifth, lands identified for potential disposal undergo considerable evaluation and analysis as outlined in the Real Estate Management Rules and MEPA process, as described in the Final EIS/HCP 2010 (Section 4.9.5 Effects of the Transition Lands Strategy, 4.9.5.1 Affected Environment, page 4-381). Through the disposal process and in accordance with ARM 36.25.803, DNRC may sell a parcel of trust land that is determined significant to threatened or endangered species only if the Land Board provides or approves compelling reasons for the sale. These layers of review and consideration (Real Estate Rules, MEPA process, and Land Board approval) decrease the likelihood that lynx habitat or important linkages would be disposed, or that those lands that are disposed would be subject to major developments with substantial adverse effects on Federally-listed species. If disposals did occur on blocked lands, these disposals may result in some adverse effects on individual lynx through the removal or reduction of lynx foraging habitat (i.e. habitat for snowshoe hares) but in most instances are unlikely to be a great enough number of acres or located in sensitive enough habitat to affect the overall habitat integrity of affected LMAs. Disposal and ensuing development of blocked lands in a mapped linkage area (Servheen et al. 2003; USFWS 1995) is unlikely to impede lynx dispersal. As noted earlier (Status of the Species), lynx are able to move great distances through or around inhospitable habitat, especially during dispersals.

The Garnet and Seeley LMAs are comprised of DNRC scattered parcels interspersed in a mosaic of Plum Creek, USFS, or BLM lands, and private ownership. While scattered parcels are typically more likely to be targeted for disposal, we do not anticipate any disposal of lands in the Garnet LMA to private development given the mosaic of land ownership and challenging topography. Within the Seeley LMA, we do not anticipate any disposal to private development because DNRC has already excluded developable parcels from the HCP. Therefore, no adverse effects on lynx from disposal of parcels from the HCP in the Garnet and Seeley LMA are anticipated.

Effects of Removal of Scattered Parcels Outside of LMAs

While scattered parcels with lynx habitat could also be removed from the provisions of the HCP, we expect that removal of scattered parcels from the HCP would have a low likelihood of resulting in adverse effects on lynx. This is because these lands would be subject to a 10 to 15 percent cap of the baseline HCP project area or 33,090 to 49,640 acres, respectively, that could be removed from the HCP project area over the permit term (anticipated to be 50 years). DNRC would be limited to removal of 33,090 acres (the 10 percent cap) until it adds 15,000 additional acres to the HCP, which is likely to partially offset the loss of habitat from prior disposals. Upon the addition of 15,000 acres to the HCP project area, DNRC could increase the removal of acres from the HCP project area to 49,640 acres (15 percent cap). The cap on the removal of lands, coupled with the provisions of the Real Estate Management Rules and the MEPA process, and measures contained in the Transition Lands Strategy make it unlikely that parcels with high threatened species value (those parcels that are occupied i.e., in critical habitat) would be disposed to a non-conservation buyer. The vast majority of scattered parcels support unoccupied lynx habitat where lynx use is incidental. Disposal of these lands would not result in adverse effects on lynx. We expect that the likelihood that a scattered parcel in occupied habitat would be disposed or that is disposed would result in adverse effects on lynx is so low as to be discountable.

Effects of Adding Lands

When the state acquires forested trust lands with habitat for HCP species, DNRC will consider adding the parcels to the HCP project area. For newly acquired parcels that would have otherwise been subjected to development (possibly resulting in the permanent loss of habitat) if they had not become trust lands, their addition to the HCP would benefit lynx. The impacts on lynx and lynx habitat under the HCP would be limited to the mitigated and mostly temporary effects associated with forest management activities, and not associated with development that would permanently remove lynx habitat. Most lands likely to be acquired and considered for addition to the HCP project area are former private timberlands with few provisions for the conservation of lynx. Adding lands to the HCP project area would provide more assurances and conservation for the species than present under existing baseline conditions. Potential benefits include increased acres managed as suitable habitat for lynx, increased acres managed as foraging habitat for lynx (particularly if these acres fall within mapped LMAs), increased den site protection, and increased connectivity and integrity of linkage areas. Even if the added lands are not potential lynx habitat, they could still facilitate habitat connectivity and linkage for lynx within the action area. Lands acquired from the USFS and added to the HCP would potentially experience a minor decrease in conservation because actions that reduce snowshoe hare habitat on USFS lands are avoided or minimized through the NRLMD to a greater degree than they would be under the HCP.

At this time, near-term acquisitions under consideration for addition to the HCP project area include four transactions comprising approximately 63,300 acres. If all these acquisitions were added to the HCP, it would increase the proposed project area by 12 percent. Lands that will be considered for addition to the HCP project area in the near term include the Lolo land exchange, the Chamberlain Creek acquisition, the Potomac acquisition, scattered parcels in the SWLO, and the North Swan acquisition. These acquisitions are described in Part II of this BO. Availability of lynx habitat on these lands is summarized below.

Lolo Land Exchange

These lands support a minimal amount of total potential lynx habitat and suitable lynx habitat on scattered parcels in the SWLO. Management of listed species on National Forest System lands typically emphasizes contributing to species recovery; therefore, the requirements for retention of lynx habitat on federal lands are more restrictive than under the DNRC HCP. Ultimately, these parcels would contribute to the retention of suitable habitat on scattered parcels at the land office scale and would support lynx home ranges centered on adjacent federal lands providing habitat for lynx. Over time, if these lands are occupied lynx habitat and are subject to timber harvest activities under the HCP, adverse effects on lynx could occur as described in Section D.

Chamberlain Creek Acquisition

DNRC is currently conducting inventories of the forest stands and will determine the presence of potential lynx habitat and suitable habitat in the near future. It is likely that some potential lynx habitat is available. Given that these lands were formerly managed by private timber landowners with few requirements for the protection of lynx habitat, at the present time, there may be limited suitable habitat for lynx. DNRC management of these lands under the HCP would ultimately increase the amount of suitable habitat on scattered parcels at the land office scale even if the lands are not immediately in a suitable habitat condition. Over time, if these lands are subject to timber harvest activities under the HCP, adverse effects on lynx could occur as described in Section D.

Potomac Acquisition

Habitat for lynx is present on these lands, although the total acreage of potential habitat and suitable habitat has not been determined. Two parcels, totaling approximately 400 acres, are located within the Garnet LMA and, if added to the HCP project area, would increase lynx habitat managed by DNRC in this LMA by 30 acres. Over time, if this acquisition is added to the HCP project area and subject to timber harvest activities under the HCP, adverse effects on lynx could occur as described in Section D.

Scattered Parcels in the SWLO

DNRC is still in the process of acquiring data associated with these parcels and does not yet know the presence of potential lynx habitat, road conditions, or forest stand attributes. Once data associated with the parcels are acquired, DNRC will evaluate these parcels for potential addition

to the HCP project area. It is likely that these scattered parcels contain some amount of total potential lynx habitat and suitable habitat and would contribute to retention of suitable habitat on scattered parcels at the land office scale. Over time, if these lands are subject to timber harvest activities under the HCP, adverse effects on lynx could occur as described in Section D.

North Swan Acquisition

Habitat for lynx is present, although the total acreage of potential habitat and suitable habitat has not been determined. If added to the HCP project area, these lands would be managed within the Swan LMA. Over time, if these lands are subject to timber harvest activities under the HCP, adverse effects on lynx could occur as described in Section D.

Summary of Effects of Land Disposal and Acquisition

Overall, removal of lands from the DNRC HCP (within LMAs or scattered parcels outside LMAs) may allow some adverse effects on individual lynx in some specific cases, potentially impacting an individual lynx's ability to breed, feed and/or shelter. Avoidance of such impacts would be the responsibility of the new landowner.

Overall, adding lands to the DNRC HCP is expected to result in beneficial effects for lynx. These benefits would arise from the application of the HCP commitments and the caps and processes in the HCP transitions lands strategy that would be applied to these lands. These are commitments not likely to be implemented on lands acquired from private industrial ownerships.

Adding lands to LMAs would increase the amount of land maintained as suitable and foraging habitat for lynx in these areas of known lynx occurrence. Nevertheless, over time, as these lands are subject to vegetation management activities, some localized adverse effects on individual lynx attributed to loss of foraging habitat may occur. Potential adverse effects on lynx from removal of foraging habitat would be limited as described above in Section E. That is, we expect annual removal of winter foraging habitat would remain at approximately 1 percent of total potential lynx habitat on DNRC lands in the HCP project area, although the total acres treated annually may increase.

Managing lynx habitat on scattered parcels would provide dispersal habitat for lynx and potentially support lynx movements and habitat needs for lynx occurring on adjacent federal lands.

Effects of the Proposed Action in Relationship to Recovery

Section 10 of the ESA does not establish a recovery standard for HCPs (HCP Handbook, page 3-20, USFWS and NMFS 1996); however, one of the issuance criteria that must be met in the Section 10 process is that the incidental take will not appreciably reduce the likelihood or survival and recovery of the species in the wild.

The action area lies within portions of the following areas identified in the recovery outline for lynx (USFWS 2005): the Northwestern Montana/Northeastern Idaho core area; the Greater Yellowstone core area; and the southwestern Montana secondary area. In 2005, we noted that only the core areas currently have a clear role in recovery (lynx recovery outline); the secondary and peripheral areas may be important for periodic population expansion and connectivity. More recently the designation of lynx critical habitat refined the areas we consider not only as having persistent records of lynx, but also identified those areas that have the quality and amount of lynx habitat needed to sustain lynx populations. Thus lynx critical habitat in Montana is those areas occupied or likely to be occupied over time, by resident and reproducing lynx. That is, the critical habitat delineation more precisely identified where resident lynx and lynx populations are likely to live. Thus, although core area continues to be useful as a preliminary planning tool, we consider core area in the action area that is outside of critical habitat and/or in secondary areas to be unoccupied by resident, reproducing lynx.

DNRC proposes to manage forested trust lands in accordance with an HCP for lands contained in the HCP project area and to manage all other forested trust lands supporting lynx habitat in accordance with the Forest Management ARMs. The HCP would require enhanced measures in LMAs where reproducing lynx are known to occur and where DNRC has both the potential to exert adverse effects while at the same time apply conservation at a meaningful scale. The HCP would also require conservation measures in unoccupied lynx habitat that may occasionally support lynx dispersal.

The recovery outline is clear in its emphasis on the need to manage lynx habitat within occupied habitat (critical habitat) to support recovery of lynx in the DPS, as is the critical habitat rule. Focusing lynx conservation efforts on occupied habitat will ensure the continued persistence of lynx in the contiguous United States. The previous sections analyzed how the proposed action would conserve lynx and lynx habitat within occupied habitat as well as within unoccupied habitat.

Below, we analyze the extent to which the proposed action addresses the recovery objectives applicable to this action. The recovery outline identifies four recovery objectives; we will use excerpts nearly verbatim:

Objective 1: Retain adequate habitat of sufficient quality to support the long-term persistence of lynx populations within each of the identified core areas.

Specifically, the objective seeks the establishment of management commitments in core areas that will provide for adequate quality and quantity of habitat such that there is a reasonable expectation that persistent lynx populations can be supported in each of the core areas for at least the next 100 years. The following actions were deemed applicable to the DNRC HCP:

- Action 1.2 - develop and implement best management practices and long-term management agreements for lynx with key State, private and/or Tribal forest managers.

- Action 2 - Maintain base inventories of lynx habitat in each core area, monitoring changes in structure and the distribution of habitat components.

To summarize, we conclude that the proposed action fulfills the actions required of non-Federal lands in core areas. The proposed action would implement conservation commitments (best management practices) for a 50-year permit term on state forested trust lands, ultimately supporting the long-term persistence of lynx populations within the Northwestern Montana/Northeastern Idaho core area.

In support of Objective 1, the proposed HCP includes the following measures:

1. The proposed action would establish and maintain a lynx habitat map following habitat definitions, protocols, and modeling procedures developed in support of the DNRC HCP (**LY-HB1).**
2. The proposed action includes vegetation management commitments that support this recovery objective and reduce potential for adverse effects, as described above (**LY-HB2**, **LY-HB4**, **and LY-HB5**).
3. The proposed action would maintain a mosaic of early to late forest successional stages necessary to support snowshoe hare and lynx. No more than 35 percent of lynx habitat within an LMA would be non-forested stands or those in a poorly stocked condition, and no more than 15 percent of lynx habitat in any LMA could be changed (harvested) to this stage per decade (**LY-LM1 and LY-LM2**). Additionally, no more than 35 percent of lynx habitat within a land office would be allowed to be in a non-forested or poorly stocked condition (**LY-HB6**).
4. The proposed action would ensure that 20 percent of an LMA is comprised of snowshoe hare winter forage habitat in mature multistoried stands (**LY-LM1[1]**) and that 20 percent of all pre-commercially thinned stands in in lynx habitat within LMAs are retained in an unthinned condition (**LY-LM2[2]**).

The HCP would allow actions that could adversely affect lynx habitat, such as reductions in foraging habitat, which could affect individual lynx. However, given the estimates of projected impacts described above, the acreage of DNRC lands, and existing habitat conditions throughout the core area, we believe it is reasonable to expect that DNRC lands along with USFS lands would sustain lynx in western Montana.

Objective 2: Ensure that sufficient habitat is available to accommodate the long-term persistence of immigration and emigration between each core area and adjacent populations in Canada or secondary areas in the United States.

Specifically, the objective seeks to identify habitat facilitating movement between each core area and lynx populations in Canada. On non-Federal lands the following specific action (Action 4.1) is identified:

- develop and implement long-term management commitments with key Canadian and United States Federal, State, Tribal, and private forest landowners to conserve these habitats.

To summarize, we conclude that the proposed action contributes to this recovery objective in part. Connectivity between the core areas Northern Rockies and Greater Yellowstone is likely important to sustaining lynx at the periphery of its range in the contiguous United States. Connectivity between the United States and Canada appears intact thus far, as the Northwestern Montana/Northeastern Idaho core area is directly adjacent to Canada, and includes Glacier Park along its northeastern edge. The DNRC HCP project area has just 1,760 acres of scattered parcels in the Greater Yellowstone core area. For all scattered parcels supporting lynx habitat, the lynx habitat commitments would apply. There are 5 parcels within 1 mile of the border between the U.S. and Canada; however, none are included in the HCP project area. The lynx commitments contained in the ARMs would continue to be applied on these parcels. The proposed action meets this objective in part by providing and conserving core area lynx habitat within the Northern Rockies core area and maintaining lynx habitat in unoccupied lynx habitat.

In support of Objective 2, the proposed HCP includes the following measures:

1. For all scattered parcels supporting lynx habitat, whether lynx are present or not, the lynx habitat commitments (**LY-HB1** through **LY-HB6**) would apply.
2. Design harvest units to maintain a connected network of suitable lynx habitat along RMZs, ridge tops, and saddles (**LY-HB6**).
3. A Transition Lands strategy that caps the acreage that can be removed from the HCP project area over the permit term and includes a process to add lands to the HCP project area.

In addition to the lynx commitments, grizzly bear commitments (**GB-PR6**) requiring visual screening in RMZs and WMZs across the HCP project area and (**GB-NR4**) restricting harvest unit size to ensure cover is available within 600 feet from any point within a clearing within grizzly bear recovery zones and NROH (which frequently overlaps with lynx habitat) would help maintain connectivity in core areas. Aquatic commitments along riparian zones requiring a 50-foot no harvest buffer and modified timber harvest in riparian zones would also maintain connectivity throughout the HCP project area on fish-bearing streams. Combined, these measures (lynx, grizzly bear and aquatic commitments) would support connectivity throughout the HCP project area in both core areas and secondary areas. Thus, we conclude that the proposed action contributes to this recovery objective.

Objective 3: Ensure that habitat in secondary areas remains available for continued occupancy by lynx.

To summarize, we conclude that the proposed action contributes to this recovery objective within the authority and management capabilities of DNRC.

The recovery outline discusses the relative importance of core and secondary areas to lynx recovery. The recovery outlines identifies a suite of actions (Actions 5.1 through 5.5) primarily directing the need for surveys and research; although Action 5.4 provides direction to identify and implement management efforts as necessary to provide lynx habitat in secondary areas.

The proposed action specifically addresses Action 5.4 because it would implement lynx habitat commitments in lynx habitat regardless of the presence of lynx, and would implement lynx management area commitments in LMAs of known importance to lynx, regardless of the presence of lynx. In secondary areas, DNRC ownership is comprised of scattered parcels, often surrounded by a variety of ownerships including federal, other State lands, industrial timber lands, and other private lands. While forest management actions could degrade lynx habitat in secondary areas (mainly through actions conducted on scattered parcels), DNRC's ability to contribute to lynx recovery in these areas is limited by its scattered ownership contrasted with the large home ranges and low densities of lynx, which make it difficult to achieve conservation on small, isolated parcels of land. Nevertheless, maintaining habitat in these areas would provide cover that would facilitate lynx roaming outside their normal home range in search of food, dispersing lynx, and when scattered parcels occur within lynx home ranges centered on adjacent federal lands would provide additional incidental habitat for lynx. Under the DNRC HCP, vegetation management actions may degrade lynx habitat, but the resulting conditions are typically temporary (i.e. not permanent). The risks of most vegetation management actions conducted by the DNRC, such as timber harvest, pre-commercial thinning, and other modifications of habitat, are reversible as forests typically regenerate over time, with or without active restoration. Additionally, DNRC forested trust lands are managed, through legal mandate (Montana Code Annotated 77-5-223(2)) under a sustainable harvesting program, which ensures a diversity of stand conditions on the landscape and provides many general protections from harvesting trees at accelerated rates. Lynx habitat on DNRC HCP project area lands in secondary areas would remain available for recovery of lynx over the Permit term.

Given the estimated low level of adverse impacts that could affect lynx habitat in secondary areas, the lesser importance of secondary area to lynx recovery (as compared to core area, we conclude that the DNRC HCP would support this recovery objective.

Objective 4: Ensure that threats have been addressed so that lynx populations will persist in the contiguous United States for at least the next 100 years.

To summarize, we conclude that the proposed action contributes to this recovery objective within the authority and management limitations of DNRC.

Although the DNRC HCP does not apply for 100 years and thus cannot provide conservation assurances beyond the Permit term of 50 years, the proposed action would support the persistence and recovery of lynx populations on lands within core areas in the action area for the Permit term. Actions 6.1 through 6.5 identified in the recovery outline to support this objective primarily require research and monitoring. As DNRC describes in its HCP (Final EIS/HCP 2010, Appendix, Chapter 4), limited funding is available to conduct rigorous scientific research within the forest management program. However, the DNRC does support research by providing access to state lands for such purpose, providing staff to participate on interagency teams, and contributes funding when available. Additionally, the DNRC HCP includes provisions to adapt the HCP in response to changed circumstances including climate change (Action 6.5) and new research (such as new threats or risks to lynx should they arise).

Summary of the Effects of the Proposed Action on Lynx

This BO considers the information and analysis in the LCAS and NRLMD biological opinions and information in our files, as well as the EIS analysis prepared in support of the HCP, which examined new information relevant to assessing the proposed action's impacts on lynx and lynx habitat.

The DNRC designed the proposed action to address those risk factors to lynx attributable to its forest management program. In many instances, the commitments were modeled after the LCAS and NRLMD, though tailored to the management needs of DNRC and updated based upon recent scientific findings including: habitat conditions for denning lynx in Montana (Squires et al. 2008), the importance and description of winter foraging habitat (Squires et al. 2010 in press), and the limited risk coyotes likely pose regarding competition with lynx (Kolbe et al. 2007).

Overall, the proposed action would reduce or avoid the potential for adverse effects on lynx by implementing a suite of commitments to retain habitat structure and components required by lynx and their primary prey, the snowshoe hare (see Section A). The primary benefits of the proposed action to lynx come from the application of enhanced commitments in LMAs, which require maintenance over time of certain percentages of suitable and winter foraging habitat in lynx LMAs, retention of 20 percent of pre-commercially thinned stands in an unthinned condition, and limit habitat conversion per decade.

Additional benefits would result from measures applied on scattered parcels in occupied habitat (47,378 acres) including maintenance of suitable habitat, which would contribute to effective lynx habitat and a snowshoe hare prey base over a larger landscape meaningful to lynx. The HCP compliments conservation of snowshoe hare habitat on adjacent federal lands. The effectiveness of lynx habitat management on scattered parcels in the HCP in unoccupied habitat

varies considerably because these lands are often surrounded by lands with varying ownership and management schemes. Nevertheless, application of lynx habitat commitments would benefit lynx during dispersal and other movements outside of home ranges.

Additional benefits are provided by commitments that contribute structure (coarse woody debris, horizontal cover) within habitat types used by lynx and snowshoe hare and by maintaining habitat linkages and connectivity across the HCP project area.

This suite of measures maintains varying levels of snowshoe hare and lynx habitat in all occupied areas in the HCP action area. Research confirms the dependence of lynx on their primary prey, snowshoe hare, and confirms the importance of early and late seral vegetation conditions for hares. The vegetation management commitments under the HCP are of primary importance to lynx. Other than vegetation management, activities conducted within the forest management program have relatively minor or less substantial impacts on lynx.

Other actions under the forest management program such as road use, public access, and grazing of livestock might result in disturbance to lynx. However, most studies pertaining to these topics indicate that lynx do not significantly alter their behavior to avoid human activities (Staples 1995; Roe et al. 1999; Aubry et al. 2000; Mowat et al. 2000). Further, there is no existing research that provides evidence of lynx being adversely affected by grazing within the NRLMD or elsewhere, or of lynx movements within home ranges being impeded by grazing practices. The best information suggests that the main influence that forest management has on lynx come from actions that impact snowshoe hare numbers through vegetation management.

Within unoccupied areas of the HCP project area,(primarily scattered parcels in secondary habitat), we do not expect the proposed action would adversely affect individual lynx. We expect that lynx would occupy these areas only intermittently through time during dispersal or other movements outside of home range. Lynx habitat commitments in unoccupied habitat would ensure that these scattered parcels provide enough cover and prey base to support dispersal and incidental foraging by lynx. We do not expect adverse effects to lynx that may occasionally occur in unoccupied habitat.

We conclude that the proposed action would conserve lynx and lynx habitat on DNRC covered lands, but would allow some projects with adverse effects to individual lynx. These effects would be dispersed across the landscape and through time such that an overall reduction in the lynx population is not expected to occur. The majority of adverse effects to lynx from the proposed action would come from timber harvest in lynx winter foraging habitat and pre-commercial thinning in younger stands. We expect that some individual female lynx would suffer impairment of breeding and feeding, as a result of the subsequent decrease in snowshoe hare prey base. However, DNRC will leave a mosaic of habitat in various seral stages and stand

condition, which is typical of lynx habitat. In most cases, vegetation management conducted by DNRC does not result in permanent alterations of habitat

Effects of the Action on Critical Habitat

The previous sections of this BO analyzed the impacts of vegetation management under the HCP on lynx, primarily by detailing and analyzing the effects on the habitat required by lynx. Thus, that analysis also provides an analysis of the specific impacts of proposed HCP actions and commitments on lynx critical habitat in the action area. The PCE for lynx critical habitat and the actions resulting adverse effects on critical habitat are described in Section B. Briefly, the PCE is: 1. Boreal forest landscapes supporting a mosaic of differing successional forest stages and containing: a) presence of snowshoe hares and their preferred habitat conditions; b) winter snow conditions that are generally deep and fluffy for extended periods of time; c) sites for denning that have abundant coarse woody debris; and d) matrix habitat that lynx are likely to travel through while accessing patches of boreal forest within a home range.

The HCP covered lands include a total of 175,316 acres of lynx critical habitat (see Table III-4). Approximately 175,316 acres of HCP lands of critical habitat lie in Unit 3 and 813 acres lie in Unit 5.

The conservation role of lynx critical habitat is to support viable core area populations (74 FR 8644). The proposed action applies measures to minimize the effects on lynx critical habitat across the HCP project area (see Section A). However, as detailed in the biological effects sections above, the proposed action may have adverse effects on lynx critical habitat by reducing habitat quality that would likely result in a reduction in snowshoe hare numbers. Browse eaten by snowshoe hares and cover needed for protection would be diminished primarily through the removal of the horizontal structure (e.g. trees and tree limbs, and shrubs) within forest stand types preferred by lynx. Thus, this proposed action fits under the first criteria, PCE1.a. described above in the Section B, as containing actions that are likely to adversely affect lynx critical habitat. Specifically the proposed action would likely adversely affect PCE 1.a. by resulting in a reduction in the amount and/or quality of snowshoe hare habitat, affecting snowshoe hare numbers. The types of actions described in criteria two and three as actions causing adverse effects on critical habitat would not occur as a result of the proposed action. We do not expect any permanent habitat losses attributable to conversion of vegetation to occur on a scale proportionate to the large landscapes used by lynx. Nor would the project increase traffic volumes or speeds on roads that divide lynx critical habitat.

PCE 1.b would not be adversely affected by the proposed action; although some winter snow compaction may occur due to DNRC actions, but these impacts would be insignificant to the function of critical habitat for lynx. PCE 1.d would not be adversely affected by the proposed

action. Timber harvest in matrix habitat would not impede lynx movement within and through matrix habitat. Such effects would be insignificant.

The HCP project area contains 174,503 acres of critical habitat in Unit 3. As a result of vegetation management, some actions conducted under the HCP would degrade snowshoe hare habitat quality in critical habitat Unit 3. Although the proposed action would adversely affect areas of critical habitat, the LMAs and scattered parcels, along with adjacent federal LAUs are expected to remain capable of producing adequate densities of snowshoe hares to support continual lynx presence because the HCP would leave snowshoe hare habitat in adequate amounts to sustain hares in most cases. Approximately 2,080 acres of winter foraging habitat would be affected annually (based on a five-year average) in LMAs and occupied scattered parcels that currently provide conditions for PCE1.a. (specifically,winter foraging habitat). However, the effects of this harvest would be limited by commitment to retain 20 percent of total potential habitat in LMAs as winter foraging habitat. Also, over the permit term (50 years), an additional total of no more than 2,320 acres that provide conditions for PCE 1a may be degraded over the Permit term in LMAs, through possible green harvest following a changed circumstance; this is type of harvest is expected to be infrequent. Adverse effects on PCE1.a (winter foraging habitat) following a changed circumstance would be distributed across the six LMAs and implementation of a mitigation plan approved by the USFWS. The HCP commitments for pre-commercial thinning would limit the effect to 1,200 acres annually across the entire HCP project area (i.e., critical habitat and areas outside critical habitat). Therefore, the total acres providing conditions for PCE1.a, and affected by pre-commercial thinning would be likely be far less than 1,200 acres annually, on average. No permanent loss (such as paving or building construction) of habitat or conversion of the boreal forest would occur as a result of vegetation management activities. Long-term, all critical habitat would retain its inherent capacity to regenerate into snowshoe hare and lynx habitat.

The HCP project area contains 813 acres of critical habitat in Unit 5. These critical habitat acres comprise a small portion of the lynx habitat on DNRC HCP project area in the Central Land Office, which contains over 87,000 acres of potential lynx habitat on covered lands in critical habitat and outside of critical habitat. Additionally, these 813 acres comprise just 0.0001 percent of the acres of critical habitat on all ownerships in Unit 5 (6,080,000 acres) and include potential lynx habitat (PCE1.a) as well as matrix habitat (PCE1.d). As detailed in previous sections, a portion of these 813 acres of critical habitat may be adversely affected by vegetation management over time, specifically affecting PCE1.a. However, the level of adverse effects is expected to be low because so few acres of critical habitat would be treated, especially in comparison to those available in the Unit. Further, treatments would affect scattered parcels, which are likely within or adjacent to LAUs providing suitable and foraging habitat for lynx and snowshoe hares. Additionally, no permanent loss (such as paving or building construction) of critical habitat or conversion of the boreal forest (critical habitat) would occur as a result of

vegetation management activities. Over the long-term, critical habitat would retain its inherent capacity to regenerate into snowshoe hare and lynx habitat.

The proposed action is not likely to have adverse effects on PCE1.b or PCE1.d as described for Unit 3 above, because effects are likely to be discountable or insignificant. The proposed action would have no adverse effects on PCE1.b. as a result of HCP commitments (LY-HB2)

The HCP includes provisions for the disposal of lands from the HCP project area that could be subject to development and permanent loss of snowshoe hare habitat. In Section E of this BO we conclude that in some specific cases such land disposal subject to private development and permanent loss of snowshoe hare habitat would adversely affect lynx. Disposal of lands identified as lynx critical habitat would also adversely affect this critical habitat for lynx. However, subsequent actions on disposed lands would be addressed by the new landowner in cooperation with the USFWS and are not further discussed.

E. SPECIES' RESPONSE TO THE PROPOSED ACTION

Lynx populations occur at naturally low densities in the contiguous United States, largely due to inherently low densities of snowshoe hares, their primary prey (Aubry et al. 2000). Low snowshoe hare densities are likely a result of the naturally fragmented boreal habitat at southern latitudes (including the HCP project area) that prevents hare populations from achieving densities similar to those in the extensive northern boreal forest of Canada.
Rarity of lynx does not necessarily mean that management actions have or will cause population reductions. At the same time, rarity and large home ranges makes it essential to develop and apply broad, landscape-level measures to manage for the mosaic of habitats needed to support lynx and their primary prey, the snowshoe hare.

The proposed action would maintain the habitat mosaic, structure, and components that support lynx and their primary prey, the snowshoe hare, on DNRC lands. Within occupied habitat, the HCP commitments in combination with surrounding or adjacent lands (mostly federal), would contribute to lynx conservation at lynx home range or potential home range scales. Not all of the proposed projects under the HCP conducted in lynx habitat would likely adversely affect individual lynx because of the maintenance of the habitat mosaic across DNRC lands operational constraints, and favorable conditions for lynx at the larger scale on surrounding federal lands. The combination of HCP conservation commitments on trust lands and favorable management on surrounding LAUs, would in most cases support lynx home ranges. In other words, although snowshoe hare habitat quality in some areas would be reduced, sufficient habitat would likely remain to support or contribute to individual lynx home ranges.

However, over the 50-year term, given the anticipated reduction in winter foraging habitat, it is also likely that some low number of individual lynx, especially females, will suffer adverse effects from a significant and abrupt reduction in the snowshoe hare prey base in its home range

as a result of harvest or thinning. In these cases, we expect failure to reproduce (i.e. decreased fecundity) or decreased survival of kittens.

On scattered parcels, we believe the likelihood of adverse effects on individual lynx from loss of winter foraging habitat or pre-commercial thinning would be low, for reasons listed above, but not entirely discountable. An individual lynx could be affected if and when timber harvest removes or thins a significant amount of snowshoe hare foraging habitat in a home range.

The previous analyses described those elements of the proposed action that reduce or minimize the level of adverse effects on individual lynx from these actions through the full suite of commitments found on in Section A.

To give perspective on what these reductions in snowshoe hare habitat mean to lynx, the average lynx territory in the action area is 53,375 acres for males and 21,745 acres for females (Squires et al. 2004). The impacts from vegetation treatments in winter foraging habitat (approximately 1,850 acres annually) would be distributed across the six LMAs in critical habitat, encompassing approximately 129,300 acres of potential lynx habitat and would likely affect a few hundred acres within a given area subject to harvest; therefore, the number of individual lynx home ranges that would be affected during any one year would be likely be low. Nevertheless, for female lynx whose home range is affected, treatment of winter foraging habitat, perhaps a few hundred acres, could mean decreased kitten survival, decreased fecundity, or displacement to another occupied home range.

The impacts from removal of winter foraging habitat on scattered parcels (1,135 acres annually) and pre-commercial thinning (1,200 acres) would be distributed across approximately 128,000 acres of potential lynx habitat. However, 40 percent of this winter foraging habitat occurs in secondary areas, and outside of critical habitat, where reductions of foraging habitat are not likely to adversely affect lynx. Within harvest units, affected areas would likely include a few hundred acres at a time, reducing the number of projects per year. As in the LMAs, fewer projects and larger harvest units on scattered parcels in critical habitat may reduce the number of individual lynx and lynx home ranges potentially affected each year. However such levels of reduction in winter foraging habitat in occupied habitat may adversely affect lynx using the area. The effects of additional loss of winter foraging habitat following a changed circumstance would be distributed across four LMAs. The type of effect and number of lynx affected would be similar to that described for loss of winter foraging habitat.

Overall, we expect that some individual lynx would suffer adverse effects from the proposed action. We expect that over the 50-year permit term, a low number of female lynx would suffer impairment of breeding and feeding, and would experience lowered fecundity or decreased kitten. We do not expect that male lynx would suffer such impairment of breeding, feeding or sheltering, as they have larger home ranges within which to hunt for prey, and they have fewer

physiological needs than reproductive-age female lynx. It is difficult to estimate how many females would be so affected over a 50-year term. However, we anticipate the number to be low, because of the relatively limited acreage the DNRC manages in the occupied habitat. Further, the effects on individual lynx with home ranges would be moderated in many cases, as LMAs and scattered parcels in occupied lynx habitat are within or contiguous with lynx habitat on adjacent federal lands. Lynx habitat on federal lands is largely protected from significant degradation. Therefore the adverse impacts on lynx as a result of DNRC actions would likely be moderated in most cases by habitat conditions on adjacent lands.

In unoccupied, secondary areas, we do not expect individual lynx to be adversely affected by the proposed action. The HCP contains a number of conservation commitments that apply to the entire project area. These commitments would adequately retain some level of snowshoe hare production on all potential lynx habitat in secondary areas. Thus transient or dispersing lynx that may occasionally use these areas would find adequate prey resources and shelter as they move through the areas.

F. CUMULATIVE EFFECTS

Cumulative effects include the effects of State, tribal, local, or private actions that are reasonably certain to occur within the action area considered in this BO. Future Federal actions that are unrelated to the proposed action are not considered in this section because they require separate consultation pursuant to section 7 of the ESA.

Other Actions in the Action Area

The action area is primarily comprised of DNRC trust lands to be managed under the HCP and overlapping federally designated LAUs, which are mostly comprised of federal lands, but include small inclusions of other federal (BLM), state, and private lands (Table III-8). In the action area, approximately 35 percent of the area is on federal lands managed under the NRLMD or LCAS. Approximately 48 percent of the action area is on state lands that would be managed under the HCP. Another 15 percent of the area occurs on private lands and 2 percent (22,800 acres) is non-HCP state lands. Portions of private lands and non-HCP state lands, especially those above 4,000 feet in elevation, are likely in potential lynx habitat.

Due to the forested nature of lynx habitat, large portions of this habitat occur on private, State, and corporate timber lands where timber harvest and thinning occurs.

Plum Creek Timber Company (Plum Creek) is a major land owner in western Montana, with over 450,000 acres of lynx habitat. Within the action area, Plum Creek manages 99,600 acres (Table III-8). The company participates in the Sustainable Forest Initiative (SFI) program, which is a comprehensive system of principles, objectives, and performance measures developed by foresters, conservationists, and scientists which combines the growth and harvest of trees and

protection of wildlife, plants, soils, and water quality (American Forest and Paper Association 2006). Plum Creek lands in western Montana are also managed under its Native Fish Habitat Conservation Plan. Both of these programs moderate to an extent, the potential adverse impacts of forestry practices on lynx. Between 2008 and 2010, 310,000 acres of Plum Creek lands were sold to The Nature Conservancy, 40,450 acres of these are in the action area and 12,900 acres were transferred to the USFS and are now managed under the NRLMD, which minimizes adverse effects on lynx. Of the remaining acres, 8,300 acres are managed by TNC under the Fiber Supply Agreement with Plum Creek and 14,600 acres are managed with a conservation easement or measures that moderate potential adverse effects on lynx.

Other smaller parcels of private lands in the action area are primarily used for residential areas, or may be used for small scale forestry, or will be developed for business uses in the future. Also, some corporate timber lands are being divided into smaller parcels and offered for sale to private landowners. For example, in the Seeley Lake/Swan Valley area of northwest Montana, Plum Creek has sold some corporate timber land for (primarily) residential development.

In addition to timber management, activities on non-Federal lands may include mineral extraction, oil and gas exploration, urban and rural development, recreation site construction and use, road construction, and utility corridors. Habitat loss or degradation and direct mortality of lynx are possible adverse impacts on lynx. Cumulatively, urbanization and highway development may impact connectivity in lynx habitat. To date, lynx are known to have dispersed long distances, from Canada to northwest Montana and from Colorado to northwest Montana (T. Shenk, pers. comm. 2007 as cited in USFWS 2007). Past highway development has evidently not created a total barrier to lynx movements and Federally-funded highway projects would be reviewed under section 7(a)2 of the Endangered Species Act. However, ensuing private land development is likely to continue.

There is potential and a reasonable likelihood for future management of private lands within the action area to have negative impacts on lynx habitat. Some snowshoe hare habitat would likely be permanently lost to development, and some would be reduced in quality through thinning or timber harvest. Not all lands would be developed or used in ways that have negative impacts on lynx habitat. Combined, private lands developed or used in ways that would have negative impacts on lynx habitat would constitute a fairly small proportion of lynx habitat within the action area (15 percent). With the exception of State or corporate timber lands, private land parcels are fairly small in size relative to the large landscape required by an individual lynx to support its home range and are scattered throughout the action area. Many are and would be adjacent to or interspersed with Forest Service or other Federal land, and therefore some of the potential negative effects on the private parcels would be moderated by federal land management.

The final rule that listed lynx did not find that present conditions on private lands threaten the DPS. Within the action area, 35 percent of lynx habitat would be managed by the Forest Service or other federal agencies into the future and 48 percent would be managed under the HCP or Forest Management ARMs. Within the HCP action area, the NRLMD substantively reduces the primary threat to lynx (inadequate regulatory mechanisms) by addressing the major adverse impacts of Federal land management on lynx, as well as several other potential impacts or influences that do not rise to the level of a threat to lynx.

Through the Plum Creek land disposal, DNRC has acquired 63,300 acres in western Montana. These acres are not included in the HCP project area at this time, but DNRC has expressed an interest in adding them to the HCP and Permit at some time in the future. Under Plum Creek ownership, these lands were not managed for lynx. Under DNRC ownership, lynx conservation would be achieved through implementation of the Forest Management ARMs. If these lands area added to the HCP, the primary adverse effects on lynx would be temporary loss or reduced quality of foraging habitat through timber harvest or thinning. However, these effects would be limited through implementation of the HCP commitments.

G. CONCLUSION

Conclusion for Canada Lynx

After reviewing the current status of Canada lynx, the environmental baseline for the action area, the effects of the proposed action, and the cumulative effects, it is the USFWS's biological opinion that the proposed action is not likely to jeopardize the continued existence of Canada lynx within the contiguous United States DPS.

The best information suggests that forest management activities managed under the conservation commitments of the DNRC HCP would not appreciably reduce the likelihood of survival and recovery of Canada lynx. Our conclusion is based on, but not limited to, the body of literature and information referenced in this document, meetings and discussions with DNRC, discussions with lynx experts, information in our files, and the information in the Draft and Final EIS. Section E analyzed and summarized key factors in detail. We find that although adverse effects are likely to some individual lynx, the proposed action is not likely to appreciably diminish survival and recovery of lynx populations. The action overall promotes the conservation of lynx and their habitat through increased conservation commitments by DNRC for forest management practices, maintenance of the habitat mosaic, structure, and components required to support lynx and their primary prey, the snowshoe hare, monitoring, and adaptive management.

The USFWS concludes that implementation of the DNRC HCP may result in some level of adverse effects to lynx. However, the level of adverse effects to lynx are not reasonably expected to, directly or indirectly, reduce appreciably the likelihood of both the survival and

recovery of the lynx DPS in the wild by reducing the reproduction, numbers, or distribution of lynx. Some key factors that considered in our assessment of jeopardy include:

- The final rule listing lynx as a threatened species (March 24, 2000; 65 FR 16052) concluded that the primary factor threatening the lynx DPS is the inadequacy of existing regulatory mechanisms, specifically the lack of guidance for conservation of lynx in federal land management Plans. The Final Biological Opinion for the Northern Rockies Lynx Management Direction (NRLMD) (USFWS 2007) concluded that the programmatic and project-level objectives, standards, and guidelines in the amended Forest Plans provide comprehensive conservation direction adequate to reduce adverse effects to lynx from Forest management and to preclude jeopardy to the lynx distinct population segment. Similar Forest Service Plan amendments or revisions have occurred in Midwest and southern Rockies. Hence, the primary threat to lynx has been addressed across most of its range.
- Overall, the proposed HCP would likely affect 257,000 acres of potential lynx habitat on DNRC LMAs and scattered parcels in the HCP project area at some point over the permit term in occupied and unoccupied habitat. Notably, approximately 107,200 acres of this habitat is in secondary areas or outside of critical habitat and is unoccupied. This is in comparison to 8.4 million acres of lynx habitat in Federal LAUs in western Montana managed under the Lynx Conservation and Assessment Strategy or the NRLMD
- The proposed action would affect 831 acres of occupied lynx habitat in the action area in the Greater Yellowstone Area (Table III-4). These lands comprise 0.0001 percent of the acres of habitat occupied by lynx on all ownerships in Unit 5 (6,080,000 acres).
- The proposed action would affect 174,400 acres of occupied lynx habitat in the action area in the Northern Rockies (Table III-4). These lands comprise less than 3 percent of the acres of habitat occupied by lynx on all ownerships in Northern Rockies Unit 3 (6,465,000 acres).
- The proposed HCP would apply additional protective provisions within areas known to be occupied by a reproductive-aged female lynx or that may become occupied or be more important to lynx during population increases (LMAs). The HCP would also provide foraging habitats and connectivity for lynx within all occupied habitat on scattered parcels. This management is expected to contribute lynx habitat and a prey base for lynx home ranges encompassing scattered parcels, or foraging by lynx using the area.
- In LMAs, the proposed action would maintain key elements of the habitat mosaic, structure, and components required to support lynx and their primary prey, the snowshoe hare, on LMAs over the long-term: The suite of enhanced conservation measures in LMAs would retain: 65 percent of total potential habitat as suitable habitat; 20 percent of total potential habitat as winter foraging habitat; 20 percent of thinned stands in an un-thinned condition; and limit conversion of habitat by decade.
- Negative effects on lynx on lynx in LMAs would not be totally eliminated, but are minimized and limited by the HCP commitments. The average lynx territory in the

action area is 53,375 acres for males and 21,745 acres for females (Squires et al. 2004). In comparison, the HCP project area encompasses 127,000 acres of potential lynx habitat distributed across six LMAs. Thus adverse effects would affect few lynx.

- The proposed action would maintain key elements of the habitat mosaic, structure, and components required to support lynx and their primary prey, the snowshoe hare, on DNRC lands. Adverse effects on individual lynx may occur as a result of a reduction in winter foraging habitat, pre-commercial thinning of regenerating stands and a limited reduction of foraging habitat following a changed circumstance. However, the proposed action minimizes the potential for and the severity of adverse effects from these actions through its operational constraints and HCP commitments (see Final EIS / HCP 2010, Appendix A, Chapter 2).
    - Adverse effects on winter foraging habitat would be limited to approximately1,850 acres per year across all LMAs (averaged over a five-year period) and 234 acres per year on scattered parcels (averaged over a five-year period). However, at all times 20 percent of an LMA must provide winter foraging habitat, and 65 percent must be in suitable habitat condition.
    - Adverse effects of the potential loss of an additional 2,300 acres of winter foraging habitat over the 50-year permit term for changed circumstances would be distributed across four LMAs. Implementation of a contingency plan would partially offset potential additional conservation measures and must be approved by the USFWS.
    - Adverse effects from pre-commercial thinning would be limited to approximately 1,200 acres annually (averaged over a 5-year period) across both occupied and unoccupied habitat. Therefore a portion of this thinning would occur in unoccupied habitat. DNRC indicates that it is likely that a similar number of acres of habitat would grow into summer foraging habitat across the HCP project area annually.
    - Adverse effects from disposal of HCP lands would be capped at 5 percent of the baseline acreage of the HCP within LMAs. This amount would not compromise the HCP's ability to complement lynx recovery efforts on adjacent Federal lands, because sufficient amounts of habitat would remain in the HCP to support lynx conservation on DNRC lands.
    - Based on caps on land disposals, coupled with the provisions of the Real Estate Management Rules and the MEPA process, parcels with high value for the covered species are unlikely to be transferred to a non-conservation entity. Disposal of lands from the HCP may result in some adverse effects on an individual lynx home range but not an appreciable loss of habitat, numbers, and distribution of lynx overall, because sufficient amounts of habitat would remain in the HCP to support lynx conservation on DNRC lands.
    - Adding lands to the LMAs in the HCP may subject these lands to vegetation management activities that could result in adverse effects on foraging habitat. However, the addition of lands would likely result in an overall increase of the

amount of land maintained as suitable and foraging habitat for lynx, because these lands are presently not managed with the same conservation commitments as the in HCP.

- This BO analyzed the various commitments in the HCP (Section A) that reduce the potential for or minimize the effects on lynx (Final EIS / HCP 2010, Appendix A, Chapter 2).
- Monitoring and tracking habitat conditions for lynx in the HCP project area are required to ensure that habitat ratios are maintained and habitat conversion does not exceed the allowable amount per 10-year increment (Final EIS / HCP 2010, Appendix A, Chapter 2 and Chapter 4).
- The HCP includes a process to respond to new research related to lynx habitat needs or lynx's response to climate change. Commitments may be adapted over time as necessary to respond to better information on habitat needs or changing habitat needs due to the influence of climate change.
- We have determined that the proposed action is compatible with recovery needs for lynx (USFWS 2005). As analyzed in this opinion (Section D), the proposed action addresses, in whole or in part, the relevant objectives for non-Federal land managers in the recovery outline for lynx.

The proposed HCP considered information in the USFWS's listing rules, the LCAS, NRLMD, recent research information, and the 2005 recovery outline for lynx. These documents outline the best available information concerning threats and risks to lynx and means to address them.

We find that although adverse effects are likely to some individual lynx over the Permit term, the proposed action is not likely to The action overall promotes the conservation and recovery of lynx and their habitat through increased conservation commitments by DNRC for forest management practices, maintenance of the habitat mosaic, structure, and components required to support lynx and their primary prey, the snowshoe hare, monitoring, and adaptive management. We have examined the impacts of the proposed action on individuals and on the lynx within the Northern Rockies and Greater Yellowstone, the areas affected by the proposal. We conclude that the proposed action would not appreciably reduce the numbers or distribution of lynx in either the Northern Rocky Mountains Greater Yellowstone Area. Thus, the proposed action is not likely to appreciably reduce the likelihood of survival and recovery of lynx in the wild.

Conclusion for Critical Habitat

After reviewing the current status of designated lynx critical habitat, the environmental baseline for the action area, the effects of the action and the cumulative effects, it is the USFWS's biological opinion that the effects of the DNRC HCP are not likely to result in the destruction or adverse modification of lynx critical habitat. This BO does not rely on the regulatory definition of "destruction or adverse modification" of critical habitat at 50 C.F.R. 402.02. Instead, we have relied upon the statutory provisions of the ESA to complete the following analysis with respect

to critical habitat. The Lynx Critical Habitat Final Rule (74 FR 8644) explains that "The key factor related to the adverse modification determination is whether, with implementation of the proposed action, the affected critical habitat would remain functional (or retain the current ability for the PCEs to be functionally established) to serve the intended conservation role for the species. Activities that may destroy or adversely modify critical habitat are those that alter the physical and biological features to an extent that appreciably reduces the conservation value of critical habitat for lynx. Generally, the conservation role of lynx critical habitat units is to support viable core area populations."

The proposed action has components that will adversely affect lynx critical habitat via reductions in lynx/snowshoe hare habitat, i.e. reductions in the quality of PCE1a. on parcels within designated lynx critical habitat. However, the proposed action would conserve adequate amounts of snowshoe hare habitat needed to sustain lynx in the LMAs and adjacent Federal LAUs, and would retain the ability for the PCE to function. When added to the status of the critical habitat unit, the effects of the project are such that the conservation role of the lynx critical habitat units (3 and 5) will continue to support their intended conservation role for lynx.

The rationale for our determination of no destruction or adverse modification of critical habitat is based on the body of literature and information referenced in this document, meetings and discussions with DNRC, discussions with lynx experts, information in our files, and the information in the Draft and Final EIS. Section E analyzed and summarized key factors in detail. Our analysis of the effects on lynx is also germane to our conclusions, because it specifically analyzes the effects on lynx habitat. Some key points in our consideration:

- Overall, we anticipate adverse effects to lynx critical habitat only from the timber harvest/thinning and pre-commercial thinning activities that occur within lynx foraging habitat (snowshoe hare habitat) and so impact PCE 1a.

- The proposed action would have no adverse effects on PCE1.b deep fluffy snow.

- The proposed action would not adversely affect PCE1.c: sites for denning, and contains commitments to ensure adequate denning sites are provided in the action area.

- For those areas of the project that provide lynx habitat but not snowshoe hare habitat or are located in matrix habitat (PCE 1.d), we do not anticipate adverse effects as a result of implementation of the HCP.

- Project-related activities would adversely affect lynx critical habitat PC1a.; however, the nature of most vegetation management alteration is temporary (forests regrow or can be restored), so no permanent loss of the inherent capacity of treated stands to provide lynx habitat is expected.

- Although adverse effects on critical habitat would occur through project implementation, the total effect on lynx critical habitat within critical habitat Unit 5 would not appreciably reduce the conservation value of critical habitat for lynx. Generally, the conservation role of lynx critical habitat units is to support viable core area populations. The actions that might adversely affect critical habitat would occur only portions (potential lynx habitat vs matrix) of the 813 acres of Critical Habitat Unit 5 over the Permit term. The 831 acres comprise 0.0001 percent of the acres of critical habitat on all ownerships in Unit 5 (6,080,000 acres). These 813 acres comprise less than 1 percent of the potential lynx habitat in the Central Land Office in the HCP project area. Further, as described in this opinion, the HCP would apply the general lynx habitat commitments to these lands to reduce or minimize adverse effects on lynx habitat.

- Although adverse effects on critical habitat would occur through project implementation, the total effect on lynx critical habitat within critical habitat Unit 3 would be not appreciably reduce the conservation value of critical habitat for lynx. The actions that might adversely affect critical habitat may occur on portions of 174,442 acres of Critical Habitat Unit 3 over the 50-year Permit Term. These lands comprise less than 3 percent of the acres of critical habitat on all ownerships in Unit 3 (6,465,254 acres). Further, the HCP would apply the general lynx habitat commitments and additional LMA commitments to these lands to reduce or minimize adverse effects on lynx habitat.

- The suite of enhanced conservation measures in LMAs would retain a mosaic of habitat stands and structure within critical habitat over time: at least 65 percent of total potential habitat as suitable habitat and no more than 35 percent in early seral conditions; 20 percent of total potential habitat as winter foraging habitat; 20 percent of thinned stands in an un-thinned condition; and conversion of habitat by decade would be limited. This strategy would support PCE1.a.

- This general strategy for lynx critical habitat would complement and be supported by management of critical habitat on adjacent federal lands. Combined with federal management, both LMAs and scattered parcels in critical habitat would contribute to PCE1.a at scales that support the conservation role of lynx critical habitat units.

- While adverse effects on habitat on parcels within designated lynx critical habitat in LMAs and Federal LAUs are expected, considering the amount and status of critical habitat in Unit 3, the application of the NRLMD on Federal land across the vast majority of lynx critical habitat, and the current status of lynx critical habitat, Unit 3 would continue to produce adequate densities of snowshoe hares to support persistent lynx populations, the conservation role of critical habitat. LAUs that have inclusions of state lands affected by vegetation management, including the reduction of foraging habitat, would continue to support snowshoe hares and lynx through the conservation commitments of the HCP and the NRLMD implemented on Federal lands.

The proposed action would result in critical habitat conditions that would continue to produce adequate densities of snowshoe hares and adequate levels of cover to support persistent lynx

populations across Units 3 and 5. We conclude the proposed action will not alter the physical and biological features of critical habitat to an extent that appreciably reduces the conservation value of critical habitat for lynx. The proposed action would not directly or indirectly alter critical habitat in Units 3 or 5 to the extent that the conservation role for the species (i.e. to support viable core area lynx populations) would be diminished; the critical habitat units would retain their current ability for the primary constituent element(s) to be functionally established (74 FR 8644). Therefore, the proposed action is not likely to adversely modify critical habitat.

H. INCIDENTAL TAKE STATEMENT

Section 9 of the ESA and Federal regulation pursuant to section 4(d) of the ESA prohibit the take of endangered and threatened species, respectively, without special exemption. Take is defined as to harass, harm, pursue, hunt, shoot, wound, kill, trap, capture or collect, or to attempt to engage in any such conduct. Harm is further defined to include significant habitat modification or degradation that results in death or injury to listed species by significantly impairing essential behavioral patterns, including breeding, feeding, or sheltering. Harass is defined as intentional or negligent actions that create the likelihood of injury to listed species to such an extent as to significantly disrupt normal behavior patterns which include, but are not limited to, breeding, feeding, or sheltering. Incidental take is defined as take that is incidental to, and not the purpose of, the carrying out of an otherwise lawful activity. Under the terms of section 7(b)(4) and section 7(o)(2), taking that is incidental to and not intended as part of the agency action is not considered to be prohibited taking under the ESA provided that such taking is in compliance with the terms and conditions of this Incidental Take Statement.

The proposed DNRC HCP and its associated documents clearly identify anticipated impacts to affected species likely to result from the proposed taking and the measures that are necessary and appropriate to minimize those impacts. All conservation measures described in the proposed HCP, together with the terms and conditions described in any associated Implementing Agreement and any section 10(a)(1)(B) permit or permits issued with respect to the proposed HCP, are hereby incorporated by reference as reasonable and prudent measures and terms and conditions within this Incidental Take Statement pursuant to 50 CFR §402.14(i). Such terms and conditions are non-discretionary and must be undertaken, and must be undertaken by the USFWS so that they become binding conditions of the incidental take permit issued to DNRC, as appropriate, for the exemptions under section 10(a)(1)(B) and section 7(o)(2) of the ESA to apply. The USFWS has a continuing duty to regulate to the full extent of its authority the activities covered by this incidental take statement wherever they occur. If the USFWS (1) fails to assume and implement the terms and conditions or (2) fails to require the applicant to adhere to the terms and conditions of the incidental take statement through enforceable terms in the HCP, the protective coverage of section 7(o)(2) may lapse [50 CFR § 402.14(i)(3)]. In order to monitor the impact of incidental take, the applicant must report the progress of the action and its

impact on the species to the USFWS as specified in the incidental take statement (50 CFR 402.14(i)(3)).

Amount and Extent of Take

This BO identifies management direction that allows for activities under the DNRC HCP that adversely affect lynx. The proposed action reduces the potential for incidental take to occur as a result of actions implemented under DNRC's forest management program with a few exceptions.

We anticipate that incidental take in the form of harm would occur associated with projects that reduce winter foraging habitat for snowshoe hares, include pre-commercial thinning. Snowshoe hares inherently occur at relatively low densities across much of the range of lynx in the action area. We anticipate this take in the form of harm, because these actions allow modification of lynx habitat that may result in decreased production and density of snowshoe hares, their primary prey. We anticipate that some adult female lynx within home ranges affected by projects allowed under the HCP would be less successful in finding adequate food resources and fail to reproduce, or kitten survival rates would be lowered. The USFWS anticipates such incidental take of lynx will be difficult to detect for the following reasons:

- Lynx are wide-ranging and not easily detected in the wild.
- Although we have a general understanding of where lynx population centers are within the action area, the numbers and distribution of individual lynx across the HCP project area or within LMAs are not known.
- Although we have a general understanding that snowshoe hares occur and are widely distributed in lynx habitat across the action area, snowshoe hare densities across the HCP project area are not known and may vary from year to year.
- Snowshoe hare populations exhibit cycles in Canada and although not well understood, populations likely fluctuate in the United States as well. This variation could cloud our ability to demonstrate a direct cause and effect relationship. It may be difficult in many cases to determine whether mortality or injury of lynx is attributable to incidental take of lynx as a result of the proposed action, or whether it was natural mortality or injury due to natural declines in snowshoe hares.
- We lack information to predict with precision the densities of hares in various habitat and forest stands, before and after specific treatments, especially in relationship to the host of naturally occurring environmental variables that may affect hare densities.
- Discovery or detection of lynx injury or mortality attributed to habitat alteration is very unlikely.

All of these variables are difficult to monitor or census and so make incidental take difficult to quantify or detect. According to USFWS policy, as stated in the Endangered Species Consultation Handbook (March 1998) (Handbook), some detectable measure of effect should be provided, such as the relative occurrence of the species or a surrogate species in the local community, or amount of habitat used by the species, to serve as a measure for take. Take also may be expressed as a change in habitat characteristics affecting the species (Handbook, p 4-47 to 4-48). Because of the difficulty of estimating the precise number of lynx that would experience take in the manner described above, we will use a surrogate measure to estimate the amount of anticipated take. The surrogate measure for the number of lynx harmed will be quantified and measured using acres of lynx habitat treated in ways that reduce the inherent capacity of the stand to produce snowshoe hares, its primary prey.

The DNRC has provided estimates on the number of acres that will be affected by timber harvest within lynx habitat. Therefore, we are using the number of acres of winter snowshoe hare foraging habitat harvested, acres of pre-commercial thinning in potential lynx habitat, acres of suitable habitat retained, and acres of winter foraging treated after a changed circumstance under the proposed action as a detectable surrogate to limit and measure and monitor the amount of anticipated incidental take in the form of harm. Because timber harvest is limited over the permit term and would be dispersed across the HCP project area, the decrease in prey base would translate to some low amount of impairment of breeding, feeding or sheltering of individual female lynx during some years, if and when a home range is affected. We anticipate such females would suffer reduced fecundity, and decreased survival rates of her kittens as a result of decreased prey base. We do not expect all females or kittens whose home ranges are impacted by DNRC actions would suffer incidental take, nor do we expect incidental take of adult male lynx. Male lynx do not have the physiological needs required by reproductive-aged female lynx.

This BO anticipates the following amounts of take in the form of harm (modification of habitat that reduces the snowshoe hare prey base for lynx):

1. timber harvest of 1,850 acres of winter foraging habitat annually (based on a rolling 5-year average) in LMAs.

2. timber harvest of no more than 2,320 acres of winter foraging habitat through green harvest within the LMAs following a changed circumstance identified in the HCP (Chapter 6 of the HCP)

3. timber harvest of 230 acres of winter foraging habitat annually (based on a rolling 5-year average) on scattered parcels within designated critical habitat

4. pre-commercial thinning harvest of up to 1,200 acres of lynx habitat annually (based on a rolling 5-year average) across the HCP project area within designated critical habitat.

Specifically, incidental take would be exceeded by the applicant (DNRC) if the following occurs:

1. If timber harvest of over 1,850 acres of winter foraging habitat annually (based on a rolling 5-year average) occurs in LMAs.

2. If at any time during the Permit term, less than 20 percent of total potential lynx habitat in each LMA is in winter foraging habitat, except as a result of changed circumstances (see 2. Below).

3. If timber harvest of more than 2,320 acres of winter foraging habitat occurs through green harvest within the LMAs following a changed circumstance identified in the HCP (Chapter 6 of the HCP).

4. If timber harvest of more than 230 acres of winter foraging habitat occurs annually (based on a rolling 5-year average) on scattered parcels within designated critical habitat.

5. If pre-commercial thinning is conducted on more than 1,200 acres of lynx habitat annually (based on a rolling 5-year average) across the HCP project area.

Effect of Take

In this BO, the USFWS determined that this level of anticipated take is not likely to result in jeopardy to the species. The lynx population in western Montana is distributed across 5.5 million acres of lynx critical habitat, or occupied habitat, on federal lands as compared to 175,000 acres on trust lands (see Table III-4). The proposed HCP will affect lynx within total of approximately 150,000 acres of occupied total potential habitat within two areas, Critical Habitat Units 3 and 5. The analysis in this BO demonstrate that overall, the HCP commitments outlined in Section A of this BO and contained in entirely in the Final EIS/HCP 2010, Appendix A, Chapter 2, reduce and minimize the impact of the anticipated incidental take on the species. The BO concludes that the HCP would affect a relatively small proportion of lynx range in Montana, a corresponding low number of female home ranges, and even lower number of female lynx.

Reasonable and Prudent Measures & Terms and Conditions

Under the terms of section 7(b)(4) and section 7(o)(2), taking that is incidental to and not intended as part of the agency action is not considered to be prohibited taking under the ESA provided that such taking is in compliance with the terms and conditions of this incidental take statement.

As described in the introduction to this ITS, all conservation measures described in the proposed HCP, together with the terms and conditions described in any associated Implementing Agreement and any section 10(a)(1)(B) permit or permits issued with respect to the proposed HCP, and all associated reporting requirements, are hereby incorporated by reference as

reasonable and prudent measures and terms and conditions within this Incidental Take Statement pursuant to 50 CFR §402.14(i).

Reporting Requirements

In accordance with 50 CFR §402.14(i)(3), the DNRC HCP specifies provisions for monitoring and reporting the effects and effectiveness of the mitigation and minimization measures on the covered species and their habitats. DNRC will also submit periodic monitoring reports to the USFWS, according to the monitoring and reporting schedule contained in the HCP.

I. REINITIATION NOTICE

This concludes formal consultation on the DNRC HCP and its effects on Canada lynx. As provided in 50 CFR 402.16, reinitiation of formal consultation is required where discretionary Federal agency involvement or control over the action has been retained (or is authorized by law) and if one or more of following occurs:

1. The amount of extent of incidental take described above is exceeded.
2. New information reveals effects of the agency action that may affect listed species or critical habitat in a manner or to an extent not considered in this opinion.
3. The agency action is subsequently modified in a manner that causes an effect to the listed species or critical habitat not considered in this opinion.
4. A new species is listed or critical habitat designated that may be affected by the action.

In instances where the amount or extent of incidental take is exceeded, any operations causing such take must cease pending reinitiation. The amount or extent of take we anticipated in this biological opinion would be exceeded when any of the conditions regarding number of annual acres specified in the list 1. through 5. in the ITS above are exceeded.

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MONTANA DNRC HCP

BIOLOGICAL OPINION

PART IV – AQUATICS

BULL TROUT,
WESTSLOPE CUTTHROAT TROUT
AND
COLUMBIA REDBAND TROUT

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PART IV. BULL TROUT, WESTSLOPE CUTTHROAT TROUT AND COLUMBIA REDBAND TROUT

A. DESCRIPTION OF THE PROPOSED ACTION SPECIFIC TO THE HCP AQUATIC SPECIES

Part IV of the biological opinion (BO) only covers potential effects on bull trout (*Salvelinus confluentus*), bull trout critical habitat, westslope cutthroat trout (*Oncorhynchus clarkii lewisi*), and Columbia redband trout[1] (*Oncorhnychus mykiss gairdneri*). Throughout the remainder of Part IV we refer to westslope cutthroat trout as WCT and Columbia redband trout as RBT.

For a complete review of the consultation history for the proposed action, please refer to Part I Section B of this BO.

Action Area for the HCP Aquatic Species

The section 7 implementing regulations define the "action area," which includes all areas to be affected directly or indirectly by the Federal action, not merely the immediate area involved in the action (50 CFR §402). Although activities that would be covered by the Permit are restricted to DNRC HCP covered lands (i.e., the 548,500 acres of trust lands in the HCP project area), the effects of the proposed action on the HCP fish species may extend beyond this area. The HCP project area is comprised of both blocked lands and scattered parcels. Blocked lands refer to large, mostly contiguous blocks of DNRC ownership specifically identified as the Stillwater and Coal Creek State Forests (Stillwater Block) and the Swan River State Forest (Figure I-1). Scattered parcels refer to all other HCP project area lands outside of blocked lands (Figure I-1). For the aquatics consultation, we therefore define the action area to include the 39,393,900 million acre planning area of the Final EIS/HCP (2010) depicted on Figure I-1 in Part I of this BO.

The extensive acreage of the planning area compared to the HCP project area is due to the numerous parcels of DNRC lands scattered through western Montana, where proposed actions may generate downstream effects, thus the inclusion of numerous adjacent land ownerships.

The action area consists of four planning area river basins, as described in the Final EIS/HCP (2010): Kootenai, Flathead, Clark Fork - where bull trout, WCT, and RBT are known to occur and the Missouri river basin where WCT are known to occur. These planning area river basins are further classified into 14 aquatic analysis units (AAUs) identified in Table 4.8-4 in the Final EIS/HCP (2010) to coincide with a watershed approach and to follow as closely as possible the analysis units used in the standard approach for jeopardy determinations for bull trout as explained below.

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[1] The Columbia redband trout is also commonly known as the Columbia River redband trout, Interior redband trout, redband trout, and Columbia River interior redband trout and is herein referred to as the Columbia redband trout.

Because the three HCP aquatic species do not occur in every water body throughout the action area (i.e., planning area), we rely on the current distribution of the three individual aquatic HCP fish species to define their occurrence by individual AAU. Bull trout occur in all AAUs except the Missouri River basin (13 out of 14 AAUs); WCT occur in all 14 AAUs; and RBT occur in only 3 AAUs – the Lower, Middle, and Upper Kootenai River AAUs. For the purposes of this part of this BO (Part IV) and to avoid confusion and to simplify our findings especially where we rely on analyses in the Final EIS/HCP (2010), we have grouped all three species into a broadly defined action area.

Most of the action area is forested mountain terrain with highly variable annual streamflows in its rivers, small streams, and headwaters (Final EIS/HCP 2010). Peak flows generally occur May through June from melting snowpack beginning in lower elevations which transition to higher elevation snowmelt accompanied by spring rainfall. Temporary increased flows during summer months can occur on occasion due to thunderstorms or sudden, heavy bursts of rainfall during unstable weather patterns.

The action area encompasses over 75,000 miles of stream habitat, of which about 44,000 stream miles is intermittent stream flow and over 31,000 stream miles are perennial (Final EIS/HCP 2010, Appendix E, Table E4-4). In the action area, stream miles (intermittent or perennial) supporting any HCP fish species is about 11,000 stream miles (about 15 percent). Of the stream miles supporting HCP fish species, about 4,000 stream miles are inhabited by bull trout, 10,000 by WCT, and 311 by RBT (Final EIS/HCP 2010, Appendix E, Table E4-4).

Relationship of Bull Trout Local Populations, Core Areas, and Jeopardy Analyses

Until the Draft Bull Trout Recovery Plan is finalized, the U.S. Fish and Wildlife Service (USFWS) has adopted the use of local population, core area, management unit, and interim recovery unit for purposes of consultation and recovery (USFWS 2002). Table IV-1 illustrates the terms used by the USFWS for purposes of consultation for bull trout, including Part IV of this BO, as well as the hierarchal relationships between these geographical units of analysis.

Table IV-1. Hierarchy of units of analysis for bull trout jeopardy determinations for the DNRC HCP.

Name	Hierarchical Relationship
Columbia River Interim Recovery Unit	One of 5 interim recovery units in the range of the species within the coterminous United States
Clark Fork River and Kootenai River Management Units	Two of 23 management units in the Columbia River Interim Recovery Unit
Core Areas as referenced in the Draft Bull Trout Recovery Plan for the Clark Fork River and Kootenai River Management Units	All of the approximately 32 core areas in the Clark Fork River Management Unit in Montana (adjusted for 4 original core areas consolidated into one - Lower Clark Fork Core Area) and all 4 core areas in Kootenai River Management Unit*
Local populations as referenced in the Draft Bull Trout Recovery Plan for core areas in the Clark Fork River and Kootenai River Management Units	There are an estimated 123 local populations of bull trout in the 32 Core Areas in the Clark Fork River Management Unit in Montana and 10 local populations of bull trout in the 4 core areas of the Kootenai River Management Unit in the U.S.*

* The number of core areas and especially local populations is subject to ongoing adjustment as more is learned about bull trout movement patterns, genetic relationships, and distribution. These numbers reflect the most recent reevaluation made by recovery staff in 2010 but are not officially adopted in a revised recovery plan at this time.

Bull trout core areas represent the closest approximation of a biologically functioning population unit for bull trout and are most often comprised of several local populations, with the exception of those core area populations that occur in isolated lakes that typically have only one spawning and rearing stream. There are 34 bull trout core areas in the Clark Fork River Management Unit (32 in Montana), and 4 in the Kootenai River Management Unit. There are 21 bull trout core areas that are distributed across the DNRC HCP project area (17 in the Clark Fork River Management Unit and 4 in the Kootenai Management Unit) (Final EIS/HCP, Chapter 4, Table 4.8-16). The amount of the bull trout core area comprised of HCP project area ranges from 0.16 to 53.01 percent depending on the distribution of scattered versus blocked lands in the core area. In this part of the BO (Part IV) we describe the current status of the affected bull trout core area populations that occupy the DNRC HCP project area based on the information in the updated bull trout core area templates (USFWS 2009). Bull trout core area templates are working summaries of each core area that reflect the current status, major threats, and population trend of the bull trout core area population and are derived from the gray literature and other scientific/technical information.

Conducting Jeopardy Analyses for Bull Trout

Jeopardy determinations for bull trout are made at the scale of the listed entity, which is the coterminous United States population (64 FR 58910). Jeopardy determinations are made following the April 20, 2006, analytical framework guidance described in the USFWS's

memorandum to Ecological Services Project Leaders in Idaho, Oregon and Washington from the Assistant Regional Director – Ecological Services, Region 1 (Appendix A). The guidance indicates that if an action "impairs or precludes the capacity of a recovery unit from providing both the survival and recovery function assigned to it, that action may represent jeopardy to the species." Within the context of the jeopardy analytical framework, the USFWS uses the hierarchal relationship between units of analysis (i.e., the geographical subdivisions of local populations, core areas, management units and interim recovery units) defined in the Draft Recovery Plan (see Table IV-1) (USFWS 2002) to characterize effects of the proposed action beginning at the lowest level or smallest scale (local population) and then progresses toward the highest level or largest scale (Interim Recovery Unit). The hierarchal relationship between units of analysis is used to determine whether the proposed action is likely to jeopardize the survival and recovery of bull trout. Should the adverse effects of the proposed action not rise to the level where it appreciably reduces both survival and recovery of the species at a lower scale, such as the local or the core population, by deduction the proposed action could not jeopardize bull trout at the higher scale of the coterminous United States (i.e., range-wide). Therefore, the determination would result in a no-jeopardy finding. However, should a proposed action produce adverse effects that are determined to appreciably reduce both survival and recovery of the species at a lower scale of analysis, then further analysis is warranted at the next higher scale.

Jeopardy Analysis for Bull Trout for the DNRC HCP

In the draft recovery plan, the USFWS relied heavily on the importance of the core area population because core areas are the classification units that relate functionally to the survival and recovery of the bull trout (USFWS 2002). The analysis not only focuses on the core area populations within the project area but also on the habitat conditions necessary to support them. Consequently, the USFWS and DNRC concluded that a unit of analysis to determine potential effects to bull trout and its habitat for the Final EIS and for the aquatic section of this BO (Part IV) should correlate to bull trout core areas. Hence, we formulated AAUs for the EIS analysis based on established bull trout core areas. Thirteen of the 14 AAUs (Missouri River is the exception) are based on the bull trout core areas identified in the Draft Bull Trout Recovery Plan and listed in the Final EIS/HCP (2010), Chapter 4, Table 4.8-16. The relationship of the planning area river basins, AAUs, and bull trout core areas is shown in Table IV-2.

The structure of the jeopardy analysis in this part of the BO (Part IV) attempts to follow the organizational hierarchy depicted in Table IV-1 above. However, the analysis of the potential effects of the proposed action begins at the "core area" (i.e., AAU) (rather than at the local population scale) and follows progressively at each higher tier as warranted. Should the analysis of a tier, at or higher than the core area result in a finding of no significant adverse effect (i.e., no jeopardy), no further analysis at the next higher tier in the scale is necessary. In Part IV of this BO, the USFWS evaluated the potential impacts from the proposed action to bull trout and bull trout habitat in the action area (Part I, Figure I-1) beginning at the core area population level. The proposed action is a programmatic plan for 50 years, and it is currently unknown which specific local populations would be affected by future DNRC HCP covered activities, such as a proposed timber sale. For example, timber sale activities are typically developed based on many factors such as market conditions and typically have 3 to 5 year planning horizons. Consequently, at present it's not entirely predictable which specific watersheds will be entered

into within the next 50 years for timber harvest activities. However, it is very likely that during the permit period, DNRC HCP actions would occur at least once in most bull trout core areas. The exception might be an isolated core area lake with very limited DNRC state lands ownership, and therefore could potentially have an influence at the local population scale. However, adverse effects to bull trout at a core area scale are not anticipated because the HCP aquatic mitigation measures were specifically designed to reduce impacts to levels such that effects to bull trout or bull trout habitat would be discountable.

Application of the Jeopardy Standard

Currently, the USFWS applies an analytical framework for bull trout jeopardy analyses that relies heavily on the importance of known core area populations to the species' survival and recovery (USFWS 2002). The analysis required by section 7(a)(2) of the Act is focused not only on these populations, but also on the habitat conditions necessary to support them. Part IV of this BO is intended to determine if the proposed action is likely to jeopardize the continued existence of bull trout (and similarly address other HCP fish species). Implementing regulations for section 7 (50 CFR 402) defines "jeopardize the continued existence of " as "to engage in an action that reasonably would be expected, directly or indirectly, to reduce appreciably the likelihood of both the survival and recovery of a listed species in the wild by reducing the reproduction, numbers, or distribution of that species."

The jeopardy analysis usually expresses the survival and recovery needs of the bull trout in a qualitative fashion without making distinctions between what is necessary for survival and what is necessary for recovery. Generally, the jeopardy analysis focuses on the rangewide status of the bull trout, the factors responsible for that condition, and what is necessary for this species to survive and recover. An emphasis is also placed on characterizing the condition of the bull trout in the area affected by the proposed Federal action and the role of affected populations in the survival and recovery of the bull trout. That context is then used to determine the significance of adverse and beneficial effects of the proposed Federal action and any cumulative effects for purposes of making the jeopardy determination. Core areas form the building blocks that provide for conservation of the bull trout's evolutionary legacy as represented by major genetic groups. The jeopardy analysis also considers any conservation measures that may be proposed by a Federal action agency to minimize or compensate for adverse project effects to the bull trout or to promote its recovery. In this case, the proposed DNRC HCP contains a suite of conservation measures intended to minimize potential impacts. If a proposed Federal action is incompatible with the viability of the affected core area population(s), inclusive of associated habitat conditions, a jeopardy finding may be warranted because of the relationship of each core area population to the survival and recovery of the species as a whole.

Conducting an Analysis of Designated Critical Habitat

The October 18, 2010, Final Rule Designating Critical Habitat for Bull Trout (75 FR 63898) provides guidance that indicates when a proposed action is "incompatible with the viability of the affected core area population(s), inclusive of associated habitat conditions, a jeopardy finding may be warranted, because of the relationship of each core area population to the survival and recovery of the species as a whole." In addition, further guidance is provided in the Director's Memorandum (USDI 2004) (Appendix B), which is in response to litigation on the regulatory

standard for determining whether proposed Federal agency actions are likely to result in the "destruction or adverse modification" of designated critical habitat under section 7(a)(2) of the Act. This memorandum outlines interim measures for conducting section 7 consultations pending the adoption of any new regulatory definition of "destruction or adverse modification." Consequently, Part IV of this BO does not rely on the regulatory definition of "destruction or adverse modification" of critical habitat at 50 CFR 402.02. Instead, the USFWS relied upon the statutory provisions of the Act to complete the following analysis with respect to critical habitat, along with the guidance provided in the Director's Memorandum (USDI 2004) (Appendix B).

The total amount of stream miles of designated critical habitat within the HCP project area (under the October 2010 critical habitat designation) is 85.3 stream miles, or about 2.8 percent of the total amount of critical habitat designated within the EIS planning area. The majority of critical habitat in the HCP project area is concentrated in three AAUs - Stillwater, Swan, and North Fork Flathead.

There is a strong relationship between the Primary Constituent Elements (PCEs) of critical habitat and the "associated habitat indicators" for bull trout, which the USFWS uses to analyze site-specific impacts to the species at the project level. The role of PCEs is explained in more detail in Part IV Section B. The USFWS examines the effects to individual PCEs based on the linkage between the PCEs and associated habitat indicators described in "*Crosswalk between the Bull Trout Matrix of Pathways and Indicators and Primary Constituent Elements of Proposed Critical Habitat*" (referred to as the Crosswalk) (Appendix C) and any other factors pertinent to the project analysis. While assessing the environmental baseline and potential effects to bull trout as a species, the USFWS provides the companion analysis of effects to the PCEs for bull trout critical habitat and related habitat indicators using the Crosswalk.

The Crosswalk analysis shows that the matrix analysis for environmental baseline conditions thoroughly addresses the PCEs for baseline conditions of designated critical habitat for bull trout. In this part of the BO (Part IV), we examine the potential impacts to the relevant PCEs that are anticipated to be affected by covered activities, and this examination of PCEs is based on the specific habitat indicators that are expected to be adversely affected at some point during the Permit term.

Table IV-2. Relationship of terms used by the USFWS for purposes of bull trout consultations and terms used to describe occurrence and distribution of the HCP fish species described in the Final EIS/HCP (2010)

Bull Trout Interim Recovery Unit	Bull Trout Management Unit	Action Area River Subbasins	HCP Aquatic Analysis Units	Bull Trout Core Areas	HCP Fish Species Occurrence by AAU		
					Bull Trout	WCT	RBT
Columbia River	Clark Fork River	Clark Fork River	Bitterroot	Bitterroot River Core Area	X	X	
			Blackfoot	Blackfoot River Core Area	X	X	
			Rock Creek	Rock Creek Core Area	X	X	
			Lower Clark Fork	Lower Clark Fork Core Area	X	X	
			Middle Clark Fork	Middle Clark Fork Core Area	X	X	
			Upper Clark Fork	Upper Clark Fork Core Area	X	X	
		Flathead River	Flathead Lake	Flathead Lake Core Area	X	X	
			North Fork Flathead	North Fork Flathead Core Area	X	X	
			Stillwater River	Stillwater Core Area	X	X	
			Swan River	Swan Core Area	X	X	
	Kootenai River	Kootenai River	Lower Kootenai	Kootenai River / Bull Lake Core Area	X	X	X
			Middle Kootenai		X	X	X
			Upper Kootenai	Lake Koocanusa Core Area	X	X	X
	NA	Missouri River	Upper Missouri	NA		X	

NA – Not Applicable.

Application of the Adverse Modification Standard

The Analytical Framework for Adverse Modification Determinations described in the Director's Memorandum (USDI 2004) is used to complete section 7(a)(2) analysis for Federal actions affecting bull trout critical habitat (Appendix B). The key factor related to the adverse modification determination is whether, with implementation of the proposed Federal action, the affected critical habitat would continue to serve its intended conservation role for the species, or retain those PCEs that relate to the ability of the area to periodically support the species. Activities that may destroy or adversely modify critical habitat are those that alter the PCEs to an extent that appreciably reduces the conservation value of critical habitat for bull trout The role of critical habitat is to support the life-history needs of the species and provide for its conservation by, in general, supporting viable core area populations (75 FR 63898).

Since the primary threat to bull trout from the proposed HCP is habitat degradation, the jeopardy analysis will evaluate the effects of the action on the conservation or functionality of the habitat for the bull trout. Because of this, we believe the analysis of the project to address designated critical habitat will be comparable.

When consulting under section 7(a)(2) in designated critical habitat, independent analyses are conducted for jeopardy to the species and adverse modification of critical habitat. In occupied bull trout habitat, any adverse modification determination would likely also result in a jeopardy determination for the same action. As such, project modifications that may be needed to minimize impacts to the species would coincidentally minimize impacts to critical habitat. Accordingly, in occupied critical habitat it is unlikely that an analysis would identify a difference between measures needed to avoid the destruction or adverse modification of critical habitat from measures needed to avoid jeopardizing the species. Alternatively, in unoccupied critical habitat, we would not conduct a jeopardy analysis; however, measures to avoid the destruction or adverse modification may be necessary to ensure that the affected critical habitat area can continue to serve its intended conservation role for the species, or retain the physical and biological features related to the ability of the area to support the species.

The adverse modification analysis focuses on the rangewide status of critical habitat, the factors responsible for that condition, and what is necessary for critical habitat to provide the necessary conservation value to the bull trout. An emphasis is placed on characterizing the functional condition of critical habitat PCEs in the area affected by the proposed Federal action. This analysis then addresses how the critical habitat PCEs will be affected, and in turn, how this will influence the conservation role of critical habitat units (CHUs) in support of viable core area populations. That context is then used to determine the significance of adverse and beneficial effects of the proposed Federal action and any cumulative effects for purposes of making the adverse modification determination at the rangewide scale. If a proposed Federal action would alter the physical or biological features of critical habitat to an extent that appreciably reduces the conservation function of one or more CHUs for the bull trout, a finding of adverse modification of the entire designated critical habitat for the proposed action may be warranted. The intended purpose of critical habitat to support viable core areas establishes a sensitive scale for relating effects of an action on CHUs or subunits to the conservation function of the entire designated critical habitat.

Section 4(b)(8) of the Act requires us to briefly evaluate and describe, in any proposed or final regulation that designates critical habitat, activities involving a Federal action that may destroy or adversely modify such habitat, or that may be affected by such designation (75 FR 63898). Activities that, when carried out, funded, or authorized by a Federal agency, may affect critical habitat PCEs and therefore result in consultation for the bull trout include, but are not limited to:

1. Detrimental alteration of the minimum flow or the natural flow regime of any of the designated stream segments. Possible actions would include groundwater pumping, impoundment, water diversion, and hydropower generation. We note that such flow alterations resulting from actions affecting tributaries of the designated stream reaches may also destroy or adversely modify critical habitat.

2. Alterations to the designated stream segments, as well as alterations to non-designated areas that could directly or indirectly cause significant and detrimental effects to bull trout critical habitat. Possible actions include vegetation manipulation, timber harvest, road construction and maintenance, prescribed fire, livestock grazing, off-road vehicle use, power line or pipeline construction and repair, mining, and development. Riparian vegetation profoundly influences instream habitat conditions by providing shade, organic matter, root strength, bank stability, and large woody debris inputs to streams. These characteristics influence water temperature, structure and physical attributes (useable habitat space, depth, width, channel roughness, cover complexity), and food supply.

3. Detrimental altering of the channel morphology of any of the designated stream segments. Possible actions would include channelization, impoundment, road and bridge construction, deprivation of substrate source, destruction and alteration of aquatic or riparian vegetation, reduction of available floodplain, removal of gravel or floodplain terrace materials, excessive sedimentation from mining, livestock grazing, road construction, timber harvest, off-road vehicle use, and other watershed and floodplain disturbances. We note that such actions in the upper watershed (beyond the riparian area) may also destroy or adversely modify critical habitat. For example, timber harvest activities and associated road construction in upland areas can lead to changes in channel morphology by altering sediment production, debris loading, and peak flows.

4. Detrimental alterations to the water chemistry in any of the designated stream segments. Possible actions would include release of chemical or biological pollutants into the surface water or connected groundwater at a point source or by dispersed release (nonpoint).

5. Proposed activities that are likely to result in the introduction, spread, or augmentation of nonnative species in any of the designated stream segments. Possible actions would include fish stocking, use of live bait fish, aquaculture, improper construction and operation of canals, and inter-basin water transfers.

6. Proposed activities that are likely to create significant instream barriers to bull trout movement. Possible actions would include water diversions, impoundments, and hydropower generation where effective fish passage facilities, mechanisms, or procedures are not provided.

Covered Activities

The DNRC management activities that are addressed in the proposed HCP as covered activities are listed in the Final EIS/HCP (2010), Chapter 1, and in greater detail in Appendix A, Final HCP, Chapter 1. These activities are also described in Part I Section A of this BO.

Commitments for the HCP Aquatic Species

The biological goal of the HCP for aquatic species is to protect bull trout, WCT, and RBT populations and their habitat and to contribute to habitat restoration or rehabilitation, as

appropriate, which may have been affected by past DNRC forest management activities. Five target objectives were formulated to achieve the biological goal identified for the three HCP fish species:

- Manage for suitable stream temperature regimes.
- Manage for suitable in-stream sedimentation levels.
- Manage for suitable levels of in-stream habitat complexity.
- Maintain stream channel stability and channel form and function.
- Provide for connectivity among sub-populations of bull trout, WCT, and RBT where appropriate on HCP project area lands.

The DNRC HCP five aquatic conservation strategies address riparian conditions (including large woody debris [LWD], shade, and stream temperature), sediment, connectivity, grazing, and cumulative watershed effects and in combination, the five strategies address all five of the management objectives (Table IV-3). These HCP conservation strategies and associated commitments are intended to maintain the existing baseline habitat conditions where conditions are suitable for HCP fish species, and improve the habitat functions for the affected species where habitat conditions are at-risk or degraded. In addition, the HCP would minimize and mitigate the effects of incidental take of these HCP fish species should it occur. The actual commitments to be implemented by DNRC are described in detail in Section D (below) and summarized below with respect to aquatic species.

Riparian Timber Harvest Commitments

The commitments comprising this strategy were designed to retain important riparian functions such that they continue to provide suitable habitat for HCP fish species. Important riparian functions specifically addressed in this strategy are LWD recruitment, stream shading, and streambank stability. These commitments include a provision for a 50-foot, no-harvest buffer along Class 1 streams. Where channel migration is likely to influence riparian functions that are potentially affected by a timber harvest, DNRC would apply additional measures such as greater tree retention, wider streamside management zones, and no harvest restrictions to protect those functions.

Sediment Delivery Reduction Commitments

The HCP sediment delivery reduction conservation strategy was designed to meet three specific management objectives for HCP fish species: 1) reduce the potential for in-stream sedimentation levels, 2) manage for levels of in-stream habitat complexity, and 3) maintain stream channel stability and channel form and function. This is primarily achieved by commitments that:

- Minimize forest management roads on the landscape
- Construct, reconstruct, maintain, abandon, reclaim, and use roads with practices and measures that reduce the risk of sediment delivery to streams supporting HCP fish species.

- Inventory and identify problem sediment sites and subsequently prioritize and correct these sites.

- Conduct timber harvest and associated operations (site preparation, slash treatment, reforestation) with practices and measures that reduce the risk of sediment delivery to streams supporting HCP fish species.

Table IV-3. Aquatic conservation strategies and corresponding management objectives.

Management Objective	Riparian Function	Sediment Reduction	Habitat Connectivity	Grazing Impacts	Minimize Cumulative Watershed Effects
Suitable Stream Temperature	X	X		X	X
Suitable Stream Sedimentation	X	X		X	X
In-Stream Habitat Complexity	X	X		X	X
Maintain Channel Stability, Form and Function	X	X	X	X	X
Subpopulation Habitat Connectivity			X		X

Fish Connectivity Commitments

This strategy addresses barriers to HCP fish species that prevent or impede fish migration upstream or downstream, specifically at road-stream crossings. DNRC has already identified approximately 106 fish passage culvert barriers in the HCP project area. The conservation commitments in this strategy require DNRC to continue its inventory activities, initiate a prioritization system, and set target rates for improving connectivity. Once all sites are prioritized, DNRC is required to provide connectivity of adult and juvenile HCP fish species during low to bankfull flows at all high-priority sites within the first 15 years that the HCP and Permit are in effect and for all other barriers within the first 30 years.

Grazing Commitments

Under this strategy, DNRC will follow its existing grazing inspection and monitoring program as a coarse filter to identify potential problem areas. The new concepts developed under this strategy focus on an inspection process and timeline for defining acceptable levels of livestock use and impact, verification and prioritization of problems that will affect HCP fish species, development and implementation of corrective actions to decrease effects on HCP fish species, and follow-up with implementation and effectiveness monitoring.

Cumulative Watershed Effects Commitments

The cumulative watershed effects (CWE) strategy builds upon DNRC practices outlined in its Forest Management ARMs. The CWE strategy incorporates conservation commitments for the implementation of a screening process, whereby CWE from covered activities will be identified

prior to the occurrence of an activity. This will allow DNRC time and opportunity to further analyze the potential for CWE, implement management mitigations, and/or develop project alternatives to eliminate or minimize potential CWE on HCP fish species or their habitat.

Monitoring and Adaptive Management Commitments

Implementation monitoring for the aquatic commitments is described in the Final EIS/HCP (2010), Appendix A (HCP), Chapter 4: Table 4-6. Effectiveness monitoring and the adaptive management program is described in detail in the Final EIS/HCP (2010), Appendix A (HCP), Chapter 4 and summarized below.

Riparian Timber Harvest Monitoring and Adaptive Management

To evaluate the effectiveness of the riparian timber harvest conservation strategy at (1) providing adequate levels of LWD recruitment, (2) maintaining adequate levels of in-stream shade, and (3) maintaining in-stream temperature regimes suitable to support the HCP fish species, DNRC will conduct monitoring on a representative number of sites where Class 1 RMZ conservation strategies are implemented. Effectiveness monitoring commitments are summarized in the Final EIS/HCP (2010), Appendix A (HCP), Chapter 4: Table 4-7. Appendix A, Chapter 4 of the HCP also describes an adaptive management program that DNRC will implement in the event that the riparian timber harvest strategy does not meet its objectives.

Sediment Reduction Monitoring and Adaptive Management

To evaluate the effectiveness of the sediment reduction strategy, DNRC will have two ongoing quantitative sediment monitoring projects to determine the effectiveness of BMPs and other mitigation measures. DNRC will use case studies to evaluate the effectiveness of corrective actions implemented on problem segments of existing roads in reducing sediment production. In these studies DNRC will model sediment production for problems road segments both prior to and following implementation of corrective actions. Model outputs will be used to quantify sediment and determine whether the percentage sediment reduction targets are being met. The information collected in the case studies and site-specific quantitative monitoring projects will be extrapolated across the broader project area to estimate progress and ensure the achievement in meeting the sediment reduction targets across the entire HCP project area. If the sediment reduction objectives are not met, DNRC would revise or create new BMPs and report the changes to the USFWS through the adaptive management program.

Fish Connectivity Monitoring and Adaptive Management

The fish connectivity strategy monitoring will include qualitative assessments of the structure's capabilities to accommodate background ranges of different stream forms and functions. The monitoring schedule will include the following: (1) a post-construction assessment within 2 years by a DNRC water resource specialist; (2) a subsequent post-construction assessment of CMP installations within 5 years following the first post-construction assessment; and (3) post-construction assessments of all other installations (non-corrugated metal pipe [CMP]) within 10 years following the first post-construction assessment (4) stream crossing structures facilitating bull trout, WCT, or RBT connectivity will be evaluated for damage after experiencing a known 25-year or greater flood event. The adaptive management program for

connectivity would address failed installations as well as ongoing updates to the priority list and accepted methods for culvert installations.

Grazing Monitoring and Adaptive Management

For grazing sites where corrective actions have been implemented, the grazing strategy requires DNRC to verify that the changes have been implemented appropriately and to conduct effectiveness monitoring to confirm that the corrective actions are having the desired effect. During verification, DNRC will determine the effectiveness of corrective actions, newly implemented practices, and/or a new grazing strategy based on thresholds established for the corrective action, practices or strategy at the time of prescription. If improvements or changes to grazing management are determined to be ineffective in correcting problems, DNRC will, through the adaptive management program: 1) adjust the permittee license to facilitate progress toward meeting the corrective action objectives, and 2) continue annual effectiveness monitoring until improvements are verified to be effective.

Recently, redds trampling by cattle has been identified as a potential issue of concern in the HCP project area. The prevalence and severity of redds trampling by cattle on HCP project area lands is unknown (Final EIS/HCP 2010, Appendix A (HCP), Chapter 4, Section 4.6.4). Therefore, under the HCP, DNRC will initiate a pilot study to determine if this impact on HCP fish species is occurring in the HCP project area. If redds trampling by cattle is identified as an issue for HCP fish species in the HCP project area, DNRC and the USFWS will collaborate, under the adaptive management program, on the development of appropriate conservation commitments to address any concerns raised by the study.

Cumulative Watershed Effects Monitoring and Adaptive Management

Monitoring and adaptive management for the CWE commitments will primarily consist of annual updates to the USFWS on all CWE conservation strategy implementation activities and issues including a list of all CWE implementation activities such as number, type, and location of CWE analyses completed. Every 5 years, the USFWS and DNRC will meet to evaluate the effectiveness of the CWE process. The 5-year monitoring meeting will serve as a coordination effort to ensure that DNRC is providing adequate levels of mitigation for CWE. Through this process the CWE commitments may be changed based on emerging science or agreement by both parties.

Changed Circumstances Commitments

The DNRC HCP describes three categories of natural disturbance events as changed circumstances for aquatic species: fire, insect or disease outbreaks, or wind events; mass movements, and floods. DNRC's response to each type of event is described below.

Fire, Insect or Disease Outbreaks, or Wind Events

When a fire, insect outbreak, or wind event occurs on trust lands, DNRC is typically required to respond in accordance with Montana Code Annotated Section 77-5-207 Salvage Timber Program, which provides for the timely salvage logging of dead and dying timber that is threatened by insects, disease, fire, or windthrow. At times, these harvests are emergency situations requiring an accelerated schedule, but more commonly they are processed as a timber

sale within the usual timelines of the DNRC Montana Environmental Policy Act (MEPA) process. DNRC conducts a MEPA analysis for all salvage projects typically ranging from an environmental checklist to an environmental assessment, and develops site-specific measures to reduce or mitigate project effects on wildlife and aquatic species when warranted.

When conducting a salvage harvest, DNRC would apply the HCP commitments unless conditions render a commitment impracticable. If a commitment cannot practicably be applied, DNRC would document the circumstances in the MEPA analysis and potentially implement alternative measures if warranted.

The triggers for changed circumstances for aquatic species related to fire, insect or disease outbreaks, or wind events are described in the Final EIS/HCP (2010), Appendix A, Chapter 6. Following the event, DNRC will conduct a project-level assessment, including an evaluation of RMZ conditions, roads, stream crossing structures, and hillslope stability. In coordination with the USFWS, DNRC will identify problem areas and develop, prioritize, and propose a schedule for the mitigation measures to address the problems. Within the contingency plan, DNRC will develop site-specific BMPs, corrective actions, or harvest prescriptions to address the problems identified. Potential site-specific minimization and mitigation measures may include, but are not limited to:

- Modified RMZ harvest prescriptions
- Replacement of undersized culverts
- Measures to address potential erosion and/or hillslope instability, such as contour felling, seeding, planting, or waddle installation
- Road improvements to address increased surface runoff (installing more drainage features)
- Review and potential adjustment of existing grazing licenses.

<u>Mass Movements</u>
The triggers for changed circumstances for aquatic species related to mass movements are described in the Final EIS/HCP (2010), Appendix A, Chapter 6. When an event occurs, DNRC will complete a field assessment of the mass movement within 30 days of becoming aware of the event. (If weather or ground conditions do not allow access to the site, the field assessment will be completed as soon as conditions allow). During the post-disturbance assessment, DNRC will:

- Document the size of the mass movement.
- Determine the sediment delivery potential (i.e., delivery has occurred or is likely to occur before deposited material stabilizes).

- Assess the risks to HCP aquatic species and habitat, (i.e., probability of detrimental impacts occurring, the type of aquatic habitat at risk, and the extent, duration, and magnitude of the impact or potential impact).

- Identify the possible cause or activity that may have contributed to the mass movement and make a determination if the cause was related to DNRC's forest management activities.

For mass movements determined to be caused by DNRC's forest management activities, DNRC will develop a contingency plan that identifies opportunities to reduce or eliminate ongoing or potential impacts resulting from the event. If the mass movement has been determined to be a natural event not associated with DNRC forest management activities, DNRC would consider participating in cooperative restoration projects as funding and resources are available.

Floods

The triggers for changed circumstances for aquatic species related to floods are described in the Final EIS/HCP (2010), Appendix A, Chapter 6. When DNRC determines a flood-related changed circumstance has been triggered DNRC will notify the USFWS. DNRC will complete a field assessment of the flood site as soon as field conditions allow or within 6 months to confirm that a changed circumstance has been triggered, unless an alternative schedule is agreed to with the USFWS. DNRC will invite the USFWS to participate in the field assessment. In developing the contingency plan, DNRC will follow the procedures outlined in the aquatic conservation strategies and expedite the inventory (or re-inventory) of roads and stream crossings within the affected area, and update the sites identified in need of corrective actions (road repair and/or culvert repair or replacement) due to high risk of sediment delivery from the changed circumstance.

Climate Change

New research and guidance materials related to the future management of state forests in light of climate change and potential effects of climate change on HCP fish species and their habitats will be a topic of discussion as necessary between DNRC and the USFWS at scheduled annual updates. Both parties will work together to develop appropriate responses to new research or guidance materials regarding the impacts of climate change on forest management and/or potential mitigation and minimization measures for HCP fish species. If over time, new research shows that the effects of incidental take have increased due to climate change or the HCP fish species are changing their habitat use, food base, or other biological needs in response to climate change such that the covered activities are affecting these new conditions, both parties would address these concerns through the administrative changed circumstances process described below (Final EIS/HCP 2010, Appendix A, Chapter 4, Section 4.1.2, 4.1.3, 4.2.3). Some examples of potential responses to the effects of climate change on the HCP fish species include:

- Adjusting timing restrictions for certain covered activities based on changes in seasons of use of certain habitats by the HCP fish species,

- Prioritizing corrective actions in specific watersheds deemed critical to the recovery and survival of the HCP fish species.

Administrative Changes

The USFWS and DNRC also acknowledge that administrative changes may occur over the permit term. Administrative changes may include changes in listing status of a fish species (e.g., listing of WCT) and/or termination of the Swan Agreement.

When an administrative change occurs that may affect HCP fish species or their habitats, the USFWS will notify DNRC, and both parties will cooperatively develop a course of action to address the issues raised by the changed circumstance.

B. STATUS OF THE SPECIES/CRITICAL HABITAT

Status of the Species/Critical Habitat – Bull Trout

Listing History

In June 1998, the USFWS published the final rule listing the Klamath River and Columbia River distinct population segments (DPS) as threatened (USFWS 1998a), with an effective date of July 10, 1998. In November 1999, the USFWS published a rule listing all populations of bull trout as threatened throughout its range in the coterminous United States (USFWS 1999a), with an effective date of December 1, 1999. This coterminous listing effectively eliminated the separate DPS designations within the United States. However, the rule states that: "for the purposes of consultation and recovery, we recognize these five DPSs as interim recovery units." For the remainder of this analysis, we will refer to the species, and not the DPS, as the listed entity, although we will present status information for the five populations of bull trout, particularly the Columbia River population, since that is the population of bull trout affected by Part IV of this BO.

Many terms have been used to describe and categorize bull trout populations. At the time of the listings, the assessment of the status of bull trout and its threats was reported by subpopulation. The USFWS identified 187 subpopulations range-wide in the Columbia, Klamath, Jarbidge, St. Mary-Belly Rivers and the Coastal-Puget Sound. During the recovery planning process beginning in 2002, new information on fish movement supported refining the delineation of the 187 subpopulations into 121 bull trout core areas (USFWS 2002).

As mentioned above, the coterminous United States population of the bull trout was listed as threatened on November 1, 1999 (64 FR 58910). The threatened bull trout occurs in the Klamath River Basin of south-central Oregon and in the Jarbidge River in Nevada, north to various coastal rivers of Washington to the Puget Sound and east throughout major rivers within the Columbia River Basin to the St. Mary-Belly River, east of the Continental Divide in northwestern Montana (Cavender 1978, Bond 1992, Brewin and Brewin 1997, Leary and Allendorf 1997).

Throughout its range, the bull trout is threatened by the combined effects of habitat degradation, fragmentation and alterations associated with: dewatering, road construction and maintenance, mining, and grazing; the blockage of migratory corridors by dams or other diversion structures; poor water quality; incidental angler harvest; entrainment (a process by which aquatic organisms

are pulled through a diversion or other device) into diversion channels; and introduced non-native species (64 FR 58910).

The bull trout was initially listed as three separate DPSs (63 FR 31647, 64 FR 17110). The preamble to the final listing rule for the United States coterminous population of the bull trout discusses the consolidation of these DPSs, plus two other population segments, into one listed taxon and the application of the jeopardy standard under section 7 of the Act relative to this species (64 FR 58930):

Although this rule consolidates the five bull trout DPSs into one listed taxon, based on conformance with the DPS policy for purposes of consultation under section 7 of the Act, we intend to retain recognition of each DPS in light of available scientific information relating to their uniqueness and significance. Under this approach, these DPSs are treated as interim recovery units with respect to application of the jeopardy standard until an approved recovery plan is developed. Formal establishment of bull trout recovery units will occur during the recovery planning process.

Thus, as discussed above in Section A, the USFWS's jeopardy analysis for the proposed DNRC HCP will involve evaluation of effects on the bull trout at increasingly higher hierarchical scales including the Columbia River Interim Recovery Unit in the DPS final listing rule cited above, which is herein incorporated by reference. However, in accordance with USFWS national policy, the jeopardy determination is made at the scale of the listed species. In this case, that is the coterminous U.S. population of the bull trout.

Taxonomy

The bull trout (*Salvelinus confluentus*, family Salmonidae) is a char native to the Pacific Northwest and western Canada, first described as *Salmo spectabilis* by Girard in 1856 from a specimen collected on the lower Columbia River, and subsequently described as *Salmo confluentus* and *Salvelinus malma* (Cavender 1978). Bull trout and Dolly Varden (*Salvelinus malma*) were previously considered a single species (Cavender 1978, Bond 1992). Cavender (1978) presented morphometric, meristic, osteological, and distributional evidence to document specific distinctions between Dolly Varden and bull trout. Bull trout and Dolly Varden were formally recognized as separate species by the American Fisheries Society in 1980 (Robins et al.. 1980). Although bull trout and Dolly Varden co-occur in several northwestern Washington river drainages, there is little evidence of introgression (Haas and McPhail 1991), and the two species appear to be maintaining distinct genomes (Leary et al. 1993, Kanda et al. 1997, Spruell and Allendorf 1997). Lastly, the bull trout and the Dolly Varden each appear to be more closely related genetically to other species of *Salvelinus* than they are to each other (Grewe et al.. 1990, Pleyte et al. 1992, Crane et al. 1994, Phillips et al. 1995). For example, the bull trout is most closely related to the white-spotted char (*S. leucomaenis*) of Japan, whereas the Dolly Varden is most closely related to the Arctic char (*S. alpinus*).

Species Description

The bull trout is a long slender fish with a large head and jaws relative to its body-size. Its tail fin is only slightly forked, and even less so in young fish. Bull trout coloration can be variable,

but generally, the body's background color is gray infused with green. Bull trout found in lakes may be silvery grey. The body is covered with small white and/or pale yellowish spots with intermingling pink or red spots that may not always be present. The ventral region can range from white to orange (during spawning). Bull trout typically have 15-19 gill rakers, 63-66 vertebrae, and 22-35 pyloric caeca. Bull trout have no spots on their fins and the lower fins typically have white anterior borders. The spotless fin characteristic of bull trout is often used to help promote angler identification of bull trout (i.e., "No Black, Put It Back") versus other fish, such as brook trout (*Salvelinus fontinalis*) (Benke 2002).

Life History

Bull trout exhibit both resident and migratory life-history strategies (Rieman and McIntyre 1993). Resident bull trout complete their entire life cycle in the tributary (or nearby) streams in which they spawn and rear. Migratory bull trout spawn in tributary streams where juvenile fish rear one to four years before migrating to either a lake (adfluvial form), river (fluvial form) (Fraley and Shepard 1989, Goetz 1989), or in certain coastal areas, to saltwater (amphidromous form) (Cavender 1978, McPhail and Baxter 1996). Resident and migratory life-history forms may be found together (Rieman and McIntyre 1993). Either form may give rise to offspring exhibiting either resident or migratory behavior (Rieman and McIntyre 1993) hence life history form appears to be an adaptive strategy, rather than a genetic trait. The evolutionary history of bull trout indicates that as an apex predator species the migratory life form was a highly successful strategy (Whitesel et al. 2004). Migratory bull trout have the advantage of greater growth due to access to more productive waters, greater fecundity resulting in increased reproductive potential, and dispersing the population across space and time so that spawning streams may be recolonized should local populations suffer a catastrophic loss (USFWS 2008a). The multiple life-history strategies found in bull trout populations represent important layers of diversity that help protect these populations from environmental stochasticity.

The size and age of bull trout at maturity depends upon the life-history strategy and habitat limitations. Resident fish tend to be much smaller than migratory fish at maturity and produce fewer eggs (Fraley and Shepard 1989, Goetz 1989). Resident adults usually range from 150 to 300 millimeters (6 to 12 inches) total length (TL). Migratory adults, generally having lived for several years in larger rivers or lakes and feeding on other fish, commonly reach 600 millimeters (24 inches) TL or more (Pratt 1985, Goetz 1989). The largest verified angler-caught bull trout was a 14.6-kilogram (32-pound) adfluvial fish caught in Lake Pend Oreille, Idaho, in 1949 (Simpson and Wallace 1982). Size differs little between life-history forms during their first years of life in headwater streams, but diverges as migratory fish move into larger and more productive waters (Rieman and McIntyre 1993).

Ratliff (1992) reported that bull trout under 100 mm (4 inches) in length were generally only found in the vicinity of spawning areas, and that fish over 100 mm may be found downstream in larger channels and reservoirs in the Metolius River Basin. Juvenile migrants in the Umatilla River were primarily 100-200 mm long (4 to 8 inches) in the spring and 200-300 mm long (8 to 12 inches) in October (Buchanan et al. 1997). The age at migration for juveniles is variable. Ratliff (1992) reported that most juveniles reached a size to migrate downstream at age 2, with some at ages 1 and 3 years. Pratt (1992) had similar findings for age-at-migration of juvenile

bull trout from tributaries of the Flathead River. The seasonal timing of juvenile downstream migration appears similarly variable.

Spawning and Rearing

Bull trout normally reach sexual maturity in 4 to 7 years and may live longer than 12 years. The species is iteroparous (i.e., can spawn multiple times in their lifetime) and adults may spawn each year or in alternate years (Batt 1996). Frequency of repeat spawning and rates of post-spawning mortality are not well documented (Leathe and Graham 1982, Fraley and Shepard 1989, Pratt 1992, Rieman and McIntyre 1996), but post-spawn survival rates are typically believed to be high.

Bull trout in a given area typically spawn over a period of a couple of weeks in a window from late August to November, during periods of decreasing water temperatures (threshold below 9 degrees Celsius [°C] 48 degrees Fahrenheit[°F]). Redds are often constructed in stream reaches fed by springs or near other sources of cold groundwater (Goetz 1989, Pratt 1992, Rieman and McIntyre 1996). Migratory bull trout frequently begin spawning migrations as early as April and have been known to move upstream as far as 250 kilometers (km) (155 miles) to spawning grounds in Montana (Fraley and Shepard 1989, Swanberg 1997). In Idaho, bull trout moved 109 km (67.5 miles) from Arrowrock Reservoir to spawning areas in the headwaters of the Boise River (Flatter 1998). In the Blackfoot River, Montana, bull trout began spring spawning migrations in response to increasing temperatures (Swanberg 1997). Depending on water temperature, egg incubation is normally 100 to 145 days (Pratt 1992), and after hatching, juveniles may remain in the substrate for an extended period. Time from egg deposition to emergence of fry may surpass 220 days. Fry normally emerge from early April through May, depending on water temperatures and stream flow conditions (Pratt 1992, Ratliff and Howell 1992).

Food Habits

Bull trout are opportunistic feeders, with food habits primarily a function of size and life-history strategy. Resident and juvenile migratory bull trout prey on terrestrial and aquatic insects, macro-zooplankton, and small fish (Boag 1987, Goetz 1989, Donald and Alger 1993). Adult bull trout of the migratory forms are highly piscivorous and opportunistic, feeding on a wide variety of available fish species (Leathe and Graham 1982, Fraley and Shepard 1989, Brown 1992, Donald and Alger 1993, Lowery 2009).

Habitat Requirements

Bull trout have more specific habitat requirements than most other salmonids (Rieman and McIntyre 1993). Habitat components that influence the species' distribution and abundance include water temperature, cover, channel form and stability, valley form, spawning and rearing substrate, and availability of migratory corridors (Fraley and Shepard 1989; Goetz 1989; Hoelscher and Bjornn 1989; Sedell and Everest 1991; Howell and Buchanan 1992; Pratt 1992; Rieman and McIntyre 1993, 1995; Rich 1996; Watson and Hillman 1997). Watson and Hillman (1997) concluded that watersheds must have specific physical characteristics to provide the habitat requirements necessary for bull trout to successfully spawn and rear and that these specific characteristics are not necessarily present throughout these watersheds. Because bull

trout exhibit a patchy distribution, even in pristine habitats (Rieman and McIntyre 1993), individuals of this species should not be expected to simultaneously occupy all available habitats (Rieman et al.1997).

Bull trout are found primarily in cold streams, although individual fish may be found migrating or foraging in larger, warmer river systems throughout the Columbia River basin (Fraley and Shepard 1989; Rieman and McIntyre 1993, 1995; Buchanan and Gregory 1997; Rieman et al. 1997a). Water temperature above 15°C (59°F) is believed to generally limit distribution of juvenile bull trout, a factor that partially explains their patchy distribution within many watersheds (Fraley and Shepard 1989, Rieman and McIntyre 1995). Rieman and McIntyre (1995) found in the Boise River Basin that no juvenile bull trout were present in streams below 1,613 meters (5,000 feet). Similarly, in the Sprague River basin of south-central Oregon, Ziller (1992) found in four streams with bull trout that "numbers of bull trout increased and numbers of other trout species decreased as elevation increased. In those streams, bull trout were only found at elevations above 1,774 meters [5500 feet]."

Spawning areas are often associated with areas of cold-water upwelling or groundwater infiltration, and typically in the streams with the coldest summer water temperatures in a given watershed (Pratt 1992, Rieman and McIntyre 1993, Rieman et al. 1997a, Baxter et al. 1999). In these streams, the upwelling often provides constant cold, but ice-free conditions during the winter incubation period. Water temperatures during spawning generally range from 5 to 9°C (41 to 48°F) (Goetz 1989).

Goetz (1989) suggested optimum water temperatures for rearing bull trout of about 7 to 8 degrees Celsius (44 to 46°F) and for egg incubation of 2 to 4 degrees Celsius (35 to 39 degrees Fahrenheit). For Granite Creek, Idaho, Bonneau and Scarnecchia (1996) observed that juvenile bull trout selected the coldest water [8 to 9°C (46 to 48°F), within a temperature gradient of 8 to 15°C (46 to 60 °F)] available.

In Nevada, adult bull trout have been collected at sites with water temperature as high as 17.2°C (63°F) in the West Fork of the Jarbidge River (S. Werdon, USFWS, pers. comm., 1998) and have been observed in Dave Creek where maximum daily water temperatures were 17.1 to 17.5°C (62.8 to 63.6°F) (Werdon, in litt. 2001). In the Little Lost River, Idaho, bull trout have been collected in water having temperatures up to 20°C (68°F); however, these fish made up less than 50 percent of all salmonids when maximum summer water temperature exceeded 15°C (59°F) and less than 10 percent of all salmonids when temperature exceeded 17°C (63°F) (Gamett 1999).

All life-history stages of bull trout are associated with complex forms of cover, including large woody debris, undercut banks, boulders, and pools (Fraley and Shepard 1989, Goetz 1989, Hoelscher and Bjornn 1989, Sedell and Everest 1991, Pratt 1992, Thomas 1992, Rich 1996, Sexauer and James 1997, Watson and Hillman 1997). Jakober (1995) observed bull trout overwintering in deep beaver ponds or pools containing large woody debris in the Bitterroot River drainage, Montana, and suggested that, because of the need to avoid anchor ice in order to survive, suitable winter habitat may be more restricted than summer habitat. Juvenile and adult

bull trout frequently inhabit side channels, stream margins, and pools with suitable cover (Sexauer and James 1997). These areas are sensitive to activities that directly or indirectly affect stream channel stability and alter natural flow patterns. For example, altered stream flow in the fall may disrupt bull trout during the spawning period, and channel instability may decrease survival of eggs and young juveniles in the gravel from winter through spring (Fraley and Shepard 1989, Pratt 1992, Pratt and Huston 1993).

Preferred bull trout spawning habitat consists of low-gradient stream reaches with loose, clean gravel (Fraley and Shepard 1989). In the Swan River, Montana, abundance of bull trout redds (spawning areas) was positively correlated with the extent of bounded alluvial valley reaches, which are likely areas of groundwater to surface water exchange (Baxter et al. 1999). In one study, survival of bull trout embryos planted in stream areas of groundwater upwelling used by bull trout for spawning were significantly higher than embryos planted in areas of surface-water recharge not used by bull trout for spawning (Baxter and McPhail 1999). Pratt (1992) indicated that increases in fine sediment reduced egg survival and emergence.

Migratory corridors link seasonal habitats for all bull trout life-history forms. For example, in Montana, migratory bull trout make extensive migrations in the Flathead River system (Fraley and Shepard 1989), and resident bull trout in tributaries of the Bitterroot River move downstream to overwinter in tributary pools (Jakober 1995). The ability to migrate is important to the persistence of bull trout (Rieman and McIntyre 1993, Rieman et al. 1997a). Migrations facilitate gene flow among local populations. Local bull trout populations that are extirpated by catastrophic events may also become re-established by migrants.

Population Dynamics

Although bull trout are widely distributed over a large geographic area, they exhibit a patchy distribution, even in pristine habitats (Rieman and McIntyre 1993). Increased habitat fragmentation reduces the amount of available habitat and increases isolation from other populations of the same species (Saunders et al. 1991). Burkey (1989) concluded that when species are isolated by fragmented habitats, low rates of population growth are typical in local populations and their probability of extinction is directly related to the degree of isolation and fragmentation. Without sufficient immigration, growth for local populations may be low and probability of extinction high (Burkey 1989, 1995).

Rieman and McIntyre (1993) assert that the characteristics of bull trout populations are consistent with the metapopulation concept, but that bull trout metapopulation structure is not well understood. Their viability analysis supports the conclusion that regional persistence of bull trout depends on the maintenance of multiple local populations. They mention that it is unlikely most local populations are actually independent of others and that climatic events would cause changes in adjacent local populations which in turn would exchange individuals to support or refound each other. Populations close to each other would likely decline together, and those too far apart would likely exchange individuals too rarely to rescue each other.

Recent research suggests that there may be more complexity to these metapopulations than originally thought (Whitesel et al. 2004). Dunham et al. (2002), reviewing data from bull trout

and Lahontan cutthroat trout, imply that simple metapopulation models, such as patch or island (including Levins-type) models, are often inappropriate for freshwater salmonids. Studies Dunham et al. cite have found that patch area appears to be a significant correlate of species occurrence. Patch size tends to be related to fish occurrence, perhaps because habitats in larger patches may be more complex and resilient to disturbance and should generally support larger populations. Rieman and McIntyre (1995), using multiple logistic regression, found patch area to be the strongest predictor of occurrence of bull trout in the Boise River Basin. Other significant factors included patch isolation (stream distance between occupied patches) and road density within patches, both inversely related to occurrence (Dunham and Rieman 1999). Dunham and Rieman (1999) suggest that some recolonization occurs at broad scales, and that the few large patches in the Boise River basin may serve as important sources of bull trout for recolonization of unoccupied habitat.

These studies provide support for the idea that a drainage scale aggregation of local populations is unlikely to be a panmictic group, thus meeting one key criterion for being a metapopulation (Whitesel et al. 2004). Some investigators have cautioned against taking literally absolute migration rate estimates extrapolated from genetic frequency data, because the model used requires assumptions that are often biologically unrealistic (Whitlock and McCauley 1999).

Evidence regarding patterns of gene flow is generally lacking in bull trout, but patterns of disturbance and evidence of recolonization (e.g., in the Lightning Creek system) suggest episodic gene flow occurs in at least some cases. Kanda and Allendorf (2001) used samples of mitochondrial and microsatellite DNA from juvenile bull trout to examine the population structure of bull trout populations in the Flathead River basin of Montana and British Columbia. They found that both types of DNA revealed substantial genetic differences among local populations and that most of these were attributable to differentiation within drainages. They also found no relationships between relative genetic similarity of the samples and geographic proximity. Kanda and Allendorf (2001) contend that their work suggests that little gene flow has occurred among the populations they examined, even over short geographic distances, and that the populations have been highly isolated reproductively. However, they also note that recent demographic declines may lead to loss of genetic variation through drift, which may either increase or decrease population differentiation and hence mask the effects of historical gene flow among the populations. They assert that the within-population levels of DNA diversity suggest that a metapopulation model with frequent local extinctions and recolonizations does not seem applicable to the populations in their study area, but that long-term persistence of this species requires maintenance of existing local population structure.

Costello et al. (2003) examined patterns of variation in microsatellite DNA in British Columbia and gathered information on environmental variables at watershed and site specific scales to test if any were associated with differences among sites in genetic variation. They found that barriers segregating habitats within individual streams are important factors in organizing localized patterns of genetic barriers in bull trout. In all regions, the smallest genetic distances were between populations isolated above a common migration barrier, and the greatest distances were between populations isolated above different barriers (Whitesel et al. 2004). Similar findings were made by Meeuwig et al. (2010) working in Glacier National Park, Montana, where differentiation between bull trout populations was linked to landscape features that restrict

dispersal. Additionally Meeuwig et al. (2010) concluded the framework used for evaluating the effects of barriers must consider not just barrier presence, but also potential asymmetries in barrier effects (i.e., one-way vs two-way effects of barriers). Combined analysis of environmental and spatial components indicated that the spatial component was the more powerful descriptor of the genetic variation observed by both researchers. Costello et al. (2003) suggest the combination of low within population variation and high levels of inter-population differentiation observed in bull trout is consistent with what would be expected if alleles are drawn from one (or a few) of a series of possible source populations during recolonization of vacant (recently deglaciated) habitats rather than as independent samples from all possible source populations. They suggest that while intrapopulation diversity appears to be largely a product of historical factors accumulating over time, inter-population diversity is more influenced by the degree of spatial connectivity between sites and by contemporary factors affecting dispersal and gene flow. Bull trout are a long-lived, late-maturing species with small effective population sizes, which makes them particularly sensitive to the genetic effects of bottlenecks and founder events that likely accompanied postglacial dispersal (Costello et al. 2003).

The question of whether bull trout are structured as metapopulations is difficult to answer conclusively. Different models of metapopulations exist, and in each model only qualitative conditions which should hold for a group of populations to fit the model are specified. Nevertheless, at least two of the criteria in Hanski (1996) and Rieman and Dunham (2000) would seem to hold for many bull trout core areas: habitat consists of discrete patches or collections of habitats capable of supporting local breeding populations, and habitat patches are not too isolated to preclude recolonization of at least some local populations. There is ample genetic evidence to indicate that local populations of bull trout are often highly divergent from other nearby local populations.

This implies that populations in many river basins are not panmictic at the level of core area, therefore meeting one condition for a metapopulation. The evidence is much more ambiguous about the level of migration between local populations, except in the case of single local populations isolated above a migration barrier. These local populations would not be characterized as components of a standard metapopulation model and could only represent a modified stepping stone (downstream migration). We do not know the current status of many core areas, or to what extent evidence indicating a high level of population subdivision reflects historical versus recent (or natural versus anthropogenic) events. Aggregations of bull trout populations that once may have acted as metapopulations may now be too fragmented, depressed, or contracted to be recognized as metapopulations today.

Status and Distribution of Bull Trout

The historical range of bull trout includes major river basins in the Pacific Northwest at about 41 to 60 degrees North latitude, from the southern limits in the McCloud River in northern California and the Jarbidge River in Nevada to the headwaters of the Yukon River in the Northwest Territories, Canada (Cavender 1978, Bond 1992). To the west, bull trout range includes Puget Sound, various coastal rivers of British Columbia, Canada, and southeast Alaska (Bond 1992). Bull trout occur in portions of the Columbia River and tributaries within the basin, including its headwaters in Montana, Idaho and British Columbia, Canada. Bull trout also occur

in the Klamath River basin of south-central Oregon. East of the Continental Divide, bull trout are found in the headwaters of the Saskatchewan River in Alberta and Montana and in the MacKenzie River system in Alberta and British Columbia, Canada (Cavender 1978, Brewin et al. 1997).

Status of Bull Trout Rangewide

Range-wide, local populations of bull trout within their respective core areas are often isolated and remnant. Migratory life histories have been lost or limited throughout major portions of the range (Ratliff and Howell 1992; Pratt and Huston 1993; Rieman and McIntyre 1993, 1995; Goetz 1991; Jakober et al. 1998; MBTSG 1998; Nelson et al. 2002; USFWS 2002; USFWS 2005b) and many fluvial bull trout populations in portions of the upper Columbia River basin appear to be nearly extirpated (USFWS 2005b).

Prior to consolidation of 4 core areas in 2006, 121 core areas were recognized across the United States range of the bull trout (USFWS 2002; 2005b, 2008a). At this time, the USFWS recognizes 118 bull trout core areas range-wide in Idaho, Montana, Oregon, Nevada and Washington (USFWS 2002). This represents a partial consolidation of some of the 188 subpopulations originally described in the various bull trout listing documents (USFWS 1999a), and is based on the use of more consistent and updated terminology as well as specific information regarding connectivity and consolidation between some populations previously considered autonomous. For example, radio telemetry information from some recent studies has been particularly useful in further describing the movements of bull trout. Core areas were previously defined as approximating interacting biological units for bull trout. Hence, as more information is obtained and recovery proceeds, we would anticipate the number of core areas and the boundaries that describe them will continue to be somewhat fluid.

Status of Bull Trout in the Columbia River Basin

Within the Columbia River basin, a total of 95 core areas are described (USFWS 2002). Generally, where status is known and population data exists, bull trout populations throughout the Columbia River basin are at best stable and more often declining (Thomas 1992; Schill 1992; Pratt and Huston 1993; USFWS 2005b). Many of the bull trout core areas occur as isolated watersheds in headwater tributaries, or in tributaries where the migratory corridors have been lost or restricted. Few bull trout core areas are considered strong in terms of relative abundance and core area stability (USFWS 1998a; USFWS 2005b, USFWS 2008a). Strong core areas are generally associated with large areas of contiguous habitat.

Range-wide Five-year Status Review

In 2005, the USFWS assessed the conservation status of bull trout and the vulnerability for each bull trout core area (USFWS 2005b). The *Bull Trout Core Area Status Assessment* concluded that the originally described threats to bull trout still existed. No substantial new and widespread threats were discovered during that review or in review of previous BOs on bull trout. Baseline conditions that existed range-wide in 2005 (USFWS 2005b) were not noted to have changed substantially since the time of the original listing (USFWS 1998a) and the range-wide population trend had not demonstrably worsened nor measurably improved (USFWS 2005b), though considerably more data had been accumulated and reviewed.

During the status assessment for the five-year review conducted in 2005, the risk assessment or ranking portion of the status review was modeled to assess the relative status of each of the (then) 121 core areas. The model used to rank the relative risk to bull trout was based on the Natural Heritage Programs' NatureServe Conservation Status Assessment Criteria, which had been applied in previous assessments of fish status, including bull trout (Master et al. 2003; MNHP 2004). The model integrated four factors: population abundance, distribution, population trend, and threats. For a complete understanding of the ranking process, a more thorough review of the report which describes the model and the output (USFWS 2005b) is required. The findings and determination are presented by the USFWS in a final 5-year review decision document (USFWS 2008a).

Status of Bull Trout in Relation to past Section 7 Act Consultations

Section 7 consultations must consider previous BOs in determining the environmental baseline conditions for an affected population of bull trout. Thus, in this section we explain how past range-wide section 7 Act consultations have affected the status of bull trout.

Aggregate Effects of Previous Range-wide Section 7 Consultations

Actions analyzed by BOs do not necessarily result in permanent adverse effects to the species. In fact, many activities are intended to allow some short-term adverse effects in order to achieve longer term benefits that support recovery of the species. Consequently, adverse effects are not necessarily additive and the proverbial "death by a thousand pinpricks" is an oversimplification. Many of these individual projects are explicitly recovery activities for bull trout or, at worst, de minimis effects because of the small scale or very short duration of the action.

The significant sources of information that we have utilized to determine that the aggregate effects of previous range-wide section 7 consultations are not necessarily permanent adverse effects include, but are not limited to the following: 1) Analysis of actions that have undergone section 7 consultations; 2) Five-year status review (USFWS 2005b, USFWS 2008a) (including core area assessments); 3) Draft Recovery Plan for Bull Trout (USFWS 2002); 4) Science team report – Bull Trout Recovery Planning: A review of the science associated with population structure and size (Whitesel et al. 2004).

The five-year status review, originally conducted from February 2005 through April 2005, was an intensive evaluation conducted individually at the core area population level as well as comprehensively at the scale of the listed entity. We relied on this information as well to help support our finding that previous opinions were not adding to a perceived reduction of bull trout range-wide.

Consulted-on Effects Analysis of Previous BOs Issued Range-wide From the Time of Listing to August 2003

Updating environmental baselines based on previously proposed actions and associated incidental take is a requirement in preparing a BO (see the USFWS's Consultation Handbook, pg 4-1 and pg 4-22, March 1998), and as previously mentioned, routinely done when a federal agency is preparing a BA. The USFWS has provided this guidance to Federal land management

agencies [U.S.D.A Forest Service (USFS) and Bureau of Land Management (BLM)] in particular because of the extensive area over which these agencies have jurisdiction within the range of bull trout) to help document baseline conditions and effects of actions when assessing the affects of their activities on bull trout (*A Framework to Assist in Making Endangered Species Act Determinations of Effect for Individual or Grouped Actions at the Bull Trout Subpopulation Watershed Scale)* (USFWS 1998b), herein referred to as the 1998 Framework. It is clearly required in the 1998 Framework that USDA and BLM use when preparing BAs. When assessing potential impacts at the local population scale the Framework's impact assessment approach evaluates 19 specific habitat parameters and four population parameters for bull trout. Quite often, the determination of risk to each of these parameters from a proposed action rests on the professional judgment of the action agency's project fish biologist because technical site data is generally lacking for bull trout streams.

To assess the effects of actions/projects on bull trout between the time of listing (1998) and this consultation, the USFWS reviewed all of the BOs received by the USFWS from June 1998 until August 2003; this summed to 137 BOs (USDI 2003b). Of the 137 actions, 124 BOs (91 percent) applied to activities affecting bull trout in the Columbia River population, 12 BOs (9 percent) applied to activities affecting bull trout in the Coastal-Puget Sound population, 7 BOs (5 percent) applied to activities affecting bull trout in the Klamath River population, and 1 BO (<1 percent) applied to activities affecting the Jarbidge and St. Mary populations (Note: these percentages do not add to 100, because several BOs applied to more than one population). The geographic scale of these consultations varied from individual actions within one basin (e.g., construction of a bridge or pipeline) to multiple-project actions occurring across several basins.

The 137 actions were categorized into 24 different activity types (e.g., grazing, road maintenance, habitat restoration, timber sales, hydropower, etc). Twenty actions involved multiple projects, including some of which are restorative actions for bull trout. Within each river basin, the number of actions, type of actions, and action description were summarized. Furthermore, each individual action was identified as to the cause of the effect and the anticipated effect on a spawning stream and/or migratory corridor if known (in most cases this effect was known). An attempt was made to further define the anticipated effect by duration (e.g., "short-term effects" varied from hours to several months) and a determination was made, when possible, to identify those projects with long-term benefits. Fifty-five actions had "unquantifiable" effects in migratory corridors and in spawning streams.

Summary of Determinations From Past Bull Trout Consultations

As stated in the previous subsection, the 137 BOs issued rangewide were considered in the most recent technical and status information, taking into account all of the previously issued BOs to update baseline conditions for bull trout (USFWS 2003b). None of the consultation actions were found to appreciably reduce the likelihood of survival and recovery of the bull trout in any core area or result in the loss of any subpopulations (the unit of analysis for BOs between 1998 and 2002) (USFWS 2003b).

Previous Consultations Within the Action Area (Clark Fork River and Kootenai River Management Units)

As stated above, the 137 BOs issued rangewide between June 1998 and August 2003 were considered in the most recent technical and status information, taking into account all of the previously issued BOs to update baseline conditions for bull trout (USFWS 2003b). The 1998-2003 analysis captured the range of variability in BO's and whether any of these consultations resulted in a jeopardy determination (none were identified). Subsequently, we chose to focus on the more recent and site-specific BO's in the Clark Fork and Kootenai rivers in Montana to characterize the status of bull trout populations because projects proposed in these river basins in Montana are more applicable to the affected bull trout populations – as is the case in the action area for the DNRC HCP. Each previous BO in these river basins had incorporated mandatory terms and conditions to reduce the impact of any anticipated incidental take (USFWS 2003b). Terms and conditions were designed to minimize impacts from the effects of the anticipated incidental take and were binding on the action agency. Even though incidental take was anticipated in all these opinions, the USFWS reasonably concluded that the viability of a core area population would not be significantly affected by the level of anticipated take, and that the terms and conditions issued to reduce the anticipated incidental take would adequately lessen the potential to affect the core area population.

A total of 101 BOs or other forms of Act compliance (i.e., section 10 permits) have been issued for the Clark Fork River Management Unit since listing to March 2011 (39 from listing to August 2003 and 62 from August 2003 to now). A total of 17 BOs have been issued for the Kootenai River Basin Management Unit. All of the opinions have included mandatory terms and conditions, which are binding on the action agency in order to reduce the potential impacts of anticipated incidental take to bull trout. Furthermore, all bull trout BOs that have been issued are considered in the most recent technical and status information and used to update environmental baseline conditions for bull trout, which is routinely done when a federal agency is preparing a biological assessment.

In summary, the USFWS's analyses of BOs (range-wide assessment from listing to the present) and the analysis of 118 BOs in the Clark Fork and Kootenai rivers Management Units showed that we consulted on a wide array of actions, which had varying level of effects with various timeframes for completion, or that continue to be ongoing either seasonally or continuously at some level throughout the entire year. However, even when accounting for the wide range in variability of previous actions that have been subject to consultation, the analyses revealed that no actions that have undergone consultation were found to appreciably reduce the likelihood of survival and recovery of the bull trout in any core area within the two river basins, or result in the loss of any subpopulations (USFWS 2003b).

At the time of preparing Part IV of this BO the Montana Field Office of the USFWS is not aware of any existing BO within the range of bull trout with other than a no-jeopardy determination. Our review of the range-wide assessment from listing to August 2003 (USFWS 2003b) and the analysis from the Clark Fork and Kootenai River basins in Montana BOs from August 2003 to the present have supported this conclusion.

BOs with Beneficial Actions and Unquantifiable Effects

Some BOs are prepared for projects that result in significant potential gains for bull trout. However, sometimes these projects have a short-term or temporary harmful effect on existing habitat conditions during construction, and therefore, require formal consultation to address the temporary change in habitat conditions. In many of these cases there could be permanent substantial benefits to the species that result in restoring habitat to historical level or near-historical conditions. A typical example would be the removal of a culvert that has blocked fish from several miles of historic spawning and rearing habitat. During the removal of the culvert from the streambed, the sediment produced in the stream channel travels downstream a certain distance depending on the amount of sediment delivered and site conditions. These conditions may temporarily impede feeding behavior or displace bull trout immediately in the affected downstream reaches. Because there is much scientific evidence that total sediment and suspended sediment can have negative impacts to fish and fish habitat, we can anticipate some adverse effect. However, it is much more difficult to determine the extent or to quantify this effect because it depends on many interacting site variables. To name a few: 1) presence of fish and particular life stage [(eggs, juveniles, subadults, adults (migratory or resident)]; 2) proximity, type, and habitat quality downstream (spawning and/or rearing habitat); 3) amount and type of fill being removed (shallow fill or deep fill; coarse or fine materials); 4) stream gradient and channel type; 5) erodibility of the fill and associated native soils; 6) steepness of the hillslope or incised stream channel; 7) effectiveness of sediment abatement measures; 8) duration and timing of the construction; 9) size and type of the culvert removed; 10) weather conditions; and 11) professional experience of the contractor conducting the work. The risk of a minimal amount of incidental take is high enough to warrant an incidental take statement in a BO and to ensure that measures will be in place to reduce the amount of sediment potentially delivered to the stream. Clearly however, the substantial gains for the species far outweigh the relatively minor and temporary harmful effect to the species or its habitat.

An example of a beneficial project is the Jocko River restoration project (programmatic BO issued in 1998, revised in 1999), which is a long-term phased project that has resulted in 13.5 miles of stream channel restoration for bull trout, more than 2,000 acres of riparian and upland habitat acquisition, and greater than 30 miles of road upgrades and decommissioning. Similarly, since the listing of bull trout, Montana Fish, Wildlife, and Parks (MFWP) has conducted numerous projects that have benefited bull trout through activities conducted under section 6 of the Act. The effects to bull trout from these annual activities are addressed in a programmatic BO (revised section 7 programmatic consultation on issuance of section 10(a)(1)(A) scientific take permits and section 6(c)(1) exemption from take for bull trout, *Salvelinus confluentus*, June 29, 1999). The activities addressed are actions like habitat restoration and enhancement, population surveys, capture and handling, tagging and marking, tissue sampling (genetic and disease research), outreach and education, and other activities necessary to conduct various ecological studies aimed at the recovery and conservation of bull trout. For example, in one year (2003) MFWP completed 49 habitat improvement projects, 92 electrofishing projects,72 redd surveys, seven trapping and tagging activities, and four telemetry studies to benefit the conservation and recovery of bull trout (J. Hagener, MFWP, in litt. January 3, 2005). A list of these annual section 6 activities is on file with the USFWS.

Under section 6 of the Act (and its associated conservation plan and programmatic BO), the USFWS has closely cooperated with MFWP to monitor and evaluate three populations of bull trout (Swan Lake, Hungry Horse, and Lake Koocanusa) where state regulations allow a restricted recreational fishery in western Montana. At present, the bull trout populations in these subbasins are strong enough to support a limited angler harvest. In 2004 through 2009, Lake Koocanusa provided about 25,000 angler days of recreational fishing for bull trout and catch of about 14,000 bull trout, of which roughly 14 percent or about 2,000 fish were harvested (Hensler and Benson 2010). Over the same six-year period the South Fork Flathead (including Hungry Horse Reservoir) provided about 13,000 angler days of recreational fishing for bull trout and catch of about 7,000 bull trout, of which roughly 5 percent or about 400 fish were harvested (Rosenthal 2010). A portion of this fishery in the South Fork Flathead River is catch and release only. Western Montana is currently the only region within the U.S. range of bull trout that supports three recreational fisheries allowing harvest of bull trout, two of which occur within the Clark Fork River Management Unit and one within the Kootenai River Management Unit.

BOs on Adverse Actions with Mitigation Having Beneficial Actions

An example is the 30-year Plum Creek Native Fish Habitat Conservation Plan (NFHCP) agreement with the largest private landowner in western Montana (BO issued in 2000). As a commitment in this agreement, Plum Creek Timber Company is conducting intensive multi-year efforts to monitor and maintain bull trout populations and habitat along important bull trout streams in the Clark Fork and Kootenai Rivers Management Units, where they have extensive land holdings totaling nearly 1 million acres. Lands within the NFHCP project area occur adjacent to several hundred miles of stream reaches, including substantial holdings that were identified as important bull trout habitat. Through implementation of the NFHCP, proactive management is occurring to protect and restore important bull trout habitat, while at the same time allowing the company to manage and harvest their timber base, construct and maintain roads, and manage other resources such as grazing allotments and recreational properties. An active monitoring strategy is being applied to track compliance and measure important habitat and population parameters. Increases to the species from completed habitat restoration projects are not well quantified, but continued monitoring will document changing abundance and distribution of bull trout in these sites.

These actions on private lands complement management activities by the USFS and others on managed Federal lands. Stream channel restoration, streambank stabilization, installation of fish passage/fish screens, and research projects are other examples of federal actions with BOs where potential gains to the species are significant, but require formal consultation. Intuitively, a bull trout present in the affected stream reach could be temporarily subjected to a minor harmful effect, but the long-term benefits of permanently improved habitat conditions is likely to increase its survival significantly, thus outweighing the short-term risk. Some would argue there may not be a harmful effect at all because these fish have adapted and evolved intrinsic mechanisms to deal with naturally occurring small events of sediment-laden water and that it is *excessive* sediment generated at times and as anthropogenic waste that often damages biological components of a stream (Waters 1995). Most often it is difficult to know whether an adverse effect will occur, and therefore it becomes somewhat subjective to determine the risk of take and the associated effect to the species or its habitat. For projects where risk of incidental take is

uncertain, but would clearly result in benefits to a species, the USFWS errs on the side of the species.

Development of Range-wide Tracking System of Effects of Consulted-on Activities

As previously mentioned, the USFWS recognizes the importance of tracking the effects of consulted-on activities on bull trout and its critical habitat in order to assess conservation and regulatory efforts for the species. To that end, in 2005 the USFWS formed a "Bull Trout Consultation Coordination Team" charged with developing and implementing a system to accomplish this task. This effort is on-going and the Coordination Team is currently working on a database that will help the USFWS more accurately track the effects of take, which in turn would help us better estimate the impacts of projects on local populations and core area populations (i.e., status of bull trout). As currently constructed, the database is in the design and testing phase and is expected to provide a tool to comprehensively track consulted-on effects of various actions with baseline conditions, extent of take at appropriate scales, and status of the species. The tracking system is nearing completion and implementation is expected in late 2011.

Factors Affecting Status of Bull Trout

Bull trout distribution, abundance, and habitat quality have declined rangewide (Bond 1992; Schill 1992; Thomas 1992; Ziller 1992; Rieman and McIntyre 1993; McPhail and Baxter 1996). Many factors have contributed to the decline of bull trout rangewide. Some threats are widespread, while others are more regional in nature. Factors negatively affecting bull trout in the coterminous United States fall into several categories including habitat degradation/isolation, loss or blockage of migratory corridors, poor water quality, and the introduction of nonnative species. The five year status review provided updated information on threats to bull trout and their habitat since listing and is summarized in this subsection (USFWS 2008a).

Changes in habitat condition vary across and within bull trout core areas. Some habitat improvements (e.g., passage improvements, stream restoration, diversion screening, road decommissioning) have occurred at the local population level within individual core areas since the time of listing; however, no monitoring is in place to measure results and their effects to bull trout. In the future, some connectivity improvements may occur under Federal Energy Regulatory Commission (FERC) relicensing agreements and planned passage restoration activities such as culvert replacements being undertaken by the Forest Service and Bureau of Land Management. In other areas, modification and destruction of habitat continue to threaten bull trout from a wide array of ongoing land uses such as forest management, road building, and development. Fragmentation of habitat from dams, water withdrawals, diversion structures, culverts, thermal barriers, and other conditions continues to be a concern with fifty-seven percent of core areas (n=69) across the coterminous range having been characterized as having low to moderate connectivity (USFWS 2008a). Approximately 21 percent of the core areas (n=25) occur within National Parks or designated wilderness and remain largely intact, though many of these are quite small (if the area of occupancy is small, it is more vulnerable to negative effects from localized events). Overall, the status information indicates that connectivity of habitat within and among core areas is low (USFWS 2008a).

Nonnative fish (especially lake trout and brook trout) introductions and their increasing distribution as a result of natural dispersal from 20th century introductions continue to threaten bull trout through predation, competition, and, in some cases, hybridization. Lake trout have expanded their distribution and abundance in some core areas and have been detected in at least three additional core areas in northwest Montana since the time of listing (USFWS 2008a). Lake trout are replacing bull trout populations in some areas where the habitat is largely protected, such as Glacier National Park (Fredenberg 2002). Brook trout, with their apparent competitive advantage over bull trout in degraded habitats, continue to threaten bull trout through competition and hybridization, especially in areas where habitat conditions continue to decline. In some core areas, distribution of brook trout is greater than previously thought or documented at the time of listing (USFWS 2008a). Predatory interactions with other nonnative species such as northern pike are an increasing concern for bull trout in some core areas (Bernall and Moran 2004). Introduced brown trout are established in several areas within the range of bull trout and compete for food and space and prey on bull trout (Ratliff and Howell 1992; Platts et al. 1993; Pratt and Huston 1993).

Dams have affected bull trout by altering habitats; flow, sediment, and temperature regimes; migration corridors; and creating additional interspecific interactions, mainly between bull trout and nonnative species (Rieman and McIntyre 1993; USDA and USDI 1996, 1997). Impassable dams have caused declines of bull trout by preventing migratory fish from reaching spawning and rearing areas in headwaters and recolonizing areas where bull trout have been extirpated (Rieman and McIntyre 1993; MBTSG 1998).

Forest management activities, including timber extraction and road construction, have affected stream habitats by altering recruitment of large woody debris, erosion and sedimentation rates, runoff patterns, the magnitude of peak and low flows, water temperature, and annual water yield (Furniss et al. 1991; Spence et al. 1996). Activities that promote excessive substrate movement reduce bull trout production by increasing egg and juvenile mortality, and reducing or eliminating habitat (e.g., pools filled with substrate) important to later life-history stages (Fraley and Shepard 1989; Brown 1992).

Roads that have been constructed for forest management have become a prevalent feature on managed forested and rangeland landscapes. Roads can have the potential to adversely affect several habitat features, (e.g., water temperature, substrate composition and stability, sediment delivery, habitat complexity, and connectivity) (Baxter et al. 1999; Trombulak and Frissell 2000). Roads may also isolate streams from riparian areas causing a loss in floodplain and riparian function. Upstream from road crossings, large areas of suitable habitats may become inaccessible to bull trout due to fish passage barriers (e.g., culverts). Although bull trout occur in watersheds where timber has been harvested, bull trout strongholds primarily occur in watersheds with little or no past timber harvest, such as the wilderness areas of central Idaho and the South Fork Flathead River drainage in Montana (Henjum et al. 1994; MBTSG 1995e; USDA and USDI 1997; Rieman et al. 1997b). However, the Swan River basin, Montana, has had extensive timber harvest and road construction, and is a bull trout stronghold (Watson and Hillman 1997). The overall effects of forestry practices on bull trout in parts of this basin are

difficult to assess because of the complex geomorphology and geology of the drainage (MBTSG 1996a).

Improperly managed livestock grazing has been identified as a factor that can degrade bull trout habitat by removing riparian vegetation, destabilizing streambanks, widening stream channels, promoting incised channels and lowering water tables, reducing pool frequency, increasing soil erosion, and altering water quality (Howell and Buchanan 1992; Mullan et al. 1992; Overton et al. 1993; Platts et al. 1993; Henjum et al. 1994; USDA and USDI 1996, 1997). These effects reduce overhead cover, increase summer water temperatures, and promote formation of anchor ice (ice attached to the bottom of an otherwise unfrozen stream, often covering stones, etc.) in winter, and increase sediment in spawning and rearing habitats.

Agricultural practices, such as cultivation, irrigation diversions, and chemical application, have contributed to nonpoint source pollution in some areas within the range of bull trout; (MDHES 1994). These practices can release sediment, nutrients, pesticides, and herbicides into streams; increase water temperature; reduce riparian vegetation; and alter hydrologic regimes, typically by reducing flows in spring and summer. Irrigation diversions also affect bull trout by altering stream flow and allowing entrainment. Many of these are located further up in watersheds and either physically block fish passage by means of a structure (i.e., a dam), or effectively block passage by periodically dewatering a downstream reach (e.g., diversion of flows through a penstock to a powerhouse; diversion of flows for the purposes of irrigation). Other effects include water quality degradation resulting from irrigation return flows and runoff from fields and entrainment of bull trout into canals and fields (MBTSG 1998). Some irrigation diversion structures are reconstituted annually with a bulldozer as “push up” berms and not only affect passage, but also significantly degrade the stream channel. The prevalence of these structures throughout the range of bull trout has resulted in the isolation of bull trout populations in the upper watersheds in many areas. Bull trout may enter unscreened irrigation diversions and become stranded in ditches and agricultural fields. Diversion dams without proper passage facilities prevent bull trout from migrating and may isolate groups of fish (Light et al. 1999). Other effects of agricultural practices on aquatic habitat include stream channelization, and large woody debris removal (Spence et al. 1996).

Mining has degraded aquatic habitats used by bull trout by altering water chemistry *(*e.g., pH); altering stream morphology and flow; and causing sediment, fuel, and heavy metals to enter streams (Spence et al. 1996). The types of mining that occur within the range of bull trout include extraction of hard rock minerals, coal, gas, oil, and sand and gravel. Past and present mining activities have adversely affected bull trout and bull trout habitats in Idaho, Oregon, Montana, Nevada, and Washington (Platts et al. 1993; MBTSG 1995a,c, 1996b,c).

Residential development is rapidly increasing within portions of the range of bull trout and has caused alteration of stream and riparian habitats through contaminant inputs, stormwater runoff, changes in flow regimes, streambank modification and destabilization, increased nutrient loads, and increased water temperatures (MBTSG 1995b). Indirectly, urbanization within floodplains alters groundwater recharge by rapidly routing water into streams through drains rather than through more gradual subsurface flow (Booth 1991).

Although bull trout are widely distributed over a large geographic area, the effects of human activities over the past century have reduced their overall distribution and abundance. Habitat alteration, primarily through the construction of impoundments, dams, and water diversions, has fragmented habitats, eliminated migratory corridors, and isolated bull trout in the headwaters of tributaries (Dunham and Rieman 1999; Spruell et al. 2000; Rieman and Dunham 2000). Because isolation and habitat fragmentation resulting from migratory barriers have negatively affected bull trout by: (1) reducing geographical distribution; (2) increasing the probability of losing individual local populations (Rieman and McIntyre 1993); (3) increasing the probability of hybridization with introduced brook trout (Rieman and McIntyre 1993); (4) reducing the potential for movements in response to developmental, foraging, and seasonal habitat requirements (MBTSG 1998); and (5) reducing reproductive capability by eliminating the larger, more fecund migratory form from many subpopulations (MBTSG 1998; Rieman and McIntyre 1993), restoring connectivity and restoring the frequency of occurrence of the migratory form has been identified as an important factor in providing for the recovery of bull trout as indicated below.

Conservation Needs of the Bull Trout

As noted above, in recognition of available scientific information relating to their uniqueness and significance, five segments of the coterminous United States population of the bull trout are considered essential to the survival and recovery of this species and are identified as interim recovery units: (1) Jarbidge River; (2) Klamath River; (3) Columbia River; (4) Coastal-Puget Sound; and (5) St. Mary-Belly River. Each of these segments is necessary to maintain the bull trout's distribution, as well as its genetic and phenotypic diversity, all of which are important to ensure the species' resilience to changing environmental conditions.

A summary of the current status and conservation needs of the bull trout within Columbia River Interim Recovery Unit, in which the DNRC HCP project area occurs, is provided below. A comprehensive discussion of these topics is found in the USFWS's draft recovery plan for the bull trout (USFWS 2002; 2005b, 2008a).

Generally, the conservation needs of the bull trout are often generally expressed as the need to provide the four Cs: cold, clean, complex, and connected habitat. Cold stream temperatures, clean water quality that is relatively free of sediment and contaminants, complex channel characteristics (including abundant large wood and undercut banks), and large patches of such habitat that are well connected by unobstructed migratory pathways are all needed to promote conservation of bull trout at multiple scales ranging from the coterminous to local populations. The recovery planning process for the bull trout (USFWS 2002; 2005b, 2008a) has also identified the following conservation needs for the bull trout: (1) maintain and restore multiple, interconnected populations in diverse habitats across the range of each interim recovery unit; (2) preserve the diversity of life-history strategies; (3) maintaining genetic and phenotypic diversity across the range of each interim recovery unit; and (4) establish a positive population trend. Recently, it has also been recognized that bull trout populations need to be protected from catastrophic fires across the range of each interim recovery unit.

Central to the survival and recovery of the bull trout is the maintenance of viable core areas (USFWS 2002; 2005b, 2008a). A core area is defined as a geographic area occupied by one or more local bull trout populations that overlap in their use of rearing, foraging, migratory, and overwintering habitat, and in some cases in their use of spawning habitat. Each of the interim recovery units listed above consists of one or more core areas. Prior to consolidation of 4 core areas in 2006, 121 core areas were recognized across the United States range of the bull trout (USFWS 2002; 2005b, 2008a). Note that the number of core areas and especially local populations is subject to ongoing adjustment as more is learned about bull trout movement patterns, genetic relationships, and distribution.

The Columbia River Recovery Unit includes bull trout residing in portions of Oregon, Washington, Idaho, and Montana. Bull trout are estimated to have occupied about 60 percent of the Columbia River Basin, and presently occur in 45 percent of the estimated historical range (Quigley and Arbelbide 1997). This population segment currently contains 97 core areas and 527 local populations. About 65 percent of these core areas and local populations occur in Idaho and northwestern Montana.

The condition of the bull trout populations within these core areas varies from poor to good, but generally all have been subject to the combined effects of habitat degradation, fragmentation and alterations associated with one or more of the following activities: dewatering, road construction and maintenance, mining and grazing, blockage of migratory corridors by dams or other diversion structures, poor water quality, incidental angler harvest, entrainment into diversion channels, and introduced non-native species.

The USFWS has determined that of the total 97 core areas in this recovery unit population segment, 38 are at high risk of extirpation, 35 are at risk, 20 are at potential risk, two are at low risk, and two are at unknown risk (USFWS 2005b). The draft bull trout Recovery Plan (USFWS 2002) identifies the following conservation needs for this recovery unit: (1) maintain or expand the current distribution of the bull trout within core areas, (2) maintain stable or increasing trends in bull trout abundance, (3) maintain and restore suitable habitat conditions for all bull trout life history stages and strategies, and (4) conserve genetic diversity and provide opportunities for genetic exchange.

The draft bull trout Recovery Plan (USFWS 2002) identified 22 recovery units within the Columbia River Interim Recovery Unit. These units are now referred to as management units. Management units are groupings of bull trout with historical or current gene flow within them and were designated to place the scope of bull trout recovery on smaller spatial scales than the larger population segments. Achieving recovery goals within each management unit is critical to recovering the Columbia River population segment. Recovering bull trout in each management unit would maintain the overall distribution of bull trout in their native range. Individual core areas are the foundation of management units and conserving core areas and their habitats within management units preserves the genotypic and phenotypic diversity that will allow bull trout access to diverse habitats and reduce the risk of extinction from stochastic events. The continued survival and recovery of each individual core area is critical to the persistence of management units and their role in the recovery of a population segment (USFWS 2002). This is the level at which the effects to bull trout are analyzed in Part IV of this BO.

Status of Designated Bull Trout Critical Habitat

On January 14, 2010, the USFWS published a proposed rule to revise designating critical habitat for bull trout in the coterminous United States (75 FR 2270). The January 2010 proposal included approximately 22,679 miles (36,498 km) of streams (which includes 985.3 miles (1,585.7 km) of marine shoreline area, and 533,426 acres (215,870 hectares) of reservoirs or lakes) proposed as revised critical habitat. Based on better occupancy data and refined information on the importance of certain habitats, we proposed to designate 3 percent more critical habitat in streams (measured on a linear basis) and 10 percent less critical habitat in lakes and reservoirs (measured by area) than were proposed in the combined 2002 and 2004 proposed rules.

The revised final rule, issued October 18, 2010 (75 FR 63898), designates approximately 18,975 miles (30,539 km) of streams and 488,252 acres (197,589 ha) of lakes and reservoirs in Idaho, Oregon, Washington, Montana and Nevada as critical habitat for the wide-ranging fish. In Washington, 754 miles (1,213 km) of marine shoreline are included in the final designation. Reductions from the proposed to the final rule are due to new biological information received during the comment period resulting in adding some habitats and removing others, and exclusion of specific areas under section 4(b)(2) of the Act based on ongoing conservation measures, activities, agreements and other factors.

Conservation Role and Description of Designated Critical Habitat

The conservation role of bull trout critical habitat is to support viable core area populations (70 FR 56212). Core areas reflect the metapopulation structure of the coterminous United States population of the bull trout and are the closest approximation of a biologically functioning unit for the purposes of recovery planning and risk analyses. Critical habitat units generally encompass one or more core areas and include foraging, migration, and overwintering areas that are important to the survival and recovery (i.e., conservation) of the bull trout.

Because there were numerous exclusions associated with the existing final critical habitat designation process that reflect land ownership, designated critical habitat is often fragmented. These individual critical habitat segments are expected to contribute to the ability of the stream to support viable local and core area populations of the bull trout in each critical habitat unit. The excluded habitat along with the final designated critical habitat is shown in maps created for public distribution and available on the USFWS bull trout website: http://www.fws.gov/pacific/bulltrout/

The primary function of individual critical habitat units is to maintain and support core areas which (1) contain bull trout populations with the demographic characteristics needed to ensure their persistence and contain the habitat needed to sustain those characteristics (Rieman and McIntyre 1993); (2) provide for persistence of strong local populations, in part, by providing habitat conditions that encourage movement of migratory fish (Rieman and McIntyre 1993; MBTSG 1998); (3) are large enough to incorporate genetic and phenotypic diversity, but small enough to ensure connectivity between populations (Rieman and McIntyre 1993; Hard 1995; Healey and Prince 1995; MBTSG 1998); and (4) are distributed throughout the historic range of

the species to preserve both genetic and phenotypic adaptations (Rieman and McIntyre 1993; Hard 1995; MBTSG 1998; Rieman and Allendorf 2001).

Critical habitat includes the stream channels within the designated stream reaches, the shoreline of designated lakes, and the inshore extent of marine near shore areas. In freshwater habitat, critical habitat includes the stream channels within the designated stream reaches, and includes a lateral extent as defined by the ordinary high-water line. In areas where ordinary high-water line has not been defined, the lateral extent will be defined by the bankfull elevation. Bankfull elevation is the level at which water begins to leave the channel and move into the floodplain and is reached at a discharge that generally has a recurrence interval of 1 to 2 years on the annual flood series. For practical purposes, bankfull elevation is most easily characterized as the point at which permanent terrestrial vegetation (e.g., grass and willows) is established. For designated lakes, the lateral extent of critical habitat is defined by the perimeter of the water body as mapped on standard 1:24,000 scale topographic maps.

Adjacent stream, lake, and shoreline riparian areas, bluffs, and uplands are not designated as critical habitat. However, it should be recognized that the quality of marine and freshwater habitat along streams, lakes and shorelines is intrinsically related to the character of these adjacent features, and that human activities that occur outside of the designated critical habitat can have major effects on the PCEs of bull trout critical habitat in the marine environment.

Within designated critical habitat areas, the primary constituent elements (PCEs) for bull trout are those habitat components that are essential for the primary biological needs of foraging, reproducing, rearing of young, dispersal, genetic exchange, or sheltering. Note that all except PCE (3) apply to foraging, migration, and overwintering habitat identified as critical habitat.

Based on the most recent life history, biological, and ecological scientific information for bull trout, the USFWS slightly revised the bull trout's PCEs from the 2005 rule (FR 70, 56211-56311, September 26, 2005) in the 2010 rule (FR 75, 63898-64070). The PCEs in this final rule represent our best current understanding of habitat requirements for bull trout. The PCEs were developed by working with a broad array of local experts to identify both occupied habitat that contains physical or biological features essential to bull trout conservation, and unoccupied habitat that is essential to conservation.

We have determined that the following PCEs are essential for the conservation of bull trout and may require special management considerations or protection:

1. Springs, seeps, groundwater sources, and subsurface water connectivity (hyporheic flows) to contribute to water quality and quantity and provide thermal refugia.

2. Migration habitats with minimal physical, biological, or water quality impediments between spawning, rearing, overwintering, and freshwater and marine foraging habitats, including but not limited to permanent, partial, intermittent, or seasonal barriers.

3. An abundant food base, including terrestrial organisms of riparian origin, aquatic macroinvertebrates, and forage fish.

4. Complex river, stream, lake, reservoir, and marine shoreline aquatic environments, and processes that establish and maintain these aquatic environments, with features such as large wood, side channels, pools, undercut banks and unembedded substrates, to provide a variety of depths, gradients, velocities, and structure.

5. Water temperatures ranging from 2 to 15°C (36 to 59°F), with adequate thermal refugia available for temperatures that exceed the upper end of this range. Specific temperatures within this range will depend on bull trout life-history stage and form; geography; elevation; diurnal and seasonal variation; shading, such as that provided by riparian habitat; streamflow; and local groundwater influence.

6. In spawning and rearing areas, substrate of sufficient amount, size, and composition to ensure success of egg and embryo overwinter survival, fry emergence, and young-of-the-year and juvenile survival. A minimal amount of fine sediment, generally ranging in size from silt to coarse sand, embedded in larger substrates, is characteristic of these conditions. The size and amounts of fine sediment suitable to bull trout will likely vary from system to system.

7. A natural hydrograph, including peak, high, low, and base flows within historic and seasonal ranges or, if flows are controlled, minimal flow departure from a natural hydrograph.

8. Sufficient water quality and quantity such that normal reproduction, growth, and survival are not inhibited.

9. Sufficiently low levels of occurrence of nonnnative predatory (e.g., lake trout, walleye, northern pike, smallmouth bass); interbreeding (e.g., brook trout); or competing (e.g., brown trout) species that, if present, are adequately temporally and spatially isolated from bull trout.

The conservation relationship between designation of critical habitat and recovery of bull trout is to "*contribute to the overall recovery strategy for a species*", however; it does not, by itself, achieve recovery plan goals (75 FR 63898). The adverse modification standard is exclusively related to the effect of an action on the likelihood of maintaining or restoring the intended recovery function of the entire designated critical habitat area. Application of the adverse modification standard does not consider the effects of the action on the reproduction, numbers, or distribution of the listed species for which the critical habitat was designated. The impact of the action on habitat in areas outside of critical habitat that may be important to a species recovery is not considered in applying the adverse modification standard, but such impacts are considered under the jeopardy standard.

<u>Current Range-wide Condition of Bull Trout Critical Habitat</u>
Although still relatively widely distributed across its historic range, the bull trout occurs in low numbers in many areas, and populations are considered depressed or declining across much of its range (67 FR 71240). This condition reflects the condition of bull trout habitat. The condition of bull trout critical habitat varies widely across its range from poor to good, with some core

areas heavily impacted by human development and associated influences and others in nearly pristine condition.

There is widespread agreement in the scientific literature that many factors related to human activities have impacted bull trout and their habitat, and continue to do so. Among those which appear to be particularly significant and have resulted in a legacy of degraded habitat and declining PCE conditions are as follows: (1) fragmentation and isolation of local populations due to the proliferation of dams and water diversions that have eliminated habitat, altered water flow and temperature regimes, and impeded migratory movements (Rieman and McIntyre 1993; Dunham and Rieman 1999); (2) degradation of spawning and rearing habitat in upper watershed areas, particularly alterations in sedimentation rates and water temperature, resulting from forest and rangeland practices and intensive development of roads (Fraley and Shepard 1989; MBTSG 1998); (3) degradation of mainstem migratory river (FMO) habitat, especially increasing water temperatures and decreasing water quality due to urban and residential development, roads, agriculture, and water withdrawals; and (4) the introduction and spread of nonnative species as a result of fish stocking and facilitated by degraded habitat conditions, particularly brook trout which hybridize with bull trout (Leary et al. 1993; Rieman et al. 2006) and brown trout which appear to share a similar niche as bull trout but tolerate much warmer water. Lake trout directly compete with bull trout for limited resources and prey upon them, especially in lakes.

Status of the Species – Westslope Cutthroat Trout

Listing History

WCT are classified as a species of concern at the federal level and in all three states of the NFHCP planning area, Montana, Idaho, and Washington. On June 6, 1997, the USFWS received a formal petition to list WCT as threatened throughout their range under the Act and to designate critical habitat. At that time, the USFWS concluded it could not process the petition because of a backlog of listing actions and personnel and budget restrictions and that processing the petition took a lower priority. On January 25, 1998, the petitioners provided an amended petition which contained substantial additional information. On June 10, 1998, the USFWS published a notice in the Federal Register (63 FR 31691) of a 90-day finding that the amended WCT petition contained substantial information that indicated the listing of the subspecies may be warranted. The USFWS immediately began a 12-month fact-finding period. On April 14, 2000, the USFWS published in the Federal Register (65 FR 20120) that after review of all the available scientific and commercial information, the listing of WCT was not warranted at that time.

On October 23, 2000, a petition was filed in the United States District Court for the District of Columbia to consider a remand of the listing decision and in March 31, 2002, the Court remanded the listing decision ordering the USFWS to reconsider whether to list WCT as a threatened subspecies, and that in so doing evaluate the threat of hybridization as it bears on the Act's statutory listing factors. On September 3, 2002, the USFWS announced in the Federal Register (67 FR 56257) initiation of a new status review for WCT in the United States, pursuant to the recent Court order. On August 7, 2003**,** the USFWS announced that listing the WCT as either threatened or endangered is not warranted at this time (68 FR 46989). Also pursuant to the Court order, the USFWS asserted that a scientifically-based conclusion about the extent to which

it is appropriate to include "hybrid" WCT populations and populations of unknown genetic characteristics in the taxonomic group was considered in the listing decision.

The USFWS's conclusion was that a hybrid WCT is a fish that has the morphological characteristics of WCT because research indicated that WCT of 80 percent genetic purity closely resemble pure WCT and have many of the same behavioral characteristics. The USFWS indicated that pure WCT now occupy between 6 and 22 percent of their historic range, according to biological estimates, while fish with at least 80 percent genetic purity occupy 43 percent of that range.

On May 20, 2005, a complaint was filed in U.S District Court (District Court), alleging that the USFWS violated both the Act and Administrative Procedures Act when it reached its most-recent finding. Plaintiffs seek to have the Court order the USFWS to consider only genetically pure WCT as WCT when making a new listing decision for the subspecies. On July 8, 2008, the Circuit Court of Appeals ruled in favor of the USFWS Policy and against the Appellants, ruling that the USFWS policy was based on best available science. This ruling effectively has ended for now any litigation or other Act-related status pertaining to WCT.

Species Description

The WCT is one of two subspecies of native cutthroat found in the state (the other is the Yellowstone cutthroat [*Oncorhynchus clarkia bouvieri*]). Cutthroat trout are so named for the red slashes near the lower jaws. Tiny teeth are usually present on the floor of the mouth behind the tongue. Characteristics of WCT that distinguish this fish from other subspecies of cutthroat trout include a pattern of irregularly shaped spots on the body, with a few spots below the lateral line except near the tail. Adult WCT typically exhibit bright yellow, orange, and red colors, especially among males during the spawning season. It can be difficult to visually distinguish westslope from other WCT subspecies, but the WCT tends to have more small spots by the tail and none by the pectoral fin and the fish is more of a silvery or greenish color. The only way to be certain about identification of this subspecies is by genetic testing.

In Montana both pure and moderately hybridized populations of WCT have a high incidence of basibranchial teeth, whereas pure rainbow trout lack these teeth. The presence of basibranchial teeth in some individuals of a rainbow trout population indicates hybridization with WCT (Leary et al. 1996). A unique number of chromosomes and other genetic and morphological traits appear to reflect a distinct evolutionary lineage (Behnke 1992).

Life History

WCT exhibit three recognized life-history forms that are distinguished only by migratory and rearing behavior: residential, fluvial, and adfluvial forms. Resident forms spend their lives entirely in the natal tributaries; fluvial forms live and grow in larger rivers, and migrate upstream to spawn in smaller tributaries; and adfluvial forms mature in lakes, and migrate up lake tributaries to spawn and rear (Shepard et al. 1984b; Rieman and Apperson 1989; Behnke 1992). All three life-history types may occur in a single drainage (Bjornn and Liknes 1986; Rieman and Apperson 1989). Most adults of fluvial and adfluvial forms return to either larger rivers or lakes after spawning, and most juveniles emigrate from tributary streams after 2 to 4 years (Rieman

and Apperson 1989; Shepard et al. 1984b). There is no evidence of genetic isolation of different life-history forms and migratory behavior may be based on social and environmental cues in conjunction with genetic codes (Shepard et al. 1984b).

In addition to the seasonal movements related to spawning and rearing, WCT often move in response to seasonal changes in habitat conditions and habitat requirements. Fluvial and adfluvial WCT may migrate distances of over 60 miles in response to habitat needs (Bjornn and Mallet 1964; Liknes 1984), and there can be considerable movement to find pools suitable as overwintering habitat (Brown and Mackay 1995). Among resident WCT in tributaries, less extensive, seasonal movements may occur in response to changing habitat requirements and conditions, particularly water temperatures. WCT may not move far within stream reaches that have numerous pools (Peters 1988), whereas movement may be more extensive in stream reaches with few pools (Peters 1988; McIntyre and Rieman 1995).

Spawning and Rearing

WCT usually mature at 4 or 5 years of age and always spawn in streams. Spawning occurs between March and July, when water temperatures warm to approximately 50°F (Trotter 1987; Behnke 1992; McIntyre and Rieman 1995). Spawning habitat for WCT occurs in low-gradient stream reaches that have gravel substrate ranging from 0.08 to 3.0 inches in diameter, water depths near 0.7 ft, and mean water velocities from 1.0 to 1.3 ft/second (Liknes 1984; Shepard et al. 1984b). Proximity to cover, such as overhanging stream banks, is an important component of spawning habitat for adult WCT. Fertilized eggs are deposited in stream gravels where the developing embryos incubate for several weeks, with the actual time period being inversely related to water temperature (Liknes 1984). Several days after hatching from the egg, WCT fry (approximately 1 inch long) emerge from the gravel into the stream and disperse.

The survival of WCT embryos can be affected by accumulations of fine sediment, which cause survival to be lower than that of other salmonid species (Irving and Bjornn 1984). This sensitivity is supported by Magee et al. (1996), who reported low WCT embryo survival (a mean of 8.5 percent) at high levels of fine sediment in the Taylor's Fork basin in the upper Missouri River drainage. Magee et al. (1996) also found that recruitment of WCT in the Taylor's Fork basin was not limited despite low estimated embryo survival. In addition, Ireland (1993) reported high densities (0.6 to 28.8 fish/120 square yards) of WCT in the Taylor's Fork basin that were higher than those reported for streams in the upper Flathead basin, Montana (0.7 to 17.7 fish/120 square yards), where stream substrates contained lower amounts of fine sediments (Shepard et al. 1984b).

After they emerge from the spawning gravel, WCT fry generally occupy shallow waters near stream banks and other low-velocity areas (e.g., backwaters, side channels) (McIntyre and Rieman 1995). Fry move into main-channel pools as they grow to fingerling size (3.0 to 5 inches). Juvenile WCT are most often found in pools and runs that have summer water temperatures of 44.6°F to 60.8°F and a diversity of cover (Fraley and Graham 1981; McIntyre and Rieman 1995). Adult WCT in streams are strongly associated with cold, high-gradient waters that have pools and cover (Shepard et al. 1984b; Pratt 1984; Griffith 1988; Peters 1988; Ireland 1993; McIntyre and Rieman 1995). During winter, adult WCT congregate in pools (Brown and Mackay 1995; McIntyre and Rieman 1995), while juvenile fish often use cover

provided by boulders and other large instream structures (Peters 1988; McIntyre and Rieman 1995). During the summer in lakes and reservoirs, adfluvial WCT are often found at depths where temperatures are less than 60.8°F (McIntyre and Rieman 1995).Growth of individual WCT depends largely upon the interaction of food availability and water temperature. Resident WCT usually do not grow longer than 12 inches, presumably because they spend their entire lives in small, coldwater tributaries. In contrast, fluvial and adfluvial WCT often grow longer than 12 inches and attain weights of 2 to 3 lbs due to the warmer, more productive environments afforded by larger rivers and lakes (Trotter 1987; Behnke 1992).

Food Habits

WCT primarily feed on macroinvertebrates, particularly immature and mature forms of aquatic insects, terrestrial insects, and, in lakes, zooplankton (Liknes and Graham 1988). This preference for macroinvertebrates occurs at all ages and in both streams and lakes. WCT rarely feed on other fishes (Liknes and Graham 1988; Behnke 1992).

Habitat Requirements

Habitat use by WCT is diverse, and there is no clear hierarchy of critical life requisites. In general, WCT have habitat requirements typical of salmonid species (Table IV-4), but are strongly associated with cold, often nutrient-poor, high-gradient waters having pools and cover (Shepard et al. 1984b; Pratt 1984; McIntyre and Rieman 1995). Stream shading/riparian buffers, clean spawning gravels, low levels of fine sediments, backwaters, undercut banks, and large woody debris all contribute to cold water temperatures, formation of pools, provide cover, and/or support different WCT life stages.

There is also evidence that even small increases in stream water temperatures may afford a competitive advantage to non-native salmonids species such as brook trout, through displacement or invasion (De Staso and Rahel 1994; Novinger 2000). However, temperature may not be the critical factor for WCT populations. Instead, the stability of sediments, stream flow, and timing changes, or other unknown factors may be more important than temperature. In addition, natural and artificial barriers strongly influence the distribution of some populations.

Table IV-4. Habitat Requirements of Westslope Cutthroat Trout

Life Stage/Attribute	Need	Preference
Spawning		
Spawning Water Depth	Range about 0.7ft[a]	5.1 to 7.9 in[a]
Spawning Water Velocity	Range about 1 to 1.3ft/sec[a]	1.0 to 2.0 ft/sec[a] 1.0 ft/sec i
Spawning Substrate	Clean gravels[b, c]	0.08 to 3 in[a] 0.08 to 2.0 in [h] Approximately 70 percent of substrate in redds > 0.25 in [j]
Spawning Temperature	<60.8°F[c]	Initiated around 50°F [b]
Incubation		
Fine (<0.25 in) sediment particles present in substrate	Survival reduced by 50 percent at 20 percent fine sediment and reduced by less than 25 percent at <10 percent fine sedimentd, e Survival ranged from 76 percent (at 0 fine sediment) to 4 percent (at 50 percent fine sediment) j	
Incubation Temperature	<60.8°F[c]	35.6 to 50°F [a] 44.6 to 60.8°F [c]
Rearing and Adult		
Juvenile Rearing and Adult Temperature	<60.8°F[c]	44.6 to 60.8°F [c]
Depth	Related to stream temperature – summer 45-61°F [c] Related to lake temperature - summer <61° F [c]	1.0 to 1.6 ft [e] 1.6 to 3.3 ft [i] 1.3 to 3.9 ft [a]
Cover	Diversity of cover [c]	Pools and runs with diverse and abundant cover [d]
Water Velocity	Diversity of flow velocities depending on habitat use [c]	0.3 to 1.0 ft/s [e, f]
Substrate	Clean substrate with low levels of fine sediments [c]	Wide range, but generally clean gravels and cobbles. Cobble in winter when temperatures drop below 39.2 to 41°F
Fish access	Natural and artificial barriers may benefit remaining populations [g]	No artificial physical barriers
Feeding and Growth	Primarily macroinvertebrates, rarely on other fishes [c]	

Sources: [a] Liknes 1984; Shepard et al. 1984; [b] Liknes and Graham 1988 : [c] McIntyre and Rieman 1995: [d] Irving and Bjornn 1984; [e] Griffith 1972; [f] Pratt 1984; [g] MFWP 1999; [h] MFWP 1982; [i] Ireland 1993;[j] Weaver and Fraley 1991

Status and Distribution of Westslope Cutthroat Trout

WCT is one of 14 subspecies of cutthroat trout native to interior regions of western North America. The historical range of WCT is the most geographically widespread among the 14 subspecies of inland cutthroat trout (USFWS 1999b). WCT have been present in Montana since at least the Pleistocene Epoch, a period of continental glaciation that ended in Montana approximately 12,000 years ago. WCT were first recorded in 1805 by the Lewis and Clark expedition (Behnke 1992). Early explorers' journals suggest that WCT were extremely abundant and widely distributed (Trotter and Bisson 1988). They are thought to have historically occupied nearly all of the drainages west of the Continental Divide in Montana, including the Kootenai, Clark Fork, and Flathead River subbasins (MFWP 1998).
The known and predicted status information analyzed by Quigley and Arbelbide (1997) indicated that WCT remain widely distributed within their historical range, inhabiting at least 85 percent of the historical range. In addition, the historical range of WCT represented about 35 percent of the Columbia River basin. They reported that some extension of the natural distribution has also occurred through hatchery introductions. Of the historical range within the Columbia River basin, WCT remain strong in only 22 percent of that range (Thurow et al. 1997).

In general, where habitat remains in relatively good condition WCT are often found in most streams accessible to them (Rieman and Apperson 1989; Rieman and McIntyre 1993) and probably also occupy many natural lakes within the range as well (Quigley and Arbelbide 1997). Although this species is widely distributed, local extirpations are evident throughout its range and there appear to be few remaining healthy populations outside the Central Idaho Mountains and potentially the Northern Cascades. Therefore, WCT may be seriously compromised by habitat loss and genetic introgression (McIntyre and Rieman 1995, Rieman and Apperson 1989). Between 1966 and 1972 WCT were listed in the USFWS's Redbook of endangered and threatened species. Presently, fish management agencies consider it a sensitive or vulnerable species in Washington, Oregon, Idaho, and Montana (Quigley and Arbelbide 1997).

Rieman and Apperson (1989) estimated that strong WCT numbers persisted in 11 percent of the historical range in Idaho, and populations that were both numerically strong and genetically pure existed in 4 percent of the historical range. Liknes and Graham (1988) estimated that the subspecies still occupied 27 percent of the historical range in Montana, and were genetically pure in only 2.5 percent. Quigley and Arbelbide (1997) suggested that the largest extirpations may have occurred outside the Columbia River basin because their analysis indicated that WCT still occupy nearly 80 percent of that portion of historical range within the Columbia River basin in Montana. Discrepancies in their results may be from resolution of the data because their summary was based on subwatersheds rather than on stream reaches. Regardless, Quigley and Arbelbide's (1997) information supported the notion that few strong WCT populations are left in Montana and WCT continue to decline as first documented over 25 years ago (Hanzel 1959).

Presently, the native distribution of WCT is primarily in western Montana, eastern and northern Idaho, and southern Alberta (Behnke 1992). A few adjunct populations are located in central Oregon in the John Day drainage, in central Washington around Lake Chelan, and in southern British Columbia. These adjunct populations are principally the result of isolation in headwater

streams because of natural barriers. Within their primary range, WCT occur in the Missouri River basin (in the mainstem river and tributaries) downstream to Fort Benton, as well as the headwaters of the Judith, Milk, and Marias Rivers; and in the Kootenai River, Clark Fork River, and Pend Oreille River drainages (Behnke 1992). WCT also occur in the Salmon and Clearwater drainages of the Snake River system (Behnke 1992). Within the action area, WCT are widely distributed throughout many river drainages (mainstems and tributaries).

West of the Continental Divide, the subspecies is native to several major drainages of the Columbia River basin, including the upper Kootenai River drainage from its headwaters in British Columbia, through northwest Montana into northern Idaho; the Clark Fork River drainage of Montana and Idaho downstream to the falls on the Pend Oreille River near the Washington-British Columbia border; the Spokane River above Spokane Falls and into Idaho's Coeur d'Alene and St. Joe River drainages; and the Salmon and Clearwater River drainages of Idaho's Snake River basin. East of the Continental Divide, the historical distribution of WCT includes the headwaters of the South Saskatchewan River drainage (U.S. and Canada); the entire Missouri River drainage, upstream from Fort Benton, Montana, extending into northwest Wyoming; and the headwaters of the Judith, Milk, and Marias rivers, which join the Missouri River downstream from Fort Benton.

WCT currently occupy about 33,500 stream miles, equivalent to 59 percent of their historic range of about 56,500 stream miles (Shepard et al. 2003). WCT having no evidence of genetic introgression are found in approximately 10 percent of the currently occupied stream miles (Shepard et al. 2003). All populations of WCT are recognized as a single population rather than being composed of DPS (USFWS 1999b). Habitats of historical stocks of WCT ranged from cold headwater streams to warmer, mainstem rivers (Shepard et al. 1984b; Behnke 1992).

Today, self-sustaining WCT stocks remain widely distributed throughout the historical range of the subspecies, but remaining stocks occur primarily in colder, headwater streams that are largely found on lands administered by federal agencies, particularly the USFS. Existing WCT stocks in headwater streams seem to be relatively secure from colonization by non-native fish species, such as brook trout, because either the habitat is unsuitable for non-native trout, or access is blocked by natural or artificial barriers (Griffith 1988; Liknes and Graham 1988; Fausch 1989).

WCT were noted to already be restricted to headwater streams in Montana by as early as 1959 (Hanzel 1959). WCT have been listed as a Class A State Species of Special Concern by the MFWP and the Montana Chapter of the American Fisheries Society since 1972. Class A designation indicates limited numbers and/or limited habitats both in Montana and elsewhere in North America. WCT are considered a species of special status species by the BLM and a sensitive species by USFS in Montana.

Currently, WCT in Montana can be found in the Oldman, Missouri headwaters, Lower Missouri, Kootenai, Clark Fork, and Flathead River drainages. The WCT distribution map presented in the Final EIS/HCP 2010, Appendix D, Figures D-49, D-51, and D-53, is based on the most recent distribution information available on the Montana Natural Resources Information System (NRIS) data maintained and supplied by the MFWP. The only significant limitation of the current distribution map is the substantial amount of stream length not surveyed to date. An estimated

10,950 stream miles (35 percent) of the 31,065 stream miles that comprise the range of WCT west of the Continental Divide have been surveyed. Of that, WCT of varying degrees of introgression have been documented in reaches totaling 8,424 stream miles (77 percent). Pure WCT occupy less than 5 percent of the habitat in the Missouri River drainage and most of these populations are isolated in headwater tributaries (Shepard et al. 2003, Shepard et al. 2005).

WCT (>95 percent) are known to occur in reaches totaling 2,181 miles of those 10,950 surveyed stream miles (20 percent), which is 7 percent of their historical range in the upper Columbia River basin in Montana. Genetically pure (100 percent pure) populations occur in only 18 percent (1,941 miles) of surveyed habitat and 6 percent of historic range. Populations occupying 240 miles of surveyed habitat are 95-99.9 percent pure (11 percent); populations occupying 679 miles of surveyed habitat are less than 95 percent pure (31 percent), and those occupying 5,565 miles of surveyed habitat remain untested (based on NRIS data last updated on 1/l/97). These figures are likely to be updated in the near future by MFWP through their basin-wide WCT assessments and WCT range-wide efforts in support of the Memorandum of Understanding and Conservation Agreement for Westslope Cutthroat Trout (MFWP 2007).

In general, WCT populations in the Columbia River basin appear to be more secure than those located east of the Continental Divide due to a number of reasons. Western Montana has less irrigated agriculture, less influence of introduced fishes, more federally managed lands, and more land designated as wilderness or National Park (Shepard 1996). There are presently 2,422 stream reaches containing WCT distributed throughout 18 sub-basins in the upper Columbia River Basin in Montana. Of these WCT reaches 495 are known to be pure, 64 are between 95 percent and 99.9 percent pure, 164 are less than 95 percent pure, and the remaining 1,699 are untested (based on NRIS data last updated on 1/l/97). Of the 2,422 reaches with known WCT populations (comprising 8,424 stream miles), 1,282 (53 percent) comprising 4,503 (53 percent) miles are classified in the NRIS database as abundant. The populations in the remaining 1,140 stream reaches consisting of 3,922 miles are considered rare. Of the 559 reaches with known populations of >95 percent purity, 366 (69 percent) comprising 1,434 stream miles are considered abundant.

Factors Affecting Status of Westslope Cutthroat Trout

Hybridization with introduced, non-native fishes, especially rainbow trout and their hybrid descendents was acknowledged as an appreciable threat to WCT by the USFWS (68 FR 46989). Continual introgression can eventually lead to loss of genetic identity of one or both of the parent species that could result in a population consisting entirely of individual fish that each contains genetic material from both of the parental species. A key concern is those self-sustaining populations of non-native fishes, very few of which can be appreciably reduced or eliminated, that pose a hybridization threat to the extent that introgressive hybridization may eventually pervade extant, nonintrogressed WCT populations, particularly those that inhabit headwater streams in high elevation areas. Hitt et al.(2003) observed 55 percent of 40 WCT populations in the Flathead River drainage with evidence of hybridization and that introgression had progressed upstream over 2 decades into smaller tributary streams. Similar results were found in the Clearwater drainage in Idaho (Weigel et al. 2003).

Shepard et al. (2003) assessed the risks to WCT range-wide using a risk classification that ranked potential risks that could occur in the foreseeable future, considered to be 2 to 3 decades. Risks were categorized into three major classifications: genetic, disease, and population-level. Genetic risk was defined by the future chance of introgression of a WCT conservation population based on the probability of non-native fish hybridizing with WCT. Losses of WCT populations in the Missouri drainage in southwest Montana are primarily associated with habitat degradation and introduction of nonnative trout since the late 1800's (Shepard et al. 2003).

Introduced species have played a key role in the current status of WCT. Non-native salmonids have been introduced throughout the range of WCT including Glacier National Park (Marnell 1988). Behnke (1992) concluded that brown, brook, and rainbow trout along with changes in flow and water quality, were responsible for the demise of some WCT populations in the Spokane and Clark Fork river drainages. Fausch (1988, 1989) suggested that the persistence of WCT is jeopardized in streams also supporting brook or brown trout. Brook trout are thought to have replaced many WCT populations in headwater streams (Behnke 1992), but the mechanism of interaction is not clear (Fausch 1988; Griffith 1988). When the two species coexist, WCT seem to predominate in the higher gradient reaches (Griffith 1988), while brook trout may prevail in lower gradients (Fausch 1989).

Although closely related, WCT and rainbow trout have remained reproductively distinct (Behnke 1992) where they evolved together. However, where non-native rainbow trout have been introduced, hybridization is widespread (Behnke and Zarn 1976; Rieman and Apperson 1989). Yellowstone cutthroat trout have also been widely introduced into the WCT range and hybridization between these two forms is common (Liknes 1984; Rieman and Apperson 1989). Genetic introgression was believed to be the most important cause for decline of WCT populations in Montana (Liknes and Graham 1988), and may compromise populations throughout the range.

Boyer et al. (2008) documented the spread of hybridization in the Flathead drainage, a stronghold for WCT. Most recently, Muhlfeld (2008) assessed behavioral ecological and fitness consequences of hybridization between WCT and nonnative rainbow trout in the Flathead River drainage upstream of Flathead Lake. In a separate paper he and coauthors (Muhlfeld et al. 2009) concluded that small amounts of hybridization markedly reduced fitness of male and female trout, with reproductive success sharply declining by approximately 50 per cent, with only 20 per cent admixture. Despite apparent fitness costs, their data suggest that hybridization may spread due to relatively high reproductive success of first-generation hybrids and high reproductive success of a few males with high levels of admixture. Muhlfeld et al. (2009) conclude this outbreeding depression suggests that even low levels of admixture may have negative effects on fitness in the wild and that policies protecting hybridized populations may need reconsideration.

Angling is an important factor affecting the status of these fish. WCT are highly susceptible to angling (Behnke 1992; Lewynsky 1986), and many populations have increased in response to harvest restrictions (Johnson and Bjornn 1978; Peters 1988; Rieman and Apperson 1989; Thurow and Bjornn 1978). Rieman and Apperson (1989) found evidence of a depensatory effect in fishing (mortality increased with decline in population size) and speculated that harvest could lead to the elimination of some small populations. Harvest restrictions may be necessary to

maintain most WCT populations (Rieman and Apperson 1989). Most state fish management agencies limit harvest of native WCT with restrictive angling regulations.

Habitat disruption is a factor consistently identified in the decline in the status of WCT. Habitat loss and degradation are primary concerns for persistence of WCT (Liknes 1984; Liknes and Graham 1988; Rieman and Apperson 1989). Accumulation of fine sediments has been a primary concern for biologists dealing with fish habitat relations (for example, Rieman and Apperson 1989; Stowell et al. 1983). In watersheds within the belt geologies of northern Idaho and western Montana, excessive bedload transport and scour are problems associated with watershed disruption and increased peak flow events (Cross and Everest 1995). In low gradient channels bed aggradation may result both in the loss of pools or pool volume, and in channel dewatering during low flow periods. The relatively simple, unstable channels that result from intensive management of these sub-basins were overlooked as problems as earlier concerns focused on fine sediments (Gamblin 1988; Rieman and Apperson 1989). Intensive management may lead to habitat disruption through a variety of mechanisms.

The current abundance of WCT appears to be restricted from historical conditions (Behnke 1992; Bjornn and Liknes 1986; Liknes and Graham 1988; Rieman and Apperson 1989, Shepard et al. 2003). Local extirpations are also evident in portions of the range. Construction of dams, irrigation diversions, or other migration barriers has isolated or eliminated WCT habitats that were once available to migratory populations (Rieman and Apperson 1989). Resident forms may persist in isolated segments of streams but the loss of the migratory life-history and the connection with other populations potentially important to gene flow or metapopulation dynamics, may seriously compromise the potential for long-term persistence (McIntyre and Rieman 1995). Climate change might be important in further restriction of WCT populations (Mullan and others 1992; Rieman and McIntyre 1995). Although small and often isolated populations appear to persist throughout the range, the long-term outlook for many of these is poor (Quigley and Arbelbide 1997).

There is little chance that populations strongly influenced by introgressive hybridization can ever be recovered as genetically pure. Because most of the genetic variation in the subspecies occurs among rather than within populations (Allendorf and Leary 1988) maintenance of the few remaining strong populations could be critical to preservation of remaining genetic diversity.

According to Quigley and Arbelbide (1997), the core of the distribution for strong populations is clearly associated with the central Idaho mountains, and many populations there appear secure. Other important regions of known or likely habitat are in Idaho and Montana within the upper Clark Fork and northern glaciated mountains. These later areas, however, are more fragmented and restricted to a relatively smaller portion of the historical distribution than the core of subwatersheds associated with central Idaho. Further erosion of remaining strongholds could influence both the broad representation of and the potential for long-term persistence of WCT.

Increased attention to the plight of native fishes has slowed the decline of WCT in Montana, although populations continue to become extirpated (MFWP 1998). The Montana Cutthroat Conservation Agreement (MFWP 2007) is a proactive step to control the losses and restore certain populations.

The causes for decline of WCT are varied. Many strong populations in Idaho and Montana occurred largely in roadless and wilderness areas or national parks (Liknes 1984; Liknes and Graham 1988; Marnell 1988; Rieman and Apperson 1989) suggesting that human activities have been an important factor in WCT declines. In general, strong populations are thought to be primarily associated with areas of limited human influence and the potential effects of fishing, watershed disturbance and non-native introductions (Rieman and Apperson 1989). The association of current distributions with areas of lower road density and with wilderness or low management impact in the classification-tree analysis is consistent with this view.

According to a summary by the USFWS (1999b) of the factors affecting WCT these include, but are not limited to the following: 1) habitat loss and degradation, 2) recreational over- fishing, 3) predation, particularly by non-native introduced species, 4) disease, especially whirling disease which can affect WCT populations where they overlap with rainbow trout (whirling disease, caused by a protozoan parasite that requires an oligochaete (an aquatic earthworm) as its intermediate host, was discovered in rainbow trout in Montana in 1994), 5) inadequacy of existing regulatory mechanisms, 6) introduced species which compete for food resources and hybridize with WCT, and 7) fragmentation of habitat due to human-caused physical barriers, thermal barriers, and dewatered sections of streams. Strongholds of WCT are generally in unroaded areas that have potential to maintain natural processes and function as refugia (Liknes and Graham 1988; Marnell 1988; Van Eimeren 1996). The USFWS determined that WCT should not be listed because abundant, stable, and reproducing populations remain distributed throughout its historic range.

Status of the Species – Columbia Redband Trout

Listing History

MFWP classifies RBT as a species of special concern and the UFWS and DNRC categorize the species as “sensitive” (Final EIS/HCP 2010, Chapter 4, page 4-237; Muhlfeld 2003). In 1994 The Biodiversity Legal Fund of Colorado and Mr. Donald Kern of Kalispell, Montana, formally petitioned the USFWS to consider the Kootenai River population of RBT as an endangered species under the Act on April 4, 1994 (59 FR 58982). However, a 90-day finding by the USFWS determined that the petition did not present substantial scientific or commercial information indicating that the petitioned actions may be warranted, because it failed to substantiate that the RBT of the Kootenai River as a distinct population segment (60 FR 40339-40340).

Species Description

The rainbow trout is a widely distributed western North America native salmonid. The historical range of all forms of RBT, a form of the rainbow, included freshwaters west of the Rocky Mountains, extending from northern California to northern British Columbia, Canada (Behnke 1992). RBT were widely distributed and occupied most accessible waters from the southern desert sub-basins to the high mountain coniferous forests (Behnke 1992; the following are as cited in Quigley and Arbelbide 1997 - Cope 1879; Cope 1889; Gilbert and Evermann 1895; Jordan 1892; Jordan and Evermann 1896; Jordan and others 1930; Snyder 1908).

Behnke (1992) divides the species into RBT and coastal rainbow trout (*O. m. gairdneri* and *O. m. irideus*). Redbands were subdivided into two major subdivisions: 1) interior Columbia RBT upstream of Celilo Falls, including the Fraser and Athabasca rivers in Canada, the upper Klamath River basin, and the isolated interior sub-basins of Oregon; and 2) the Sacramento-San Joaquin RBT. Redbands and coastal rainbow forms do not show clear-cut distinctions as do some subspecies. However, they do reflect a continuum of differentiation that indicates a high degree of diversity and adaptive specialization (Howell 1997). Redbands, like coastal rainbows, have various migratory and resident life histories. Even though there are obvious physical and behavioral differences between resident redbands and steelhead (anadromous *O. mykiss*), the extent of reproductive isolation where they occur sympatrically remains uncertain (Howell 1997). Although the systematics is incomplete, physical characteristics and genetic studies support the view that Behnke's rainbow trout forms warrant sub-specific recognition (Quigley and Arbelbide 1997).

In the Columbia River basin RBT have two distinct life histories, anadromous (steelhead) and nonanadromous (Quigley and Arbelbide 1997). Quigley and Arbelbide (1997) considered allopatric RBT those that evolved outside the historical range of steelhead and assumed the allopatric form was potentially genetically and evolutionarily distinct from other RBT because of this isolation. They considered sympatric RBT to be the non-anadromous form historically derived from or associated with steelhead. Morphologically, anadromous and non-anadromous *Oncorhynchus mykiss* juveniles are indistinguishable, and it's likely that the life history differences have evolved repeatedly from a single form throughout the basin (Quigley and Arbelbide 1997). Inland, or resident, freshwater RBT consist of three major groups (Behnke 1992): 1) RBT of the Columbia River basin east of the Cascade Mountains and the upper Fraser River basin (a subspecies present within the NFHCP action area); 2) RBT of the Sacramento River basin; and 3) coastal rainbow trout. Other subspecies of RBT have been described, but they have not been consistently distinguished from these three groups (Behnke 1992).

Life History

The life history and habitat requirements of the different subspecies of rainbow trout are essentially the same; however, there are several forms whose life histories are variable and have been described including adfluvial and fluvial migratory forms, non-migratory resident or stream-dwelling forms. Their main differences are in geographic location/isolation and morphological characteristics (physical appearance) (Behnke 1992). In addition, Lee et al. (1997) subdivided the resident RBT into those that are sympatric or allopatric with the anadromous form (steelhead). Allopatric RBT are those that evolved outside of the historical range of steelhead, whereas sympatric RBT either occur within the steelhead range or were evolved from steelhead populations. In most areas, interior RBT have adfluvial life histories, migrating between highly productive rearing areas in lakes and spawning areas in streams, or between productive marshes and streams. Adfluvial RBT (such as Kamloops rainbow trout) migrate from lentic waters to tributaries and fluvial RBT remain in flowing waters throughout their entire life cycle, using streams ranging from small tributaries to large rivers (Moyle at al.1989). Smaller stream-resident RBT are typically insectivorous while larger lake-residents eat small fish as well as insects.

The ecology of RBT remains largely unknown although many early life-history characteristics may be similar to those for steelhead. Other rainbow trout may also be representative, but because of the potential effects of introgression with introduced forms, that representation is not clear. It appears that steelhead confined above barriers adopt a non-anadromous lifestyle appropriate to the habitats available (Moffit and Bjornn 1984) but retain the potential for anadromy (Mullan et al. 1992).

Allopatric RBT are isolated in small patches of habitat above migration barriers and persist with only minimal movements. Movement among populations may be an important mechanism for maintenance of genetic variability in populations (Leary et al. 1992) and for their persistence in variable environments.

Little is known about the interaction of RBT with other species. Where RBT and WCT are naturally sympatric, the two species appear to have evolved segregative strategies (Rieman and Apperson 1989). However, genetic introgression with coastal rainbow trout has been documented in both Idaho and Montana (Sage 1993; Leary 1997; Knudsen et al. 2002).

Spawning and Rearing

RBT are primarily spring spawners that generally spawn between March and June depending on water temperatures, although they may reproduce at any time of the year (Kunkel 1976). Spawning occurs when water temperatures exceed about 35 to 39 °F (Stolz and Schnell 1991). RBT spawn exclusively in flowing waters and typically migrate to spawning areas. In Basin Creek, Montana (Kootenai River subbasin), adult RBT commenced spawning (e.g. redd construction) during June as spring flows subsided following peak runoff (Muhlfeld 2002). Thurow (1990) observed allopatric RBT migrating upstream to suitable spawning locations in spring. Migration timing is likely effected by water temperature and stream flow. Following spawning allopatric RBT may maintain restricted home ranges until migrating to overwintering areas in the fall (Thurow 1990).

During the rearing season, resident RBT are found in cool, clear, fast-flowing permanent streams where riffles tend to predominate over pools (Moyle 1976). Migratory juveniles typically move downstream to their ancestral lake or river after 1 to 3 years of rearing in or near their natal area. Sexual maturity typically occurs at 3 to 5 years. Growth is variable but likely dependent on genetic and environmental conditions. Use of substrate and cover by juvenile and adult RBT did not show an apparent preference for any particular substrate size (Muhlfeld 1999). In summer, adults and juvenile fish used more cover than expected; however, young-of-the-year age class was found along stream margins with virtually no cover (Muhlfeld 1999).

Food Habits

Adults are typically drift feeders. They prefer habitat with sufficient depth and velocity to allow holding near an area with swifter water where drifting invertebrates can be intercepted. Juvenile and adult RBT were observed more than expected in deeper, slower habitats with more total cover and smaller substrates, but appeared to occupy higher velocities during higher flows in order to maintain positions in deep areas of the stream (Muhfeld 1999). These sites may include near-bank instream cover, an undercut bank, instream wood, or boulders and cobbles in riffles

(Stolz and Schnell 1991). Fry and small juveniles tend to school in slow, shallow inshore waters or eddies. Preferred water temperatures for rearing RBT are 54 to 66 °F (Bell 1991).

Habitat Requirements

RBT may be found in a wide range of conditions, often more extreme than those associated with other species. The species inhabit a variety of stream types and has been observed at stream gradients of 0.1 to 24 percent (Quigley and Arbelbide 1997), although Muhlfeld (1999) observed a negative relationship between stream gradient and RBT densities in sloped box canyon streams in Montana. Populations are found inhabiting desert environments with turbid and alkaline waters that range from near freezing to over 77 °F. RBT are often found in warmer waters than other salmonids. Growth has been positively associated with temperature in forested streams (Mullan et al.1992), but there are likely limits to their tolerance, however. In warmer and drier environments the loss of riparian cover has been associated with reduced numbers and production of fish (Li et al. 1994; Tait et al. 1994).

RBT are broadly distributed within the Columbia River Basin and occupy a wide range of biophysical settings (Quigley and Arbelbide 1997). RBT were more likely to be present or strong in watersheds less influenced by land management on USFS administered land, in mid-size or smaller streams, and in higher gradient streams, with more solar radiation, precipitation greater than about 12 inches, and mean temperatures less than 46.4 to- 48.2 °F (Quigley and Arbelbide 1997).

Muhlfeld (1999) observed that RBT in small forested streams in western Montana were limited in distribution primarily to lower gradient headwater reaches (>4 percent) and no RBT were found in gradients steeper than 10 percent due to barriers to fish migration and inadequate habitat conditions. Suitable RBT habitat was associated with small low-gradient reaches with abundant pool habitat and narrow widths. This compares with other research on cutthroat trout and brook trout where distribution was found to be limited to channel slopes less than 10 percent, particularly in high elevation streams (Bozek and Hubert 1992; Kruse et al. 1997; Chisholm and Hubert 1986). It has been established that often brook trout dominate rainbow trout in slow, low-gradient streams, which led Muhlfeld (1999) to reason why the abundance of RBT is lower in the low-gradient reaches of the Yaak River in Montana where non-native brook trout were introduced.

Habitat use patterns of RBT are generally similar to other salmonids (Quigley and Arbelbide 1997). Thurow (1988) found RBT most abundant in pool habitats and in association with cover components including undercut banks, large woody debris, and overhanging vegetation. Muhlfeld (1999) reported that low gradient stream reaches with abundant pool habitat supported the highest densities of RBT during summer. RBT, like steelhead, may be associated with higher gradient channels, often in riffles or with substrates dominated by boulders, cobbles and pocket water (Kunkel 1976). Water depth was postulated to be an important microhabitat feature in summer for old-aged fish in two small-sized streams in western Montana (Muhlfeld 1999).

Winter habitat preferences are similar to most salmonid species. Preferences include areas with low water velocities and access to refuge cover, such as deep pools, areas with woody debris,

side channels, and backwaters (Baltz et al. 1991; Behnke 1992). Patterns of feeding and hiding behavior tend to shift as water temperatures decrease, with daytime hiding behavior starting as water temperatures decrease from 46 to 37 °F. Rainbow trout have been observed seeking refuge in stream substrates during winter days and feeding at night (Campbell and Neuner 1985; Riehle and Griffith 1993).

Status and Distribution of Columbia Redband Trout

The RBT is considered a species of Federal concern and special concern by the American Fisheries Society, which has listed RBT as a Class A Species of Special Concern since 1993. A Class A species of special concern is defined as a species or subspecies that has "limited numbers and/or habitats both in Montana and elsewhere in North America and elimination from Montana would be a significant loss to the gene pool of the species or subspecies."

The RBT is classified as a sensitive species by the USFS and BLM (Williams et al. 1989). In Region I of the USFS the state rank for Montana is S1, for Idaho S2S3, and the provincial rank for British Columbia is S4. The S1 rank means the subspecies is critically imperiled because of extreme rarity or because of some factor(s) of its biology making it especially vulnerable to extinction. The S2 rank means the species is considered imperiled because of rarity or because of other factor(s), demonstrably making it very vulnerable to extinction throughout its range. An S3 rank means it is very rare and local throughout its range, or found locally (even abundantly at some of its locations) in a restricted range, or vulnerable to extinction throughout its range because of other factor(s).

In its *Analysis of the Management Situation for the Kootenai and Idaho Panhandle National Forests* (KIPNF 2003), the USFS reports that current populations range from strong to depressed. In all but five of the 6-field hydrologic unit codes (HUCs) on the Idaho Panhandle National Forest, RBT status is described as "presence unknown". In three HUCs, redbands are known to be present but their population status is unknown, and in two they are present but depressed.

In the Upper Kootenai Subbasin, Muhlfeld (2003) reports that genetically pure stocks of RBT have been identified in Callahan Creek, Basin Creek, the upper north (British Columbia) and east forks of the Yaak River, and upper Big Cherry Creek and Wolf Creek (Allendorf et al. 1980; Leary et al. 1991; Huston 1995; Hensler et al. 1996). Recent results of additional genetic testing conducted by MFWP (Allendorf 2003 unpublished) show the range of genetically pure populations of redband also includes upper Libby Creek and the upper Fisher River (including the Pleasant Valley Fisher, East Fisher River drainages). The status of these Montana RBT populations is presumed to be stable (J. Dunnigan, MFWP, pers. comm. 2004).

<u>Range-wide Status and Distribution of Columbia Redband Trout</u>

Globally, RBT (*Oncorhynchus mykiss gairdneri*), a subspecies of rainbow, have a G5T4 ranking, meaning that the subspecies is apparently secure, although it may be quite rare in parts of its range, especially at the periphery. A recent status report estimated that in Oregon, Washington, Idaho, western Montana, and northern Nevada, only 4.6 percent of subwatersheds within the

subspecies historic range are currently occupied by known strong populations, and 75 percent of subwatershed populations with known status are depressed (Bradley et al. 2002).

The RBT was more widely distributed within the Columbia River basin than any other salmonid (Behnke 1992). The only major areas within the Columbia River basin that did not support RBT were the Snake River upstream from Shoshone Falls, tributaries to the Spokane River above Spokane Falls, Eastern Rocky Mountain sub-basins in Montana, and portions of the northern Great Basin in Oregon (Quigley and Arbelbide 1997). RBT probably replaced native cutthroat trout in many sub-basins within the last 30,000 years, perhaps favored by climatic and hydrologic events during and following glaciation (Behnke 1992). Native RBT are likely being replaced by introgressed forms of RBT, hybrids with introduced rainbow or cutthroat trout.

Based on known and predicted status and distribution, Quigley and Arbelbide (1997) reported that RBT remain the most widely distributed key salmonid in the Columbia River basin, with sympatric and allopatric forms jointly known or predicted to occupy 47 percent of the entire basin. They estimated that RBT occur in 64 percent of their combined historical range, but despite their broad distribution, less is unknown about the current distribution of RBT than any of the other key salmonids. About 30 percent of the historical range was not classified (unknown occurrence) and another 37 percent of the historical range was judged to support RBT but too little information was available to evaluate status (Quigley and Arbelbide 1997).

Despite their broad distribution, relatively few strong sympatric RBT populations were identified by Quigley and Arbelbide (1997). Known or predicted strong areas included 17 percent of the potential historical range and 24 percent of the present distribution. Allopatric RBT had fewer strong populations, including 9 percent of the potential historical range and 18 percent of the present distribution (Quigley and Arbelbide 1997). Allopatric RBT populations are least well distributed in the Northern Great Basin and Columbia Plateau where they are believed absent in 72 percent of the potential historical range and few strong populations were known or predicted within the present distribution (Quigley and Arbelbide 1997).

The long history of stocking rainbow trout within the Columbia River basin, and the proclivity for redband and rainbow trout to hybridize, suggested to Quigley and Arbelbide (1997) that the true distribution and status of the original genotypes could be more depressed than their estimates indicate. Preliminary status reviews in Idaho, Oregon and Montana generally support this concern (Perkinson 1995). Introgressive hybridization is viewed as one of the most pervasive problems in the management of other non-anadromous native salmonids (Allendorf and Leary 1988; Liknes and Graham 1988) and may be a serious threat for many fishes in general (Quigley and Arbelbide 1997).

Those RBT found in the action area are Columbia River basin inland RBT and are predominantly residents of freshwater streams. However, a few lacustrine (lake dwelling) populations of Columbia River basin RBT are present in the upper Columbia River and Fraser River basins, and are commonly referred to as Kamloops trout (Behnke 1992). Within the action area, most RBT are found in tributaries to the Kootenai River, which is a major tributary to the upper Columbia River. RBT distribution in the action area sub-basins is shown in the Final EIS/HCP (2010), Appendix D, Page D-55.

Status and Distribution of Columbia Redband Trout in Montana

In its *Analysis of the Management Situation* (KIPNF 2003), the USFS reported that historically, RBT were the most widely distributed salmonid in the Columbia River Basin, but that they were not naturally widespread in areas within the Kootenai and Idaho Panhandle National Forests. For years, the upper distribution of RBT in the Columbia River Basin was believed to extend upstream to Kootenai Falls, which was considered a barrier falls (Allendorf et al. 1980; Chapman and May 1986), but it is now thought the barrier was not Kootenai Falls, but one that existed in geologic time near the present day Libby Dam or Fisher River (Hensler et al. 1996). Genetic surveys also indicate that RBT were not just found in headwater reaches as they are now, but were native to low-gradient valley-bottom streams throughout the Kootenai River drainage (Muhlfeld 1999). This range contraction may have occurred in response to past and present land use and fishery management practices.

RBT in the Kootenai River drainage in Montana represent the farthest inland penetration of native rainbow trout in the Columbia River drainage (Hensler and (Muhlfeld 1999). RBT, or inland rainbow trout, are native to the lower Kootenai River drainage in northwestern Montana (Huston 1998; Hensler et al. 1996). RBT historically inhabited low-gradient valley-bottom streams throughout the Kootenai River drainage, but currently the distribution has been reduced and confined to isolated headwater areas. These remnant populations may represent the only known sources capable of refounding the historic distribution of pure RBT in Montana (Muhlfeld 1999). Concern has arisen in recent years that RBT in the Kootenai River basin are at a high risk of extinction (Muhlfeld 1999).

In the Kootenai River drainage, Muhlfeld (1999) studied RBT in two small streams, Callahan and Basin creeks. This investigation examined summer habitat use and distribution and fall and winter habitat use and movement of adults. From a land management viewpoint, results indicated that maintaining and enhancing features that promote channel complexity (e.g., large woody debris, boulders) would provide RBT with resting and feeding habitat. In fall and winter for adults, maintaining habitat features that influence pool formation and depth throughout their limited range is likely essential for overwintering habitat. Land management activities have altered the magnitude, timing and frequency of channel-forming discharges which have resulted in degradation of stream habitat in the Kootenai River drainage, including Callahan and Basin creeks. The low quality stream habitat and spatial fragmentation, plus the likelihood of local disturbance in these two watersheds, may put these local populations at potential risk of extirpation if a stochastic event occurred (Muhlfeld 1999).

Genetic surveys of fish in the Kootenai River drainages from 1980 through 1995 showed that RBT (i.e., interior rainbow trout) were present above and below Kootenai Falls in certain watersheds and subwatersheds (Hensler et al.1996). Allendorf and Utter (1979) observed local heterogeneity in their genetic samples of rainbow trout that they attributed to planting of hatchery rainbow which created the genetic divergence among the local stocks. Allendorf et al. (1980) believed they had found five genetically pure remaining populations in Callahan Creek, Porcupine Creek, and the upper east and north forks of the Yaak River.

Based on genetic analyses in northwest Montana, populations of RBT have been identified in Callahan Creek, the East Fork Yaak River and its tributaries, the Yaak River (downstream from

Yaak Falls), the North Fork Yaak River, and tributaries to Libby Creek and the upper Fisher River (including the Pleasant Valley Fisher, East Fisher River drainages) (Allendorf et al. 1980; Leary et al. 1991; Huston 1995; Hensler et al. 1996; Knudsen et al. 2002). Currently, unintrogressed RBT populations are restricted to headwater reaches. RBT inhabiting Callahan Creek and the upper Yaak drainage are isolated into two separate regions by Yaak River Falls, a falls-chute barrier located 2.5 miles from the mouth of Callahan Creek and a barrier falls located in the lower East Fork of the Yaak River. Telemetry-based research conducted by Muhlfeld (1999) suggested that RBT in Basin Creek and East Fork Yaak River (upstream from the barrier falls) may represent a metapopulation of RBT that includes both resident and fluvial life history forms.

Currently, in the Fisher River and Libby Creek drainages RBT are confined to parts of these drainages where they occupy some streams and lakes. They are found in several Cabinet Wilderness lakes. Drainages containing genetically pure RBT include: North Fork and East Fork Yaak River drainages; Yaak River below Yaak Falls; Wee Lake in the Yaak River drainage; Callahan Creek drainage; Wolf Creek drainage; Silver Butte Fisher River; and Big Cherry Creek. Presently, MFWP has a no-planting policy in all but two of these listed areas. Pleasant Valley above Loon Lake may have contained native RBT according to genetic analyses of fish collected from Barnum and Mark creeks and the mainstem Fisher in Pleasant Valley (Hensler et al.1996). This analysis indicated there was a mix of coastal rainbow, WCT, but primarily inland rainbow (i.e.; redband). MFWP suggests this area may have potential to increase RBT through restoration since no stocking has occurred in the Pleasant Valley Fisher River area since 1952 (Hensler et al.1996).

RBT did not occur in the section of the Kootenai River above the current site of Libby Dam prior to impoundment but are now present, and they continue to be stocked. Five thousand Gerrard rainbow trout were stocked annually into Kikomun Creek, a tributary to Koocanusa Reservoir, between 1986 and 1998 by the B.C. Ministry of the Environment. This practice was discontinued because of concerns with hybridization of stocked rainbow trout with WCT.

MFWP has developed an isolation facility for the conservation of redband rainbow trout at the Libby Field Station. Existing ponds were restored and the inlet stream was enhanced for natural outdoor rearing. The agency treated the newly renovated spring creek and pond with antimycin on November 1, 2000, to remove eastern brook trout and non-native rainbow trout. Native RBT from Basin Creek were stocked into the pond and spring creek in early May 2001 to provide a future source of eggs for restoring redband stocks within their historic range in the Kootenai River basin. The isolation facility also provides a source of native redband for use as an alternative to stocking lakes and private ponds with nonnative fish.

Factors Affecting Status of Columbia Redband Trout

The most limiting habitat attributes for RBT in U.S. tributaries identified in the Kootenai Subbasin Plan (KTOI & MFWP 2004) are riparian condition, fine sediment, high temperature, and channel stability, in that order. In the mainstem, the most limiting were altered hydrograph due to Libby Dam, riparian condition, low temperature, and fine sediment. Biological limiting factors in U. S. tributaries include non-native species, system productivity, and connectivity

between the mainstem and tributaries. Biological limiting factors in the U. S. mainstem include non-native species and system productivity.

Land and water use practices, habitat loss, over harvest, hybridization and a geographical restricted range are leading factors contributing to the decline of RBT abundance, distribution and genetic diversity in the Columbia River basin (Williams et al. 1989; Behnke 1992). Habitat degradation has been primarily attributed to poor land management practices, construction of dams and diversions, and floodplain development. Land development activities such as road construction, logging and grazing can alter substrate composition and reduce the frequency and area of pools, which may have very deleterious effects to the abundance and distribution of RBT. Recent concern has arisen that Kootenai River Basin RBT populations are at a high risk of extinction due to hybridization with introduced coastal rainbow trout, habitat fragmentation, and stream habitat degradation (Perkinson 1993; Muhlfeld 1999).

Genetic introgression with coastal rainbow trout has been documented in both Idaho and Montana (Sage 1993; Leary 1997; Knudsen et al. 2002). Habitat fragmentation examples include aggraded alluvial fans preventing migration from tributary streams, and culvert barriers preventing upstream migration of adults to spawning habitat (Partridge 1983; Downs 2000). Introductions of non-native trout including coastal rainbow trout, brown trout (*Salmo trutta*), and eastern brook trout (*Salvelinus fontinalis*), could lead to competition and species replacement.

Stocking non-native fish upstream from geologic barriers and in adjacent drainages poses a threat to the genetic purity and population persistence of isolated populations of RBT.

Libby Dam is responsible for several physical (habitat) and biological changes that together are probable limiting factors for RBT. For example, Koocanusa Reservoir is a nutrient sink, limiting biological productivity downstream of the dam (Woods and Falter 1982; Snyder and Minshall 1996). Abundance and diversity of important aquatic invertebrates has declined since construction of Libby Dam (Hauser and Stanford 1997), reducing food abundance for trout.

Limited food resources could affect survival of RBT, especially juveniles. The altered hydrograph (e.g. high winter flows, fluctuating daily flows, no flood events) may also have affected RBT through loss of mainstem juvenile habitat and possibly mainstem spawning habitat. Direct affects of other changes due to Libby Dam including the hydrograph and lack of flood events to flush and sort substrates are difficult to measure due to the lack of pre-Libby Dam data, but aquatic ecosystems are not resistant to changes of this magnitude.

In summary, environmental factors potentially affecting RBT in the action area are essentially the same as those for bull trout and WCT. Hybridization, fragmentation and isolation of habitats, and habitat degradation are the major environmental risk factors affecting the status of RBT. Hybridization and competition are biotic factors influencing RBT status. Introduced rainbow trout are now the most widely distributed fish in the action area that have contributed to losses of native RBT. Watershed disturbances that result in loss of corridors or connecting habitats can progressively isolate RBT populations into smaller and smaller habitat patches increasing their risk of local extirpation. Land management activities that have led to, and continue to lead to, alteration of stream channels; loss or conversion of riparian cover; water diversions; and

blockage of fish passage are principle threats to the quality of remaining habitat for RBT. Remaining populations of native RBT in the action area appear to be highly fragmented and restricted to small patches of known or potential habitat.

Native RBT are considered a species of special concern by MFWP. Conservation of RBT in northwest Montana is largely linked to two concerns: maintenance of existing habitats and genetic integrity (Hensler et al. 1996). Special consideration should be given to habitat protection and enhancement when designing and implementing land management activities such as timber harvest, livestock grazing, and mining. Introduction of other fish species can result in extirpation of native fish through loss of genetic integrity, particularly when accompanied by habitat degradation which favors the introduced species. Maintenance of genetic integrity of RBT is a primary concern of MFWP. MFWP are presently examining fishery management actions and potential habitat restoration projects in the Kootenai River Basin to aid in the recovery of native RBT (Hensler et al. 1996).

Climate Change

With respect to climate change, observations show that warming of the climate is unequivocal, and that human activities have led to large increases in heat-trapping gases over the past century (Karl et al. 2009). Human-induced emissions of heat-trapping gases come mainly from the burning of fossil fuels (coal, oil, and gas), with important contributions from the clearing of forests, agricultural practices, and other activities. The human-induced increases in heat-trapping gases from these activities have caused increases in global average temperatures, and changes in ocean heat content, precipitation, atmospheric moisture, and Arctic sea ice (Karl et al. 2009).

Climate changes have been characterized at the global, national, regional and local level and are expected to continue into the future (Karl et al. 2009; Battin et al. 2007). That these changes are attributable to human activities is undisputable, and the data suggests that certain human activities are more likely than others to contribute heat-trapping gases. However, it is virtually impossible to attribute proportions of the climate change trends to specific landowners and land managers, or to specific categories of human activities (i.e., many human activities directly and indirectly contribute some proportion to heat-trapping gas emissions).

The following discussion focuses on how climate change may have affected the status of HCP fish species. Most likely bull trout and its habitat may have been influenced to a greater degree than other native salmonids, including WCT and RBT, due to climate changes that have occurred in the western Montana (i.e., action area). This is because bull trout tend to have more spatially restrictive biological requirements than other native salmonids and are among the most cold water adapted fish that require very cold water for incubation, juvenile rearing, and spawning initiation (USFWS 1998d). Nevertheless, these same influences have likely occurred (although likely to a lesser degree) to WCT and RBT and their habitats because the habitat requirements for these native salmonids are very similar to that of bull trout.

Climate Change Influence on the Status of HCP Fish Species and Their Habitats

Climate change trends to date in western Montana (i.e., the action area) have likely been important with respect to how these trends affected characteristics of suitable HCP fish species

habitat. Habitat components that influence HCP fish species distribution and abundance include water temperature, cover, channel form and stability, substrate for spawning and rearing, and migratory corridors.

HCP fish species rely on cold water throughout their various life stages and increasing air temperatures due to climate change likely has caused a reduction in the availability of suitable cold water habitat, and most notably for bull trout, have significantly limited their distribution. Climate change has likely affected both the frequency and magnitude of fires over the last few decades, especially in the warmer, drier regions of the west such as western Montana. Bisson et al. (2003) noted that forests that naturally occur in a particular area may or may not be the forests that have, or will be, responding to the fire regimes of an altered climate. For example, in several studies related to the effect of large fires on bull trout populations, bull trout appear to have adapted to past fire disturbances through mechanisms such as dispersal and plasticity. However, the recent extreme fire events may have had a dramatic effect on bull trout and other aquatic species (e.g., WCT and RBT), especially in the context of continued habitat loss, simplification and fragmentation of aquatic systems, and the introduction and expansion of exotic species (Bisson et al. 2009).

There is still a great deal of uncertainty associated with how the effects of climate change may have changed the relative timing, location, and magnitude of risk to HCP fish species and their habitats. It is likely that the intensity of effects has varied by region and some populations of HCP species, especially bull trout populations, appear to face higher risk than others (ISAB 2007; Rieman et al. 2007). In streams and rivers with temperatures approaching or at the upper limit of suitable water temperatures for HCP fish species there is little, if any, likelihood that these fish have been able to adapt to or avoid the effects of climate change and global warming, especially for the most sensitive species like bull trout.

There is little doubt that climate change has been (and will continue to be) an important factor affecting distribution of HCP fish species. It is likely that climate change has contributed to their present day status, and that in some cases, has resulted in a contracted distribution, reduced patch size, and truncated connectivity for some of these native fish populations. Many of these populations that are currently connected may face increasing isolation, which could accelerate the rate of local extirpation beyond that resulting from changes in stream temperature alone as Rieman et al. (2007) surmised for bull trout. They suggested that due to variations in land form and geographic location across the range of the bull trout, it appears that some populations currently face higher risks than others. Bull trout in areas with currently degraded water temperatures and/or at the southern edge of its range may already be at risk of adverse impacts from current as well as future climate change (Rieman et al. 2007).

Climate change has likely contributed to warming stream temperatures in western Montana which has resulted in thermal refugia as critical to the persistence of many bull trout populations and probably WCT and RBT populations to some degree. Thermal refugia is important for providing patches of suitable HCP fish habitat during migration or fish movements through or to feeding forays into areas with greater than optimal temperatures.

HCP fish species require cold water for spawning and incubation. Suitable spawning habitat is often found in accessible higher elevation tributaries and headwaters of rivers and streams particularly for bull trout. However, impacts on hydrology associated with climate change have likely caused shifts in timing, magnitude and distribution of peak flows, and these changes have likely occurred (and predicted to occur) in high elevation stream basins (Battin et al. 2007). Thus, the increased magnitude of winter peak flows in high elevation areas has probably impacted the location, timing, and success of spawning and incubation for species like the bull trout, and probably WCT and RBT to a lesser extent. Lower elevation river reaches probably have not experienced as severe an impact from alterations in stream hydrology because they are unlikely to provide adequate stream temperatures for spawning, incubation and juvenile rearing. For bull trout, increased frequency and severity of flood flows during winter may have affected the over-wintering juvenile fish and eggs incubating in the streambed. Bull trout eggs deposited in the fall during spawning may have suffered higher levels of mortality when exposed to increased flood flows (Jager et al. 1997). In general, current WCT habitat rangewide is likely the result from the increased recent flooding and wildfires (Williams et al. 2009).

Recent projections of the loss of habitat suitable for bull trout in the interior Columbia River basin (Columbia River Basin interior includes over 140 million acres in portions of seven states including eastern Washington and Oregon, Idaho and western Montana), which includes the action area, as a result of climate warming, range from 22 percent to 92 percent (Rieman et al. 2007). The areas most severely affected were at lower elevations. The present reduction in bull trout spawning habitat and the habitat fragmentation of existing populations has reduced the opportunity for genetic exchange, which has likely contributed to the acceleration in the decline of this species in the interior Columbia River basin beyond that predicted simply due to temperature change.

Ground water temperature is generally correlated with mean annual air temperature, and has been shown to strongly influence the distribution of salmonids. Ground water temperature is also linked to bull trout selection of spawning sites, and has been shown to influence the survival of embryos and early juvenile rearing of bull trout (Rieman et al. 2007). Increases in air temperature are likely to be reflected in increases in both surface water (Stephan and Preud'homme 1993; Stoneman and Jones 1996; Mohseni and Stefan 1999) and groundwater temperatures (Meisner 1990; Shuter and Meisner 1992). Consequently, climate change increases in air temperature in certain watersheds may have been a factor in spawning site selection by bull trout and possibly WCT and RBT.

Migratory bull trout and WCT can be found in freshwater lakes and large rivers. Probable physical effects of climate change that may have occurred to rivers that are relevant to these migratory fish include increased competition and predation due to a shift in distribution of both predator and prey species, and reduced survival because of increased stream temperatures, reduced summer flows, and increased winter flows resulting in scouring and sedimentation (Irvine 2004).

The physical effects of climate change that may have occurred to lakes have likely impacted migratory adfluvial bull trout and WCT that seasonally rely upon lakes for their greater availability of prey and access to tributaries. Climate-warming impacts to lakes may have led to

longer periods of thermal stratification, and coldwater fish, such as adfluvial bull trout and WCT, could have been restricted to these bottom layers for greater periods of time. Deeper thermoclines resulting from climate change may have further reduced the area of suitable temperatures in the bottom layers and intensified competition for food (WWF 2003).

Based on modeling, Rieman et al. (2007) indicated that the effects of climate change on bull trout populations in the United States have been more pronounced in some regions than in others because bull trout are distributed across a broad range of environments and landforms of varied relief (see below). This scenario likely applies to WCT and RBT populations as well, although RBT is confined to a much smaller geographic range within the HCP project area.

Bull Trout Critical Habitat

The USFWS published a Final Rule revising designated critical habitat for bull trout (USFWS 2010b). The USFWS focused on six recovery units identified in the 5-Year Review (USFWS 2008a). The Columbia Headwaters Recovery Unit includes the Clark Fork, and Kootenai river basins in western Montana, i.e. the action area (USFWS 2010b). This recovery unit is considered essential to the conservation of bull trout because: 1) populations are significantly different from the other two recovery units west of the Cascade Range; 2) they are mostly isolated from other recovery units in the headwaters of the Columbia River basin by ancient waterfalls downstream; 3) most populations occur in the adfluvial migratory form; 4) they evolved in the absence of anadromous salmonids; 5) they occur inland in a cooler and drier climate and different vegetative conditions than the two recovery units west of the Cascade Range and the Mid-Columbia Recovery Unit; 6) loss of this recovery unit would result in a significant gap in the range of bull trout; and 7) populations within each of three different, isolated watersheds have or could have a shared evolutionary future by migrating among populations over long periods of time (USFWS 2010b).

The decline of bull trout is primarily due to the introduction of nonnative species followed closely by habitat degradation and fragmentation, blockage of migratory corridors, poor water quality, past fisheries management practices, impoundments, dams, and water diversions. Climate change may have exacerbated some of these impacts (USFWS 2010b). That is, climate change will likely interact with other stressors, such as habitat loss and fragmentation (Rieman et al. 2007; Porter and Nelitz 2009); invasions of nonnative fish (Rahel et al. 2008); diseases and parasites (McCullough et al. 2009); predators and competitors (McMahon et al. 2007; Rahel et al. 2008); and flow alteration (McCullough et al. 2009), rendering some current spawning, rearing, and migratory habitats marginal or wholly unsuitable.

Many of the PCEs identified in the final rule may have been affected by climate change. These PCEs are primarily related to sites for breeding, reproduction, or rearing (or development) of offspring; and habitats that are protected from disturbance are representative of the historical, geographical, and ecological distributions of a species. These PCEs include springs, seeps, groundwater sources, and subsurface water connectivity (hyporheic flows) to contribute to water quality and quantity and provide thermal refugia; water temperatures ranging from 36 to 59°F, with adequate thermal refugia available for temperatures that exceed the upper end of this range; a natural hydrograph, including peak, high, low, and base flows within historic and seasonal ranges or, if flows are controlled, minimal flow departure from a natural hydrograph; and

sufficient water quality and quantity such that normal reproduction, growth, and survival are not inhibited. Over a period of decades, climate change may directly threaten the integrity of the essential physical or biological features described in these PCEs (USFWS 2010b).

Future Conditions Attributed to Climate Change

Human activities in the future are expected to continue to contribute to climate change. There is high agreement and much evidence that even with current climate change mitigation policies and related sustainable development practices, global greenhouse gas emissions will continue to grow over the next few decades (IPCC 2007). The rate will depend on the level of emissions of heat-trapping gases that continue to be created and the actions taken around the world to reduce emissions of heat-trapping gases.

Climate change trends in western Montana (i.e., the action area) will be important with respect to how these trends may affect characteristics of suitable bull trout habitat. Habitat components that influence bull trout distribution and abundance include water temperature, cover, channel form and stability, substrate for spawning and rearing, and migratory corridors.

Summary of Climate Change Effects to Bull Trout

Future loss of bull trout habitat due to climate warming within the interior Columbia River basin was predicted to be 18 to 92 percent of habitat areas that are currently thermally suitable and 27 to 99 percent of large (> 24,710 acres) habitat patches (Rieman et al. 2007). If that were to occur, bull trout would remain in only a few high-elevation strongholds, becoming functionally extinct because the populations would be too small and isolated to guarantee ample genetic flow (Rieman et al. 2007). Because loss and fragmentation of habitats with warming has important implications for bull trout conservation, the loss of isolated patches of habitat could affect bull trout populations at a disproportionately greater level than that predicted based only on the overall loss of habitat area (Rieman et al. 2007). The model also predicted that of the three major bull trout basins in Montana, the Clark Fork River basin is at greatest risk from climate change, followed by the Flathead and Kootenai River basins.

Climate change has the potential to profoundly alter the aquatic ecosystems upon which the bull trout depends via alterations in water yield, peak flows, and water temperatures in streams and large waterbodies, and an increase in the frequency and magnitude of catastrophic wildfires in adjacent terrestrial habitats (Bisson et al. 2003). It is difficult to accurately predict how this aquatic niche species would respond to environmental changes associated with climate change; however, bull trout rely on cold water throughout their various life stages and increasing air temperatures likely will cause a reduction in the availability of suitable cold water habitat. At this time, the scope and scale of such changes are unknown, although the effects on bull trout would likely be negative.

The USFWS and DNRC considered the anticipated effects of climate change in the development of the HCP. In the final HCP, the no-harvest buffers were widened from 25 feet to 50 feet and the number of streams subject to the wider no-harvest buffer was increased. Extending the no-harvest buffer is a proactive approach, in part, to help insulate streams in harvest units against potential effects of climate change. Overall, the application of the DNRC HCP aquatic strategy

commitments is expected to help buffer the effects of climate change on channel form and function in the HCP project area by maintaining healthy riparian buffers, reducing sediment delivery, and addressing CWEs.

Summary of Climate Change Effects to Westslope Cutthroat Trout

The following information is largely derived from Williams et al. (2009). This paper discusses the potential consequences of climate change on the persistence of cutthroat trout populations in the western USA. We summarize this information and refine the discussion points to focus on the action area to the extent possible.

Williams et al. (2009) examined the 3 factors of increased summer stream temperatures, winter flooding, and increased wildfires due to climate change and related these factors to the predicted persistence of 3 subspecies of cutthroat trout, including WCT. They predict that within the next 50 years, wildfire, floods, and other disturbances may have a greater influence on populations of cutthroat trout than increased summer stream temperatures alone. The results of their analysis identified subbasins in the action area where WCT populations are at high risk of persistence from climate change.

In general, current WCT habitat rangewide is at lower risk for increased summer temperature but at varied risk for increased flood and wildfire risks. Only 3 percent of current habitat is predicted to be at high risk from increased summer temperatures, whereas 31 percent is at high risk from increased flooding and 37 percent from increased wildfire (Williams et al. 2009). If risk from winter flooding, wildfire, and temperature are combined, 65 percent of the current range of WCT is rated at high risk from climate change, and those high-risk habitats are distributed across all the subbasins in the action area that were studied.

In the action area, some high-risk areas for winter flooding were found centered in the Lower, Middle, and Upper Kootenai subbasins and the Upper, Middle, and Lower Clark Fork subbasins. Also, they found that high wildfire risk is concentrated in substantial habitat areas within the Upper Missouri subbasin and the North Fork and Flathead Lake subbasins. Because of existing habitat fragmentation and small population size of WCT populations in the Upper Missouri subbasin, it was observed that this subbasin under current conditions did not meet minimum persistence criteria and therefore was considered already at risk. Furthermore, they predicted that climate change will exacerbate this risk in the Upper Missouri where 100 percent of existing populations meeting persistence criteria are already at high risk from winter floods and wildfires.

The composite climate change risk is high for more than 50 percent of WCT populations meeting persistence criteria in all the Clark Fork and all the Kootenai subbasins. Many of the WCT populations they considered in these subbasins were already at risk because populations existed as small, isolated populations in fragmented and degraded habitat. Their analyses suggest that these risks will be further compounded by climate change, and some populations that are currently considered to be in relatively good condition are likely to suffer negative consequences from climate change, especially those populations relegated to smaller, isolated headwater habitats. Moreover, their analysis suggests that some of the remaining populations in lower-elevation habitats will be at risk from increased temperatures, increased winter flooding, or both.

Williams et al. (2009) indicated that cutthroat trout will have a much better chance of persisting in the face of increasing environmental threats if they have access to heterogeneous habitat and refugia, both seasonally and during disturbance. Secondly, they stated that ecological and life history diversity could potentially be restored by providing instream flows and reconnecting stream systems to allow access to migratory habitats by removing instream barriers. Finally, they reported that existing habitat stressors (such as livestock grazing, road development, and water withdrawals) should be curtailed. Such ecologically based strategies offer proven effectiveness in the face of increasing environmental uncertainty (Williams and Williams 2004). They concluded that impacts from climate change are likely to increase the risk of loss of WCT populations (and other subspecies of cutthroat trout) evaluated, particularly where they exist as small, isolated populations. However, in the HCP area, application of the DNRC HCP aquatic strategy commitments is expected to help buffer the effects of climate change on channel form and function in the HCP project area by maintaining healthy riparian buffers, reducing sediment delivery, and addressing CWEs

Summary of Climate Change Effects to Columbia Redband Trout

As mentioned above, future climate change has the potential to profoundly alter the aquatic ecosystems upon which native salmonids depend via alterations in water yield, peak flows, and water temperatures in streams and large waterbodies, and an increase in the frequency and magnitude of catastrophic wildfires in adjacent terrestrial habitats (Bisson et al. 2003). It is difficult to accurately predict how RBT would respond to environmental changes associated with climate change; however, it is not unreasonable to assume the response would be similar to bull trout and WCT. Although bull trout is likely to be more sensitive to changes, RBT also relies on cold stream temperatures throughout its various life stages, and increasing air temperatures likely will cause a reduction in the availability of suitable cold water habitat. At this time, the scope and scale of such changes are unknown, although the specific effects on RBT would likely be negative, but more closely follow WCT in terms of effects because of their similarity in life history form. In addition, application of the DNRC HCP aquatic strategy commitments is expected to help buffer the effects of climate change on channel form and function in the HCP project area by maintaining healthy riparian buffers, reducing sediment delivery, and addressing CWEs.

C. ENVIRONMENTAL BASELINE

Regulations implementing the Act (50 CFR 402.02) define the environmental baseline as the past and present impacts of all Federal, State, or private actions and other human activities leading to the current status of the species, its habitat (including designated critical habitat), and ecosystem in the action area. Also included in the environmental baseline are the anticipated impacts of all proposed Federal projects in the action area which have already undergone section 7 consultations and the impacts of State and private actions which are contemporaneous with the consultations in progress.

Introduction

In this section, the environmental baseline conditions for each HCP fish species are characterized by their distinct geographical distribution according to core areas (AAU) for bull trout or sub-

basins for WCT and RBT, and this information is carried forward in this section as explained below.

Thirteen of the 14 AAUs (Missouri River is the exception) are based on the bull trout core areas identified in the Draft Bull Trout Recovery Plan and listed in the Chapter 4, Table 4.8-16, of the Final EIS/HCP (2010). The Environmental Baseline discussions for the bull trout in this part of this BO (Part IV) focus on the descriptions of bull trout core areas as currently depicted in the updated bull trout core area templates (USFWS 2009). This information is applicable to the AAUs described in the Final EIS/HCP (2010) because they are: 1) closely equivalent geographically to classified bull trout core areas; 2) provide meaningful discrete, biological relevant units; and 3) typically contain all of the bull trout typical life histories.

To characterize the existing habitat and population conditions for WCT and RBT, Part IV of this BO will draw from the data and analyses presented in the Final EIS/HCP (2010) and other scientific and commercial available information, mostly in the scientific literature. The scale of analysis found to be the most appropriate based on best scientific and commercial available for both species is the subbasin level (Quigley and Arbelbide 1997) or major river drainages designated by 4th field hydrologic unit codes (HUCs) in the U.S. Geological Survey (USGS) system for classifying watersheds. Therefore, the environmental baseline conditions for these two species will be described by subbasin (Clark Fork, Flathead, Kootenai, and Missouri for WCT and Kootenai for RBT), unlike bull trout which will be characterized at the AAU scale (i.e., core area).

The baseline information obtained from the core area templates and other data on the AAUs in the Final EIS/HCP (2010) can be useful to establish existing habitat and population conditions not only for bull trout but for the other two HCP fish species, as well, because all are cold-water adapted, stream-dwelling, salmonids that need cold, clean, connected, and complex habitats to survive. Nevertheless, it is recognized that bull trout are more sensitive to changes in their environment than WCT and RBT because of the differences in the bull trout life history strategy (Rieman and McIntyre 1993). Thus, each species is discussed in their own respective sections in this part of the BO (Part IV).

Environmental Baseline for Bull Trout

Thirteen of the 14 AAUs (Missouri River is the exception) are based on the bull trout core areas identified in the Draft Bull Trout Recovery Plan (USFWS 2002). The relationship between the AAUs and bull trout core areas is shown in Table IV-2. Tables IV-5 and IV-6, show that HCP project land acreages and stream miles vary significantly in size within the AAUs. For example, two AAUs (Stillwater and Swan) each contain over 9 percent of the HCP project lands by area and stream miles, and four others (Lower Clark Fork, Rock Creek, Lower Kootenai, and Upper Missouri) contain less than 1 percent of the HCP project area and stream miles within their boundaries.

Table IV-5. Aquatic analysis unit acreage.

	Clark Fork Basin						Flathead Basin			
	Bitterroot	**Blackfoot**	**Lower Clark Fork**	**Middle Clark Fork**	**Rock Creek**	**Upper Clark Fork**	**Flathead Lake**	**N. Fork Flathead**	**Stillwater**	**Swan**
Action Area	1,827,284	1,478,362	714,038	3,197,557	568,475	1,793,565	761,502	612,855	498,460	466,102
All DNRC Ownership	40,079	67,753	4,493	112,967	6,731	74,191	18,885	18,835	101,631	45,523
HCP Project Area	27,743	56,528	4,185	88,512	4,592	47,173	10,470	18,499	87,321	44,613
Non-DNRC Ownership	1,787,205	1,410,609	709,545	3,084,590	561,744	1,719,374	742,617	594,020	396,829	420,579
Percent of HCP Project Area in Action Area	1.52	3.82	0.59	2.77	0.81	2.63	1.37	3.02	17.52	9.57
Bull Trout Habitat[1]	1,757,736	1,065,986	450,891	2,070,975	556,713	1,114,737	379,094	503,268	361,302	466,090
WCT Habitat[1]	1,827,250	1,465,783	714,026	2,799,720	568,439	1,499,782	545,401	574,940	432,674	466,090
RBT Habitat[1]	0	0	0	0	0	0	0	0	0	0
HCP Project Area										
Bull Trout Habitat[1]	22,187	41,803	1,650	60,237	4,059	27,407	2,002	16,259	85,730	44,506
WCT Habitat[1]	25,369	51,842	2,933	77,015	4,059	38,050	5,449	16,648	85,730	44,506
RBT Habitat[1]	0	0	0	0	0	0	0	0	0	0

Table IV-5. Continued

	Kootenai Basin			Upper Missouri Basin	
	Lower Kootenai	**Middle Kootenai**	**Upper Kootenai**	**Upper Missouri**	**TOTAL**
Action Area	622,274	893,582	807,903	14,298,458	**28,540,416**
All DNRC Ownership	3,650	31,180	12,368	802,565	**1,340,849**
HCP Project Area	3,527	28,767	11,153	115,441	**548,525**
Non-DNRC Ownership	618,624	862,402	795,535	13,493,144	**27,195,588**
Percent of HCP Project Area Within Action Area	0.57	3.22	1.38	0.89	**2.02**
Bull Trout Habitat[1]	240,505	597,718	404,278	0	**9,969,296**
WCT Habitat[1]	622,273	883,247	768,088	4,079,348	**17,247,060**
RBT Habitat[1]	542,278	646,531	58,435	0	**1,247,244**
HCP Project Area					
Bull Trout Habitat[1]	2,555	15,177	7,076	0	**330,648**
WCT Habitat[1]	2,555	25,317	9,563	27,865	**416,901**
RBT Habitat[1]	2,267	17,826	988	0	**21,081**

[1] Defined as a sixth-order HUC where there is a known presence of the species(s) concerned.

Source: USFWS and DNRC 2010, Table E4-3, Appendix E.

Table IV-6. Total stream miles (perennial and intermittent) and stream miles supporting HCP fish species in the action area and HCP project area by aquatic analysis unit.

	Clark Fork Basin						Flathead Basin			
	Bitterroot	Blackfoot	Lower Clark Fork	Middle Clark Fork	Rock Creek	Upper Clark Fork	Flathead Lake	N. Fork Flathead	Stillwater	Swan
Action Area	**6,374.4**	**4,907.3**	**2,093.6**	**10,392**	**1,876.2**	**5,577.3**	**1,650.8**	**1,508.4**	**1,433.6**	**1,376.2**
All DNRC Ownership	165.3	163.7	9.7	269.3	14.1	135.5	34.7	56.8	275.2	136.6
HCP Project Area	110.0	29.9	0.7	103.9	6.7	91.7	26.6	2.7	43.7	0.5
Non-DNRC Ownership	6,209.1	4,713.7	2,083.2	10,018.8	1,855.4	5,350.1	1,589.5	1,448.9	1,114.7	1,239.1
Percent of HCP Project Area Within Action Area	2.5	3.3	<1.0	2.6	<1.0	2.4	2.1	3.8	19.2	10.0
Bull Trout Habitat[1]	787	487.2	127.8	796	292.3	348.2	68	271.2	208.6	264.3
WCT Habitat[1]	1,099.2	1436.8	556.2	1,734.5	464.9	857.1	159.8	518.7	213.9	371.6
RBT Habitat[1]	0	0	0	0	0	0	0	0	0	0
HCP Project Area										
Bull Trout Habitat[1]	19.6	23.3	0.2	52.1	2.2	15.9	4.1	36.0	101.1	56.9
WCT Habitat[1]	26.1	44.3	1.4	75.7	2.5	31.4	8.1	38.8	97.7	66.2
RBT Habitat[1]	0	0	0	0	0	0	0	0	0	0

Table IV-6. Continued

	Kootenai Basin			Upper Missouri Basin
	Lower Kootenai	**Middle Kootenai**	**Upper Kootenai**	**Upper Missouri**
Action Area	**1,752.0**	**2,841.2**	**2,134.9**	**31,686.3**
All DNRC Ownership	11.2	93.5	34.6	232.9
HCP Project Area	0.9	13.2	0.6	1,515.0
Non-DNRC Ownership	1,739.9	2,734.5	2,099.7	29,938.4
Percent of HCP Project Area Within Action Area	<1.0	3.2	1.6	<1.0
Bull Trout Habitat[1]	100.7	220.3	97.4	0
WCT Habitat[1]	554.4	497	508.2	1126.3
RBT Habitat[1]	162.9	139.2	9.0	0
HCP Project Area				
Bull Trout Habitat[1]	3.8	12.4	7.3	0
WCT Habitat[1]	3.8	21.3	10.0	15.6
RBT Habitat[1]	1.6	13.7	0	0

[1] The number of stream miles supporting an HCP fish species were compiled using the l00K NRIS fish distribution dataset and the DNRC 24K Conflation Dataset. Calculations on DNRC lands were performed using the 24K dataset while calculations on non-DNRC lands used the l00K dataset. Stream miles supporting an HCP fish species not on DNRC lands are more than likely underestimated given the coarse nature of the dataset.

Source: USFWS and DNRC 2010, Appendix E, Table E4-

Status of the Bull Trout within the Action Area

The status of bull trout in the action area is described below by core area. The relationship of the core area to the action area AAUs is also established at the end of each subsection.

Status of the Flathead Lake Bull Trout Core Area

The Flathead Lake watershed is one of the largest, most complex, and best-documented bull trout core areas in the upper Columbia River watershed. Flathead Lake is the largest lake, in terms of surface area, of any natural freshwater lake in the western US, and is one of the 300 largest lakes in the world (CSKT and MFWP 2004). It covers 126,000 acres, has a mean depth of 165 feet, and a maximum depth of 370 feet. The Flathead Indian Reservation, where the Confederated Salish and Kootenai Tribes (CSKT) is the primary landowner, encompasses the south half of the lake.

An extensive redd count monitoring program was devised by MFWP and has been in place since 1980 (MFWP 2004a). These redd counts accurately reflect the population trend. Based on data collected from eight index tributary streams in the North Fork and Middle Fork Flathead River (collectively representing about half the known spawning in the basin), bull trout index redd counts ranged from about 300-600 in the 1980's (averaging 392), then dropped drastically in the early 1990's, to a range of 83-243 in the seven years prior to listing (averaging 137 between 1991 and 1997). In the 5 years post-listing (1998-2002), a brief rebound was experienced (range 187-251; average 215), but the 2003 redd count was only 130 and in 2004 only 136 redds were

found (MFWP)2004a). Results in 2008 indicate that counts, totaling 225 redds, were consistent with the previous two years (221 in 2006, 203 in 2007) and indicate a roughly stable adult population over the most recent past (Table 3; T. Weaver, MFWP, in litt. 2008).

Also, in 2008, MFWP conducted a basin-wide redd count in the Flathead Lake core area, incorporating portions of 14 streams. The 2008 basin-wide total redd count was 503 redds. Assuming 3.2 adults per redd and alternate year spawning as the norm, this count places the adult bull trout population in the Flathead Lake core area at around 3,000 bull trout.

Redd counts over the last decade have declined with spikes when strong cohorts are present. For the entire 25 years of record, interpretation of population trend is strongly dependent upon the portion of that time frame that is considered. There is no doubt that current bull trout numbers remain significantly below 1980's levels, but whether bull trout have substantially rebounded from the prelisting lows of the early 1990's may not yet be clear. Trouble signals remain for some formerly strong local populations (e.g. Coal Creek) where redd counts remain at an especially low ebb, occasionally reaching zero. Counts for the past 5 years (2004-2008) totaled 136, 144, 221, 203, and 205 redds. The 2004 and 2005 counts were considered minimum counts due to poor conditions during portions of the survey. Based on these counts, the recent trend appears stable.

In the longer term, basin-wide counts were made sporadically in 10 of the 30 survey years, representing "all 31 stream sections known to be used by Flathead Lake spawners" (T. Weaver, 2008, MFWP, pers. comm.). The basin-wide total has ranged from lows of 236 (1997) and 291 (1992) to highs of 1,156 (1982) and 850 (1986). The basin-wide count of 297 in 2003 was the third lowest on record, and the 2008 basin-wide count of 503 was the fourth lowest, but not far off the 10-year average of 578.

Given all that, there is considerable uncertainty, but the 2008 basin-wide count would seem to indicate an adult bull trout population of at least 1,500 fish in this core area (3.2 adults per redd conversion) and perhaps as high as nearly twice that (adding in non-spawning adults that remained behind in the lake or river).

At the same time, there is abundant evidence that the lake trout population in the Flathead Lake core area is roughly 100 times larger than the adult bull trout population, as much as 395,000 catchable-sized fish by one recent mark-recapture estimate (CSKT 2009). Intense predation and competition between lake trout and bull trout in Flathead Lake remains the highest ranking threat in this core area. Catch per unit effort and species composition of the 2008 lake-wide gill net catch (MFWP and CSKT 2009) were similar to catches in recent years, but numerous indicators suggest the lake trout population remains stable or potentially increasing (Hansen and Evarts 2008). Pike numbers also appear relatively stable, but bioenergetics modeling (Muhlfeld et al. 2008) indicates northern pike consume over 13,000 WCT and nearly 3,500 bull trout annually in the core area. Black crappie have been illegally introduced into a number of interconnected Flathead lakes and appear to be established and spreading. Scattered reports of smallmouth bass have also occurred.

Considerable new information has been developed in recent years that indicate a generally improving recent trend in overall bull trout habitat in this core area (see e.g., Weaver 2005, Muhlfeld et al. 2005, 2007, Steed et al. 2008, and Sylvester et al. 2008). Generally, the bull trout spawning and rearing habitat is either located in designated Wilderness, Glacier National Park, or in portions of National Wild and Scenic River corridors. Private land ownership is limited and on major portions in the Flathead National Forest there has been minimal development of new roads or timber sales and a strong emphasis on road decommissioning and application of BMPs. Potential for significant negative impacts due to sediment production and other wide-scale effects of recent large fires has been largely mediated by favorable precipitation and runoff patterns in the vulnerable post-fire periods. Some concerns remain due to potential for long term increases in water temperatures and future effects of rain-on-snow precipitation patterns. Long-term data sets include sediment scoring and coring for most major streams harboring local populations of bull trout. Additional emphasis has been placed recently on identifying and evaluating important bull trout habitat in the British Columbia headwaters of the Flathead, given threats of expanded coal, oil, and gas exploration and development. Crews surveyed over 25 stream reaches collecting species distribution information and genetic samples in British Columbian tributaries to the North Fork. WCT, bull trout and sculpin were observed in many reaches.

In 2001 and 2003 a series of major fires burned large portions of the bull trout habitat in the North Fork and Middle Fork Flathead River drainages. While these events are part of recurring long-term natural cycles in these lodgepole pine and Douglas fir ecosystems, the scope and severity of the fires was unusual and may have been exacerbated by a history of 20th century fire suppression activities on the forests. No immediate short-term impacts to bull trout populations were noted as a direct result of the fires or post-fire conditions and sediment transport was minimized due to burned area rehab activities and favorable runoff conditions. McNeil core samples have shown that the percent fines in monitored streams in the Flathead River system are generally within the same range as conditions in the late 1980s when bull trout numbers were strong.

Though Hungry Horse Dam on the South Fork Flathead River removed a substantial portion (up to about 40 percent) of the spawning and rearing habitat, the integrity and connectivity of the remaining habitat in the North and Middle Fork drainages of this core area is high. Hungry Horse now functions as an independent bull trout population with some natural barriers in headwaters and occasional temporary barriers resulting from beaver dams or other natural activities. However, there are no known man-caused barriers on bull trout spawning and rearing streams.

Flathead is a large, deep, cold lake with many groundwater–influenced spawning and rearing streams and a huge expanse of interconnected habitat. For that reason, the core area should be relatively immune to climate change concerns, although site-specific impacts could occur in some tributaries. Precipitation patterns appear conducive to higher frequency of rain-on-snow conditions in certain watersheds, as has been exhibited in several recent year events.

Bull trout in the Flathead Lake core area is much diminished from historic levels, largely as a result of nonnative species threats. For the most part, the habitat remains capable of supporting a much larger bull trout population than currently exists. Information collected since the time of listing indicates the status of this core area remains static at best. The magnitude of the lake trout threat has not declined and some local bull trout populations are at precariously low levels. The current status may or may not be sustainable and is documented by the long history of annual redd counts. In the near term, this core area should be able to sustain limited short-term impacts from land management activities in the watershed, especially if long-term habitat improvements result. However, due to the above-described threats from nonnative species invasion, there is tremendous uncertainty whether this bull trout population will remain viable in this core area.

The South Fork Flathead River population is also adfluvial with the majority of spawning occurring within the wilderness with the exception of Sullivan and Wounded Buck creeks. This population, which corresponds to this core area shows that 10,470 acres of the HCP occur within this AAU and that 2,002 acres are considered within bull trout habitat (see Table IV-5). In addition, 4.1 stream miles that support bull trout occur on HCP project lands within this AAU (see Table IV-6).

Status of the Swan Core Area (Swan River, Swan Lake, and Tributary Streams)

The Swan River flows generally north for about 66 miles, from its headwaters in the Swan and Mission Mountain ranges to where it enters Flathead Lake. Fifty-three named tributaries enter the Swan River from the Swan (East) and Mission (West) mountain ranges. Three relatively large natural lakes, each designated as a separate bull trout core area, are linked directly to the Swan River drainage. The most southerly is Lindbergh Lake (726 acres), which the upper Swan River flows through. Approximately five miles downstream from Lindbergh Lake, Holland Creek enters the river from the east, after flowing through Holland Lake (408 acres). The Swan River then flows south for approximately 35 miles to Swan Lake, the largest lake in the drainage (2,680 acres). Leaving Swan Lake, the river continues 14 miles downstream on its course to a small run-of-the-river impoundment created by Bigfork Dam. Bigfork Dam (built in 1902) is 12 feet high and contains a 4.1 megawatt hydroelectric facility operated by PacifiCorp. During much of the past 100 years Bigfork Dam contained a poorly functioning fish ladder. The ladder was permanently closed off in the 1980's, when it became apparent that upstream transfer of lake trout or other nonnative species from Flathead Lake into the Swan system would be highly undesirable. Downstream from Bigfork Dam, the Swan River cascades through a mile-long high gradient reach prior to entering Flathead Lake.

The Swan River drainage serves as the important migratory corridor for bull trout migrating to spawning streams upstream of Swan Lake. In 1996, the Montana Bull Trout Scientific Group (MBTSG 1996a, USFWS 2002a) reported that the primary spawning streams for migratory bull trout in the Swan drainage were Elk, Cold, Jim, Piper, Lion, Goat, Woodward, Soup, and Lost Creeks. These streams were subsequently designated as local populations in the Draft Bull Trout Recovery Plan (USFWS 2002a). However, the MBTSG (1996a) also reported that bull trout spawning and/or rearing had been documented in several other tributary drainages, including Kraft, Cedar, Glacier, Soup, Buck, Condon, Cooney, and Dog Creeks. These recorded observations were considered to represent less intensive and, in some cases, incidental use by

mostly transitory individuals and for that reason these streams were not considered to represent local populations.

Swan Lake is the only water in Montana where angler harvest of bull trout has been permitted since 1998. A sustained annual harvest of approximately 500 fish per year (Rumsey and Werner 1997) has occurred. However, a looming lake trout threat may force a reevaluation of angling regulations and could result in future restrictions on the recreational bull trout fishery. The Swan Lake bull trout fishery has remained open to angler harvest, despite the concerns about impacts of lake trout in the drainage, largely because to date the spawning runs have remained stable and there's no evidence anglers are impacting the total numbers.

Bull trout redd counts, conducted in index reaches of the four primary spawning streams of the Swan drainage and estimated to account for about 65 percent of the entire spawning run, have been conducted annually for the past 26 years. The results indicate that 2007 counts, totaling 521 redds, were the highest since 1998 and reflect a robust adult population that has existed in this core area since at least the mid-1990s. If the redd count is expanded to reflect the 35percent of the population not represented in these four streams (n ~ 802) and then multiplied by an approximate factor of 3.2 adult bull trout per redd (Fraley and Shepard 1989), an estimate of about 2,565 adult bull trout is obtained for the 2007 Swan Lake spawning run. This is believed to represent somewhere around half of the total adult population, since on average adfluvial adults spawn approximately every other year (Fraley and Shepard 1989).

In 1998 through 2003, a total of 11 lake trout (20 to 30 inches long) were reported caught by anglers from Swan Lake and the Swan River. These were the first documented reports of lake trout in the drainage (unpublished MFWP file records). In September 2003, the first evidence of lake trout reproduction was recorded, with a gill net catch of a 9-inch specimen. In the fall of 2004, seven more juvenile lake trout were caught in a single gill net at the same location (MFWP file records). The Montana Bull Trout Scientific Group (MBTSG), in their Swan Lake Status Report (MBTSG 1996a), concluded: "Swan Lake supports an introduced *Mysis* shrimp population and, if lake trout were also introduced, it is likely they would rapidly become the dominant fish species." The USFWS concurred with that assessment and considered nonnative lake trout to be the single greatest threat to bull trout in this area (see USFWS 2002a).

More recently, intensive net sampling (gill nets and trap nets) conducted in the fall of 2007 provided conclusive evidence that explosive lake trout population expansion is underway in Swan Lake. A total of 2,204 lake trout ranging in length from about 7 to 30 inches were captured, with especially large numbers of juvenile and subadult fish. The population is currently being studied and about 1,400 of the captured lake trout were tagged and released to facilitate future population monitoring. No decisions have been made by managers as to whether lake trout population control is feasible or will be implemented.

Whether by mechanism of competition, predation, or some other interaction lake trout have been repeatedly shown to dominate mountain lake ecosystems when introduced on top of bull trout populations (Donald and Alger 1993, Fredenberg 2002). This evolving situation portends a fairly bleak prospect for maintaining the currently robust bull trout population in this core area. In other ecosystems within the Flathead River drainage lake trout invasion or introduction has

resulted in the collapse of bull trout populations within a brief 25-30 year period (Fredenberg 2002). In ecosystems with established food chains that can support high rates of lake trout expansion and survival, particularly those such as Swan Lake where *Mysis* and kokanee are present, resulting collapse of bull trout has been profound and (to date) irreversible.

In the 2005 Bull Trout Core Area Conservation Status Assessment (USFWS 2005b) the Swan Lake core area was ranked *At Risk*, with a risk score placing it in the midrange of the 25 bull trout core areas in the Flathead SubUnit. Swan Lake core area received relatively high ranks for population size, distribution, and trend, but a low rank for threats due to the emerging lake trout issue.

As described, the previously identified threat of lake trout introduction has become reality and more recent evidence indicates the lake trout population is established and reproducing. Consequently, the magnitude of this threat is expected to increase in the next decade to 25 years and impacts to the bull trout population are imminent.

The Plum Creek Native Fish HCP (NFHCP) currently covers approximately 900,000 acres of lands in western Montana (originally 1.4 million acres) (USFWS et al. 2000). Lands within the NFHCP occur adjacent to several miles of stream reaches, including substantial holdings that were identified as important bull trout habitat in this core area. Through implementation of the NFHCP, proactive management is occurring to protect and restore important bull trout habitat, while at the same time allowing Plum Creek to manage and harvest their timber base, construct and maintain roads, and manage other resources such as grazing allotments and recreational properties. An active monitoring strategy is being applied to track compliance and measure important habitat and population parameters. Implementation is being achieved, and based on Plum Creek's 10-year status assessment of the NFHCP the overall effectiveness of the program in protecting and restoring bull trout and their habitat appears to be working (Plum Creek Timber Company 2011).

Bull trout from Swan Lake have tested positive for whirling disease in the past, though no clinical signs were apparent. Additionally, whirling disease was detected in fish from lower Lion Creek, a major bull trout spawning tributary to the Swan River upstream of Swan Lake. A fish health screening of 60 lake trout taken from Swan Lake in the fall of 2008 detected no reportable pathogens (MFWP 2008).

Some concern has also been expressed regarding the impacts of a northern pike population, established in Swan Lake in the 1980's. However, there appears to be limited niche overlap between pike and bull trout and the bull trout population has remained robust over a 20+-year period while pike were present, so this is not currently as much of a concern as the interactions with lake trout and brook trout, which pose major threats to bull trout through either predation, competition, or hybridization as in the case with brook trout.

The status of bull trout in this core area was considered "stable" and trend was "increasing" based on information available at the time of listing (USFWS 1998c). The current status of the species is amongst the strongest in the entire range, though numerically redd counts are down about 30percent since the peak level recorded in 1998, so the trend is no longer considered

increasing. If newly identified lake trout expansion (perhaps exacerbated by the undetermined effects of whirling disease) cannot be halted or mitigated, it is expected that bull trout abundance in this core area will experience steep declines within the next 10-25 years. Potential long-term benefits accruing from implementation of the Plum Creek NFHCP will largely protect the habitat status quo, but will not be adequate to offset negative effects of lake trout introduction and continuing impacts from other established introduced species (brook trout and northern pike).

In other ecosystems within the Flathead River drainage lake trout invasion or introduction has resulted in the collapse of bull trout populations within a brief 25-30 year period (Fredenberg 2002). In ecosystems with established food chains that can support high rates of lake trout expansion and survival, particularly those such as Swan Lake where *Mysis* and kokanee are present, resulting collapse of bull trout has been profound and (to date) irreversible.

Bull trout have shown the ability to maintain a relatively high population level in the Swan Lake ecosystem despite past impacts from land management (development, highways and forest management), angling harvest, and nonnative species introductions (*Mysis*, kokanee, brook trout, northern pike). This is attributed in large measure to the relatively abundant and high quality groundwater-influenced tributary spawning and rearing habitat. Much of the future viability of bull trout in the Swan core area depends on the ultimate outcome of the current lake trout suppression effort. Lake trout expansion over the past 10 years has not resulted in measurable impacts to the bull trout population, to date. If the lake trout population can be dramatically reduced in the near term, the threat may be less severe or at worst moderate severity in terms of impacts to bull trout. If the lake trout suppression effort fails, it is anticipated that within 1-2 bull trout generations (5-10 years) the impact to bull trout will be severe and the threat would then be considered high in severity, probably leading to irreversible declines in the bull trout population.

Strong emphasis has been placed on protection of habitat in important spawning and rearing streams on both public and private lands. Some of those gains will be offset by increasing pace of development on private lands in the valley bottom. The greater risk stems from the lake trout expansion. Inadequate amounts of effort are being allocated to this issue.

Redd counts, juvenile population counts, and McNeil core samples are the best indicators of adfluvial bull trout populations in the Swan River system. Habitat conditions for adfluvial bull trout are functioning at-risk, but expected to improve over time. However, bull trout populations are largely being influenced by the ecological changes in Swan Lake and not local habitat conditions. Redd counts over the last decade have declined with spikes when strong cohorts are present. McNeil core samples have shown that the percent fines in monitored streams are generally within the same range as conditions in the late 1980s when bull trout numbers were strong. Very recent information about lake trout invasion in Swan Lake is the basis for concern about potential for downward trend in the Swan Lake core area bull trout population.

In summary, bull trout in the Swan core area have represented one of the more robust populations across the species range. This current status has been sustainable as documented by the long history of annual redd counts and even provides a recreational sport fishery and limited angler harvest. In the near term this core area should be able to sustain limited short-term impacts from land management activities in the watershed. This is especially true if long-term

habitat improvements result from such projects. However, due to the above-described threats from nonnative species invasion, there is uncertainty whether this bull trout population will remain healthy and will be able to continue to withstand such impacts in the future.

The Swan AAU, which corresponds to this core area shows that 44,613 acres of the HCP occur within this AAU and that most of these acres (44,506) are considered within bull trout habitat (Table IV-5). In addition, 56.9 stream miles that support bull trout occur on HCP project lands within this AAU (Table IV-6).

Status of the North Fork Flathead River of the Flathead Core Area

The Flathead watershed of northwestern Montana and the southeastern corner of British Columbia constitute the northeastern-most drainage of the Columbia River. Headwater tributaries originate in Glacier National Park and British Columbia, Canada (North Fork), as well as the Bob Marshall and Great Bear Wilderness areas (Middle Fork and South Fork). There are over 50 headwater lakes in the drainage, many of which form their own separate bull trout core areas. Approximately ten miles south of the confluence of the North and Middle Forks, the South Fork Flathead River enters the mainstem after leaving Hungry Horse Reservoir. The headwaters of the South Fork are in the Bob Marshall Wilderness. The North, Middle, and South Forks of the Flathead River have a combined drainage area of 4,464 square miles and an average annual discharge of 9,699 cubic feet per second, as measured at Columbia Falls. Between Columbia Falls and Kalispell, Montana, the mainstem of the Flathead River flows through the Flathead Valley on its way to Flathead Lake.

The North and Middle forks, which intersect to form the mainstem of the Flathead River system, and Flathead Lake comprises the Flathead Lake core area for bull trout. Ostensibly, the North Fork is a subunit of the Flathead Lake core area and it may have its own local population of bull trout according to the Draft Bull Trout Recovery Plan (USFWS 2002a).

The North Fork of the Flathead River originates in British Columbia, flowing 50 miles before reaching the Canadian U.S. border, with 25 percent of the North Fork spawning occurring in Canada (MBTSG 1995d). The North Fork flows southerly for another 58 miles before joining the Middle Fork of the Flathead River. All Eastern tributaries arise from Glacier National Park (GNP). For the most part, tributaries from GNP do not support bull trout populations with the exception of 16 disjunct populations in lakes (USFWS 2002a). This is believed to be caused by the geology of the area, with thermal restriction originating at the outlet of lakes (USDA 2000a). These populations have recently been shown to be genetically distinct from bull trout in the Flathead Lake System (pers. com. Wade Fredenberg, USFWS, 2002). Two additional disjunct populations exist, Cyclone Lake and Frozen Lake. Frozen Lake is in Canada and Cyclone Lake is on DNRC lands under the proposed HCP.

On the Flathead National Forest there are sixteen tributaries to the North Fork which are known to support migratory bull trout: Big, Hallowat, Coal, South Coal, Mathias, Red Meadow, Whale, Shorty, Trail, Cauldrey, Cabin, Howell, Stravation, Sage, Kishenehn and N. Fork River (USDA 2000a). Of these drainages Big, Coal, Whale, Trail, Red Meadow, Howell and Cabin Creeks are considered by MFWP the most important bull trout spawning and rearing areas (MBTSG 1995d, USFWS 2002a). These drainages are essential to the continued existence of bull trout in the

Flathead River. Although use appears limited or incidental, bull trout have also been documented in Tepee, Canyon, and McGinnis creeks.

MFWP data from 1980 - 2001 showed an average 339 redds in the North Fork. During the same time period Big Creek had an average of 39 (6 percent) redds and Coal Creek had an average of 48 (8 percent) redds. In 2001, Big Creek supported 11 percent of the redds in the entire Flathead River Basin compared to 6 percent in previous years and Coal Creek supported only 1 percent of the basins redds compared to 8 percent in previous years. Over the last 22 years the redd counts in Big Creek have fluctuated every 5 to 6 years with redds presently at just above the average and 12 less than the high for the same time period. In Coal Creek the redd numbers have been declining steadily since 1988 with zero redds reported in 2001. There is concern over the trend as it is unknown whether bull trout from Big Creek or other local populations will repopulate Coal Creek. Redds may still be present in non-index sections of Coal Creek that could assist in the recovery of bull trout in Coal Creek. Although, there is concern that this local population may become extirpated due to a decline in redds from a high of 61 in 1983. Reasons for the decline are unknown but may be in part due to sediment delivery to Coal Creek from roads and land management actions (MBTSG 1995d). Overall the redd counts in the Flathead Basin have been increasing over the last 4 to 5 years. MFWP redd count data from primary spawning streams in the North Fork are as follows:

1. Trail Creek (Index) (1979-2008; n = 30) (Low = 8; High = 94)
2. Whale Creek (Index) (1979-2008; n = 30) (Low = 12; High = 211)
3. Red Meadow Creek (1980-2008; n = 10) (Low = 0; High = 19)
4. Coal Creek (Index) (1979-2008; n = 30) (Low = 0; High = 61)
5. Big Creek (Index) (1979-2008; n = 30) (Low = 2; High = 41)

Additional streams monitored, but not currently considered local populations (or existing within the same watershed as part of an existing local population:

- Hallowat Creek (trib of Big Cr.) (1980-2008; n = 19) (Low= 0; High= 32)
- Charlie Creek (1991-2003; n = 5) (Low = 0; High = 3)
- Mathias Creek (trib of Coal) (1980-2008; n = 17) (Low = 0; High = 19)
- North Coal Creek (trib of Coal) (1980-2008; n = 16) (Low = 0; High = 29)
- South Fk. Coal Creek (trib of Coal) (1980-2008; n=15) (Low=0; High=33)
- Trail Creek (trib of Strawberry) (1980-2008; n = 10) (Low = 0; High = 53)
- Shorty Creek (trib of Whale) (1980-2008; n = 10) (Low = 0; High = 56)

Connectivity habitat in the North Fork drainage is considered good as there are no dams or other man-caused barriers on the mainstem North Fork Flathead River that impede fish passage or no known man-caused barriers on bull trout spawning and rearing streams.

In 2001 and 2003 a series of major fires burned large portions of the bull trout habitat in the North Fork River drainage. While these events are part of recurring long-term natural cycles in these lodgepole pine and Douglas fir ecosystems, the scope and severity of the fires was unusual and may have been exacerbated by a history of 20th century fire suppression activities on the forests. No immediate short-term impacts to bull trout populations were noted as a direct result of the fires or post-fire conditions and sediment transport was minimized due to burned area rehabilitation activities and favorable runoff conditions.

Generally, the bull trout spawning and rearing habitat in the North Fork is located either in Glacier National Park, Coal Creek State Forest, or the Flathead National Forest. Private land ownership is limited and on major portions in the Flathead National Forest there has been minimal development of new roads or timber sales and a strong emphasis on road decommissioning and application of BMPs. Some concerns remain due to potential for long term increases in water temperatures and future effects of rain-on-snow precipitation patterns. Long-term data sets include sediment scoring and coring for most major streams harboring local populations of bull trout. Additional emphasis has been placed recently on identifying and evaluating important bull trout habitat in the B.C. headwaters of the North Fork Flathead River, given threats of expanded coal, oil, and gas exploration and development in B.C. Crews surveyed over 25 stream reaches collecting species distribution information and genetic samples in British Columbian tributaries to the North Fork. WCT, bull trout and sculpin were observed in many reaches.

Information collected since the time of listing indicates the status of bull trout populations using the North Fork watershed remains static at best. The magnitude of the lake trout threat to adfluvial bull trout populations inhabiting the North Fork has not declined and some local populations are at precariously low levels. Magnitude and imminence of existing nonnative species threats remain high, despite management efforts to mitigate them. Recent (2004) efforts by the B.C. government to auction coalbed methane leases and more recently to reopen exploratory coal mines (2005) in the headwaters of the North Fork Flathead River in British Columbia indicate the magnitude and imminence of threats to habitat and water quality in this contiguous transboundary system are elevated.

Redd counts, juvenile population counts, and McNeil core samples are the best indicators of adfluvial bull trout populations in the North Fork Flathead River. Habitat conditions in the North Fork are functioning at-risk and expected to improve over time for adfluvial bull trout; however, bull trout populations are largely being influenced by the ecological changes in Flathead Lake and not local habitat conditions. Redd counts over the last decade have declined with spikes when strong cohorts are present. McNeil core samples have shown that the percent fines in monitored streams are generally within the same range as conditions in the late 1980s when bull trout numbers were strong.

The North Fork Flathead River of the Flathead Core Area corresponds to the North Fork Flathead AAU. It shows that 18,499 acres of the HCP project area lands occur within this AAU and that 16,259 acres are considered within bull trout habitat (Table IV-5). In addition, 36 stream miles that support bull trout occur on HCP project lands within this AAU (Table IV-6).

Status of the Stillwater Core Area

Most of the Stillwater drainage, including the spawning and rearing habitat for bull trout, is located in the Stillwater State Forest and is timberlands managed by DNRC. The entire bull trout population is distributed in one or two headwater tributaries. This state forest is included in the DNRC HCP.

Index redd counts have been conducted in a reach of the upper Stillwater River since 1994 (MFWP 2004a). Index counts ranged from 2 to 16 prior to listing of bull trout in 1998 and have trended higher (12-35) since 1998. There is uncertainty about whether these fish are primarily fluvial or adfluvial and an abundance of brook trout in the system presents concerns about the adequacy of redd counts as an accurate population index. Redd counts averaged 7.5 in 1994-1997 (range 2-16), rising to a mean of 24.2 in 1998-2003 (range 12-35). No counts were conducted in 2004-2006. A count of 28 redds was made in 2007. These data indicate there are fewer than 200 adult bull trout in this system, with extremely low numbers remaining in Upper Stillwater Lake, and the trend is uncertain.

The robust population of northern pike and recent pulse of nonnative lake trout offer limited prospects for bull trout recovery in the lacustrine habitat and the future of fluvial or resident stocks that are increasingly isolated in the headwaters is not certain. It is unlikely that bull trout persist in any numbers in Upper Stillwater Lake, given the strong presence of these two competing species. The relative abundance of brook trout in the Stillwater River remains problematic as well. The former adfluvial population of bull trout shows signs of conversion to a fluvial or resident life history form restricted to the upper watershed. Previous genetic work showed evidence of a bottleneck and extirpation of bull trout in this core area is a possibility.

Lake trout have invaded this core area and a reproducing population has been established in Upper Stillwater Lake. Combined with the high density of northern pike that were established in the 1970's, former foraging and migratory habitat for bull trout in Upper Stillwater Lake and portions of the Stillwater River (e.g. area known as Duck Lake) has been reduced or eliminated. The bull trout population has been further restricted to the headwaters of this system. As a result of this fragmentation, a population that formerly maintained an adfluvial life history component is now restricted to a fluvial existence, increasing levels of risk.

The nonnative species influences, combined with a high proportion of the drainage in heavily managed lands, make long-term prospects for bull trout in this core area rather tenuous. It is unknown what effect potential conversion from an adfluvial to a fluvial or resident population may have, but the resiliency built in to multiple bull trout year classes in the lake habitat appears to have been compromised.

Kanda et al. (1995) observed a unique departure from normal allele frequencies in electrophoretic results from a sample of 25 juvenile bull trout collected from the upper Stillwater

River in 1993. All fish were heterozygous at a particular allele, suggesting they were full siblings from a single mating. Only two redds were observed in 1995. These are indications that the population may have been sufficiently reduced to cause a genetic bottleneck, but no further evaluation has occurred.

There is no available information to indicate elevated risk, but based upon the degraded habitat conditions and relative position of the watershed, the USFWS presumed the risk in this watershed could rise. This presumption is drawn from the status reviews which assessed the continuum of risk for the core area based on the sensitivity to change for each of four parameters - population size, population distribution, population trend and threats (USFWS 2005b, USFWS 2008a). Roads exist throughout the upper Stillwater River drainage. There are legacy concerns associated with past land management (i.e., forestry) practices and roads. Several major runoff events have occurred in recent years that resulted in BMP applications to most of the road system such that some of the legacy issues have been stabilized. Precipitation patterns appear conducive to higher frequency of rain-on-snow conditions, as has been exhibited in several recent year events.

There are no barriers in the system between Upper Stillwater Lake and upstream spawning and rearing habitat. There are two aging wooden dams on the outlets of Upper and Lower Stillwater Lakes which may impede upstream passage at certain flows. The Stillwater River is otherwise unobstructed to the Flathead River upstream of Flathead Lake (approximately 55 miles), but much of it is degraded and extremely warm in the summer months.

The status and trend of bull trout in this core area was considered “depressed” and “declining” based on information available at the time of listing (USFWS 1998c). Based on updated information, low numbers of adult bull trout remain (<200) and no particular recent trend is evident. There is low confidence in the use of redd counts as an index of population status and trend due to the decline of large adfluvial forms of bull trout and the abundance of brook trout that may overlap the spawning area. Both magnitude and imminence of the nonnative species threat have increased in this core area. There is doubt whether the food chain can be stabilized or altered to favor bull trout recovery. The high densities of northern pike and increasing prevalence of lake trout will permanently complicate the bull trout recovery picture in this core area.

The Stillwater AAU, which corresponds to this core area shows that 87,321 acres of the HCP occur within this AAU and that most of these acres (85,730) are considered within bull trout habitat (Table IV-5). In addition, 101.1 stream miles that support bull trout occur on HCP project lands within this AAU (Table IV-6).

<u>Status of the Blackfoot River Core Area</u>

The Blackfoot River core area supports a fluvial bull trout population. A large amount of sampling and monitoring has been conducted in this core area and bull trout distribution is well documented (see e.g., Pierce and Podner 2006). Of 52 streams within the Blackfoot River watershed sampled by MFWP from 1986 to 1996, 12 (including one tributary to the Clearwater River) were occupied by bull trout. Excluding the Clearwater River drainage, fluvial bull trout currently occur in 10 subwatersheds (6th code HUCs) (Quigley and Arbelbide 1997) in the

Blackfoot River drainage, and based on historical records, are extirpated from 11 drainages or approximately 120 miles of stream. Fluvial bull trout currently use about 420 miles in the core area, including the 120 miles of mainstem river and 300 miles of tributaries. Spawning occurs in approximately 24 of these 300 stream miles (8 percent).

In 1996, a total of 198 redds were recorded in a drainage-wide survey. Seventy percent of these redds were recorded in Monture Creek and the North Fork of the Blackfoot River. Copper Creek, located near the headwaters of the Blackfoot River, is the tributary which receives the third greatest amount of bull trout spawning use. These three primary streams are the index streams with long-term monitoring and that have historically represented around 90percent of the identified spawning redds counted in the Blackfoot River core area. Total redds counted in these three streams in 2004-2007 were 98, 99, 109, and 107, respectively. While there is some annual variability, these numbers are relatively consistent and probably indicate that abundance in the most recent 5-year period declined from a level that was higher around 2000-2003. Existing adult abundance appears to be in the neighborhood of 350-500 in total for these three streams.

In general, an increasing trend is indicated in this core area beginning about the mid-1990's (approximately 50 redds in index streams in late 1980's and early 1990's, rising to approximately 150-200 redds in 2000-2003). However, redd counts in 2004 were low in two of the most significant local populations (Monture Creek and the North Fork Blackfoot River), indicating that the increasing trend is not as strong or consistent as previously suggested. The 20-year monitoring data indicates that a long-term increasing trend occurred from the early 1990's until it peaked around 2000-2002. Since that peak the population dropped off some but was stable. Overall, bull trout may be stable or expanding in this system, which is currently at a level of about 500-1,000 adults.

Several smaller tributaries in this core area may have lost their populations (Pierce et al. 1997). A telemetry study completed in the headwaters of the Blackfoot River indicated the headwater population of bull trout is isolated during fall and winter by intermittent reaches in the principle channel of the Blackfoot River just upstream of the town of Lincoln. The five fluvial bull trout implanted with transmitters for the study used only 4 miles of the principle channel of the Blackfoot River and the lower Lander's Fork to Copper Creek.

The Snow-Talon Fire of 2003 burned extremely hot in the Copper Creek drainage, causing at least short-term negative impacts to one of the major spawning tributaries. Only four redds were counted in that drainage in 2003, less than half the previous lowest mark in 15 years of record. Numbers rebounded, with 12 redds observed in 2004. Although bull trout redd counts in Copper Creek were temporarily depressed in 2003-2005, in 2006 (n = 33) and 2007 (n = 32) were the highest in the 19-year period of record. Lesser impacts of fire were experienced in other watersheds, including the Gold Creek drainage.

In the Landers Fork drainage bull trout populations are at very low densities likely due to a number of variables such as the presence of a complete barrier to bull trout movement at Silver Kings Falls, the lack of bull trout upstream of the natural barrier, the threat from brook trout hybridization, reduced pool quality and quantity, and high stream temperatures in portions of the drainage above the confluence of Copper Creek.

Milltown Dam, an aging hydroelectric facility blocking the Clark Fork River immediately downstream from the Blackfoot River confluence, had been an upstream fish barrier since its' construction in 1908 (Schmetterling and McEvoy 2000). Approximately 6.6 million cubic yards of toxic sediments accumulated behind the dam as a result of upstream copper mining and smelting operations at Butte and Anaconda. The result was America's largest Superfund site. In 2006 the U.S. Environmental Protection Agency (EPA) finalized plans for complete removal of the dam and the sediments and in 2008 the Milltown Dam was removed. This dam removal restored upstream connectivity, eliminated habitat for a predatory population of northern pike, and mitigated for future potential for recurring fish kills during high flow events (Schmetterling 2003). All of these factors are expected to benefit the migratory bull trout population of the Blackfoot and Clark Fork Rivers.

Prior to the removal of Milltown dam in 2008, a small number of migratory bull trout were captured at the base of Milltown Dam each year since 1997 and transported over the dam to a release site on the upper Clark Fork River upstream from the damsite (U.S. EPA and MDEQ 2004, Swanberg 1997). These fish were observed in the Clark Fork River between the Milltown damsite and Rock Creek, and in the Blackfoot River (Swanberg 1997). Now that the dam has been removed and the channel restored, bull trout have free passage from the Clark Fork River upstream into the Blackfoot River system (USFWS 2009).

The Blackfoot watershed has been host for a model conservation planning and habitat restoration effort for nearly 20 years. Focused, prioritized, watershed-based conservation projects have occurred in most of the major tributary drainages, with special emphasis on native fish strongholds, including bull trout local populations (Pierce and Podner 2006). Those efforts were believed largely responsible for the increased population levels of bull trout in the 1990's. The recent population downturn is believed related more to decreased instream flow and relatedly warmer water temperatures resulting from a drought pattern as well as the effects from increased angling and increased abundance of non-natives (see below). The entire region of the Blackfoot River core area experienced drought conditions in 2001 through 2003, resulting in reduced streamflow and potentially affecting bull trout numbers, which have been slow to respond. These conditions would be considered to fall within the range of historic natural variability.

Intensive efforts have been made over the past decade to reopen blocked portions of the subbasin through renovation of irrigation and culvert barriers as well as by providing instream flow enhancements to improve seasonal migratory deficiencies (Pierce et al. 2003). Other projects are addressing acid mine runoff and point sources of thermal enrichment that may contribute to seasonal or migratory fragmentation. As a result of this and positive response from restrictive angling regulations bull trout are becoming more common in formerly unoccupied or low occupancy habitat.

Five of the six local populations are well connected. Cottonwood Creek and portions of the upper basin suffer from dewatered sections in late summer, but continual improvements are being applied through a series of projects involving diversion upgrades and screening, habitat improvements, and instream flow acquisition. An example of this expanding distribution is Snowbank Creek (a tributary of Copper Creek) where a problematic diversion was corrected.

The lower mainstem Blackfoot River is exceptionally warm during midsummer and may present a partial thermal barrier to late migrating fish. The removal of Stimson Dam on the lower Blackfoot and Milltown Dam on the mainstem Clark Fork immediately downstream of the Blackfoot confluence in 2008 should provide additional opportunity for genetic exchange and return migration of bull trout from the Clark Fork.

The expansion of whirling disease in the Blackfoot River core area is ongoing and severity has been documented as increasing. There are no known effects to bull trout. However, there seems to be a pattern of increasing brown trout populations in watersheds where this disease causes declines in rainbow trout. There is also circumstantial evidence that brown trout, occupying a similar ecological niche as bull trout, may compete with bull trout for food, space, and cover. This pattern may warrant further scrutiny in the Blackfoot River core area.

Angler use on the Blackfoot River is high. MFWP mail surveys, conducted every two years to estimate angler use, document that the rate of increased use was particularly high during the 1990's in the middle section of the river (Clearwater River upstream to North Fork) which is important foraging, migrating and overwintering (FMO) habitat for bull trout (MFWP 2006). Use in that river section averaged 4,973 angler days in the 1980's, 11,500 angler days in the 1990's, and 10,948 angler days in 2001-2005 (MFWP 2006). Previous MFWP surveys and enforcement work have shown that anglers have poor fish identification skills (Pierce and Podner 2006). Thus, overutilization of bull trout by anglers remains a serious concern, despite fishing regulation changes designed to address these concerns. Additional law enforcement activity geared toward bull trout protection has occurred and new angling restrictions have been put in place (i.e., no bait) in areas of the mainstem Blackfoot and tributaries where incidental catch of bull trout has been problematic (Belmont, Copper, Gold, Monture, North Fork).

Combined effects of over a century of farm and ranch-related land management uses, including dewatering, grazing, and water quality impairment (temperature, sediment and runoff), are considered to have the greatest existing impacts on the Blackfoot River core area. Many of these problems are being systematically corrected, but their legacy endures. Intertwined with these impacts are the effects of introduced species, primarily brook trout and brown trout, which are notoriously able to thrive in degraded ecosystems (temperature, water quality, sediment) where native fish are less viable. The existing legacy of forest roads and forest practices are also an ongoing concern as well as issues with angling overutilization.

Status of bull trout in this core area was considered "depressed" and trend was "unknown" based on information available at the time of listing (USFWS 1998c). The current status of bull trout in this core area is one of the strongest among fluvial populations in the Clark Fork River Basin. Generally, an increasing trend is indicated beginning in about the mid-1990's, though redd counts in 2004 were low in some significant local populations, indicating that the increasing trend may not be as strong or consistent as previously suggested. Overall, bull trout are expanding in this system, which is currently at a level of about 500-1,000 adults.

Due to extensive watershed-based habitat restoration efforts, spearheaded by the Blackfoot Challenge, remarkable amounts of funding and effort have been expended in the watershed over the past decade or longer. These results are contributing to increasing populations of native bull

trout and WCT. With the removal of Milltown Dam just downstream of the confluence of the Blackfoot with the Clark Fork River, and additional ongoing habitat-based restoration efforts the potential for bull trout recovery looks good. However, trouble spots remain (e.g. dewatering, thermal enrichment, nonnative species, impacts of whirling disease, expanding recreational use) and full recovery of bull trout is still an uncertain prospect. Potentially, this core area should be able to support 1,000 or more adult bull trout.

Strong emphasis has been placed on protection of habitat in important spawning and rearing streams on both public and private lands (e.g. Blackfoot Challenge, Plum Creek HCP). Removal of Milltown Dam will be a huge benefit to the entire region, including the Blackfoot River core area. Some gains will be offset by increasing pace of development on private lands in the valley bottom and increasing recreational pressure on this resource. Natural events, such as the Snow-Talon Fire and recurring drought may temporarily interrupt progress. Overall, the habitat trend is at least stable, and probably improving.

The Blackfoot AAU, which corresponds to this core area shows that 56,528 acres of the HCP occur within this AAU and that 41,803 acres are considered within bull trout habitat (see Table IV-5). In addition, 23.3 stream miles that support bull trout occur on HCP project lands within this AAU (see Table IV-6).

Status of the Bitterroot River Core Area

The Bitterroot River originates in the headwaters of the Bitterroot and Sapphire mountains in western Montana. The East and West forks join near the town of Conner and from there the mainstem flows north through irrigated crop and pasture land of the Bitterroot Valley 85 miles to where it enters the Clark Fork River near Missoula. The total drainage area upstream of the flow gauge near Missoula is 2,814 square miles. The major landowners in the drainage are the USFS, which manages most of the higher elevation lands, and private landowners who own some of the forested and most of the unforested valley floor (USDA 2000b).

The Bitterroot River has 27 major tributaries on the west side and 12 on the east side of the valley. In general, the west side tributaries contribute 40 percent of the entire stream discharge and the east side tributaries contribute 24.5 percent. The headwater tributaries contribute the remaining 35.5 percent.

Tributary streams are variable in their channel and habitat types, but most are comprised of narrow, high gradient channels on the National Forest lands. The headwaters of most of the tributaries are on National Forest and many flow onto private lands before joining the Bitterroot River. The tributaries generally become more meandering, lower gradient, warmer, and have more fine sediments on the flatter private lands. There are no major natural barriers to fish migration that would have excluded bull trout from any significant portions of the Bitterroot River drainage except barrier falls at higher elevations in tributary streams (MBTSG 1995b, USFWS 2002a).

Historically, bull trout were likely distributed throughout the Bitterroot drainage. As explained below, the major life form of bull trout in the Bitterroot drainage today is resident fish that tend to live in higher elevation streams within the National Forest. Migratory or fluvial forms that live

in the Bitterroot River are rare (USDA 2000b). In general, Bitterroot River tributary streams contain populations of small bull trout (rarely over 12 inches in length) in the upper reaches which are isolated from other bull trout streams. The connections between the tributaries and the mainstem Bitterroot River have often been severed by habitat degradation, dewatering and other passage barriers. Tributaries on the east side of the valley tend to have more bull trout than on the west side. Brown trout are common in the Bitterroot River and the lower end of the tributary streams, and brook trout are common throughout many tributary streams (MBTSG 1995b, USFWS 2002a).

Brook trout are common in streams in the Bitterroot Valley. Approximately 75 percent of bull trout streams also contain brook trout within the same drainage, although not necessarily in the same stream reaches as bull trout. Some genetic analyses of the fish in these streams have been conducted and many streams contain hybrids between these two species. Sampling in some areas indicates that brook trout may be expanding their range and numbers at a relatively rapid rate in some habitats (MBTSG 1995).

The lower Bitterroot River has been determined to be a major non-point source of nutrient pollution in the middle Clark Fork basin, primarily from sewage effluent from towns and also land development along the river. There are about 39 miles of stream, including the entire mainstem of the Bitterroot River that is impaired or partially impaired for beneficial uses of the water. Sources of impairment are primarily from agriculture (siltation and flow modification), silviculture (siltation and habitat modification) and resource extraction. However, land development, road and highway modifications and wastewater effluent also contribute to impairment (MBTSG 1995b, USFWS 2002a).

Based on the fact that few bull trout have been collected in the lower portions of the Bitterroot River recently, bull trout appear to be absent, or nearly so, from the mainstem Bitterroot River from the mouth of the river up to Blodgett Creek. From Blodgett Creek to the East Fork of the Bitterroot, bull trout are rare, and in the upper reaches of the East and West Forks, some migratory fish (over 20 inches) exist, but in low numbers (MBTSG 1995b, USFWS 2002a). Overall, the Bitterroot drainage contains fragmented bull trout populations containing limited numbers of small fish with little or no genetic interchange (MBTSG 1995b). At best, bull trout are considered "depressed" in the majority of the areas encompassing this project corridor, and they are absent or of unknown status in the remaining few areas (USDA 2000b).

The Bitterroot River bull trout core area has been considered an example of a watershed where systematic decline of the migratory life history form of bull trout has resulted in the increased prominence of isolated and fragmented populations of resident fish. Nelson et al. (2002) used extensive trapping of migrating fish in three drainages (Sweathouse, Skalkaho, and Sleeping Child Creeks) of the Bitterroot River watershed to evaluate the persistence of migratory bull trout life history forms. They observed that by 1996-1997, the migratory form which was historically much more common was now rare or absent in two of the tributaries, but still present at a low level in the third. They determined that in the drainages they studied there were not physical barriers to migratory fish, indicating that other downstream mortality factors such as predation or temperature played a bigger role in the extirpation of those stocks. Nelson et al.

(2002) suggested that the isolated, nonmigratory remnants of the population were at increased risk of extinction, and that restoration of the migratory form was an important conservation goal.

Brassfield et al. (2006) provides detailed updated survey information for eight west side canyon tributary streams, six of which contained bull trout (Blodgett, Roaring Lion, Lost Horse, Chaffin, Trapper, and Boulder Creeks). It is noteworthy that in most of these streams the habitat occupied by bull trout was restricted to a middle reach 1.3-4.0 miles in length, often overlapping with brook trout distribution. Upstream portions were unoccupied and downstream portions are typically dewatered in summer months. The researchers noted that confidence in detection of bull trout in streams with low levels of occupancy remain problematic.

With the migratory form of bull trout nearly gone, this core area is comprised mostly of a complex mixture of fluvial and resident populations of bull trout. There is a high degree of habitat fragmentation and much of the mainstem Bitterroot River as well as the lower reaches of many tributaries are unsuitable for bull trout (warm and dewatered) in midsummer. The resident form of bull trout predominates and the fluvial migratory component of this population exists at low abundance. Nine local populations have been identified, but bull trout occupancy occurs at some level in many more tributaries. The high frequency of resident bull trout populations in this drainage makes interpretation of status and trend information difficult.

The local populations in this core area that have continuous redd count data are in the Skalkaho Creek tributary Daly Creek, the upper mainstem East Fork of the Bitterroot River, and its tributary Meadow Creek. These streams are considered to be representative of the remaining spawning and rearing habitat for fluvial bull trout, but it has been difficult to impossible to distinguish between redds of fluvial and resident fish. Redd counts in Daly Creek were consistent, ranging from 30-39 in 2004-2007. In the upper East Fork the range was 0-1 for the same period and in Meadow Creek it was 1-18 redds (MFWP, unpublished). If these are mostly fluvial fish, as suspected, then it represents an adult abundance of around 200 or fewer.

Much of the fragmentation that occurs in this watershed is due to natural dewatering of groundwater-fed tributaries that go subsurface before reaching the Bitterroot River. Some of these are exacerbated by irrigation and there are several large irrigation structures and flumes that mix water sources and complicate connectivity. Many are not screened. In addition, the West Fork Dam severs the upper Bitterroot River from a major portion of the best spawning and rearing habitat, though it does create a separate core area upstream. Milltown Dam was successfully removed in 2008. This will allow greater freedom of bull trout movement within the upper Clark Fork and individuals may more freely access various drainages, though the Bitterroot enters the Clark Fork a few miles downstream of the previous Milltown site and may not benefit directly.

In 2001 and 2003 a series of major fires burned large portions of the bull trout habitat in the Bitterroot River drainage. While these events are part of recurring long-term natural cycle, the scope and severity of the fires was unusual and may have been exacerbated by a history of 20th century fire suppression activities on the forests. No immediate short-term impacts to bull trout populations were noted as a direct result of the fires or post-fire conditions and sediment transport was minimized due to burned area rehab activities and favorable runoff conditions.

Nevertheless, the 2000 Sula Fire was a 300,000 acre fire which burned with high severity and following thunderstorm rainfall events in July 2001, created some large runoff events causing localized rilling, gullying, and debris flows in some drainages (e.g., Rye Creek, Laird Creek, Prairie Creek, Sleeping Child Creek). The effects of the sediment delivered to these streams as a result of this fire were probably localized, short-term impacts to aquatic resources, which likely have some natural resiliency to such inputs as a result of the periodic recurring exposure over long periods of time.

Mahlum et al. (2008) studied the effects of fire on stream temperature in the Bitterroot River basin. They examined temperature data from 33 streams in a variety of burned and unburned watersheds. They documented a significant overall increase in late summer water temperature (August-September) over the past 12 years in all streams, which they attributed to climate change. Increases of maximum summer water temperatures of 0.7° F occurred in reference reaches, 1.9° F in below-burn reaches, and 5° F within burns. Certainly, these findings suggest bull trout habitat may be further contracting and fragmentation is likely to increase. Importantly, they found no significant recovery of colder stream temperatures in burned areas five years after wildfires. They concluded the fires have had localized, long-term impacts on water temperatures (Mahlum et al. 2008). In addition, DNRC has conducted stream temperature monitoring annually from 2001 to 2010 on three streams on DNRC lands affected by the Sula fire (2000) in the Bitterroot Valley. In two of the three systems, monitoring data shows that the maximum summer temperature (based on MWMT) increased for the first 4 to 5 years post-fire but has since declined and is now lower than it was during the first year post-fire. Based on the data gathered in the third stream, which was more intensely burned than the others, it cannot be determined if stream temperatures are increasing or decreasing (Jim Bower 2011, DNRC, personal communication).

The East Fork Bitterroot River still contains relatively good bull trout habitat, and probably has the inherent capability to support a sizeable bull trout population (USDA 2002b). A primary concern is the current dominance of exotic rainbow trout, brown trout, and brook trout in the river and its tributaries. The USFS estimates that if all of the habitat on the Forest could be restored to pre-settlement conditions, the presence of large numbers of exotic trout in the mainstem of the East Fork Bitterroot River is likely to limit bull trout recovery. In addition, the East Fork Bitterroot River receives considerable angling pressure (mostly during the summer months), and anglers continue to have problems distinguishing between bull trout, brook trout, and brown trout. Many of the anglers are non-residents who are unfamiliar with trout, and have diffculty properly identifing bull trout from brook trout and brown trout. The presence of hybrids further exacurbates proper identification.

Baseline conditions in the action area are partially attributable to impacts from forest management activities, primarily road construction. In the lower East Fork Bitterroot River system road densities are moderate to high averaging > 2.5 mile/mile^2. Highway encroachment is a major problem as well of the 27 miles of the East Fork Bitterroot River, about 15 miles is located within 150 feet of U.S. Highway 93 and the East Fork Highway. Highway encroachment has cut off several meanders in the river, reducing the river's length and complexity. The intact

meanders of the East Fork Bitterroot River typically contain the best fish habitat with the most pools and woody debris and the highest complexity.

The status and trend of 26 individual resident bull trout subpopulations were originally identified in this core area. Status of all subpopulations was considered “depressed” and trend was “unknown” based on information available at the time of listing (USFWS 1998c). Further consideration determined that these subpopulations were the result of extensive fragmentation and loss of the migratory form in this drainage, rather than a natural condition, so the subpopulations were combined into a single core area in the Bull Trout Draft Recovery Plan (USFWS 2002a). Generally, weak monitoring efforts have occurred of adult bull trout populations across this core area over the recent decade. The high frequency of resident bull trout populations in this drainage makes interpretation of status and trend information difficult. In general, the counts indicate adult abundance of at least 200 migratory adult fish may remain in this drainage (MFWP 2004a), but there is no evidence these populations are increasing.

The mainstem Bitterroot River is considered nodal bull trout habitat. Nodal habitats are waters which provide migratory corridors, overwintering areas, or other habitat critical to the population at some point during the fishes' life history. Other nodal habitats within this system include two large tributaries, the East Fork Bitterroot River and West Fork Bitterroot River. Local populations are smaller drainages that currently contain the strongest remaining spawning and rearing populations of bull trout and they usually occur in relatively undisturbed drainages in this system. For example, local populations in the upper East Fork Bitterroot River include Bertie Lord Creek, Warm Springs Creek, Sleeping Child Creek, Skalkaho Creek, Fred Burr (Mill) Creek, West Fork Bitterroot River above Painted Rocks Reservoir, and the upper Burnt Fork Creek drainage (MBTSG 1995b).

The habitat trend is expected to decline in this watershed due to extremely high rates of development on private lands, complications of complex multiple ownership patterns, heavy demands for irrigation water, impacts of recent fires, and other factors. Increasing human use and angler pressure, competition with nonnative fish, and other impacts make prospects for recovery of bull trout or more migratory adult fish unlikely.

Overall, the upstream portions of many of the streams of the mid to upper parts of the Bitterroot core area contain good bull trout habitat and fair numbers of bull trout, but appear to be functioning at risk. Bull trout from these streams have the capability to support and maintain a limited bull trout core area population in the foreseeable future, but isolation is a concern for long-term persistence of local populations. Grazing and residential development also have significant impacts on the streams in the Bitterroot River system. Effects from these land use practices include eroding banks, sedimentation and overall bank instability resulting from lack of riparian vegetation and woody debris and consequential increased temperatures. Water diversions and the distribution of brook trout limit the chances of full bull trout recovery in this area (USDA 2000b).

Dewatering, both natural and artificial and the resulting fragmentation of bull trout habitat that results in this system, combined with the synergistic effects of climate change and post-fire increases of stream temperature, represent the greatest threat to bull trout in the Bitterroot River

core area. These same factors combine with and are exacerbated by increasing populations of brook trout and brown trout and increasing levels of urbanization along stream corridors.

The re-establishment of connectivity between the Bitterroot River and its tributaries is considered imperative for the long-term survival of bull trout in this watershed system. Otherwise, it is believed that demographic factors, genetic factors, natural or human-caused catastrophic events will act in concert to gradually cause the elimination of remaining local populations. Once extirpated, the chances of natural re-colonization given the present situation are essentially zero. A key component of the restoration goal for bull trout in the Bitterroot River is to establish a self reproducing migratory life form in the mainstem river which has access to the primary spawning and rearing tributary streams (MBTSG 1995b, USFWS 2002a).

The Bitterroot AAU, which corresponds to this core area shows that 27,743 acres of the HCP occur within this AAU and that 22,187 acres are considered within bull trout habitat (see Table IV-5). In addition, 19.6 stream miles that support bull trout occur on HCP project lands within this AAU (see Table IV-6).

Status of the Rock Creek Core Area

Rock Creek is a tributary to the Clark Fork River, located in west-central Montana. It flows north from the continental divide for approximately 70 miles to it's confluence with the Clark Fork River, about 25 miles east of Missoula, Montana. Rock Creek drains an area of approximately 885 square miles, flowing mostly through a forested, highly dissected landscape. Land ownership in Rock Creek is dominated by Forest Service ownership (80 percent), with 17 percent of the sub-basin in private ownership, much of which straddles the mainstem, 2 percent BLM, and 1 percent owned by the State (MBTSG 1995a). Average stream flow is 513 cfs (MBTSG 1995a). The maximum recorded flow is 6,500 cfs, recorded on June 1, 1972. Rock Creek contains approximately 2,218 miles of streams.

Rock Creek supports one of the strongest populations of bull trout in Montana outside of the Flathead and Blackfoot river drainages (Thomas 1992), although there are concerns about the declining numbers of this core area population. Fluvial fish inhabit the mainstem and migrate to spawn in tributary streams throughout the length of Rock Creek. Small, adfluvial populations persist in Kaiser Lake, Moose Lake and Mud Lake. An isolated population inhabits the East Fork Reservoir, spawning and rearing in the stream reaches upstream from the reservoir. Bull trout occur in all seven principal watersheds in Rock Creek. Spawning has been documented in approximately 55 stream miles, in 19 streams, located in 16 sub-watersheds. Bull trout spawning has not been documented in the mainstem of Rock Creek.

Evidence from a radio-telemetry project supports the idea that bull trout in Rock Creek probably constitute a single core area population with separate groups of fish utilizing specific tributary streams for spawning and rearing (Carnefix 2002). It appears that Rock Creek provides habitat for all life stages of bull trout within the confines of the drainage. Adult fish spawning in different tributaries co-mingle in the mainstem outside the spawning season. Major spawning tributaries are located in all seven subwatersheds within the drainage. Each of these subwatersheds provides spawning and rearing habitat for the fluvial population of bull trout in Rock Creek. Tributary streams in each of the subwatersheds provide some adult habitat outside

of spawning, although most adult fish use the mainstem except during spawning migrations. The major subwatersheds in the Rock Creek drainage include, East Fork Rock Creek, Middle Fork Rock Creek, Ross Fork Rock Creek, West Fork Rock Creek, Upper Willow Creek, Upper Rock Creek (from the confluence with the Forks to Stoney Creek), Middle Rock Creek (Stoney Creek to Wahlquist Creek) and Lower Rock Creek (Wahlquist Creek to the confluence with the Clark Fork River).

The Rock Creek core area is one of the most complex core areas for fluvial populations of bull trout in Montana, with 16 local populations identified. However, several of those may never have been, or may no longer be adequate to qualify as local populations. There is a strong indication that, due to an impassable barrier dam at the outlet, the East Fork of Rock Creek upstream of East Fork Reservoir is a stand-alone population, with its own upstream spawning and rearing habitat in East Fork Rock Creek. For that reason, establishing a new core area in East Fork Reservoir is under consideration.

The complex movement patterns of migratory fish in the Rock Creek drainage (Carnefix et al. 2001), along with overlap of some resident bull trout populations, make interpretation of some status and trend information difficult. Carnefix et al. (2001) described three general movement patterns after observing 96 monitored bull trout that were radio tracked in this watershed over a two-year period. Some (16 fish) were non-migrant, others exhibited simple patterns of upstream movement into spawning tributaries followed by return to the mainstem, and the third type exhibited complex migratory movements into and back out of multiple tributaries in succession. The authors suggested the latter behavior results from foraging opportunities. Fidelity to specific tributary streams remained consistent among years. They also found evidence that annual spawning was the norm for bull trout in this core area, as opposed to alternate year spawning that is common in most adfluvial populations in Montana.

This population had been generally considered stable in the past, but based on the past 12 years of redd counts has been declining over that period at a steady and relatively rapid rate. Regular redd count monitoring has been conducted since 1993, with some data available for about 11 local populations. In general, the counts indicate that about 100-300 redds are constructed annually in the monitored reaches, indicating adult abundance of at least 500 and as many as 1,000 or more fish (MFWP 2004a). Trend information is difficult to interpret, due to missing counts and other factors, but the data indicate this core area population may have declined since the time of listing. Total basin-wide redd counts were 200-270 in 1996-1998, but only about 100-163 in 2002-2004. Some or the entire decline may have been due to natural variation as a result of system-wide drought conditions in recent years. Additional years of monitoring will be required to accurately interpret the effect of the current decline in redd counts.

The perceived declining trend, indicated by 2002-2004 data, seems to have been accentuated in a recent 3-year period. In 2005-2007, the total of basin-wide bull trout redd counts in 11 more or less continuously monitored streams (Butte Cabin, Alder, East Fork, Hogback, Carpp, Copper, Middle Fork, Ross Fork, Little Stony, Stony and Welcome Creeks) were 79, 69, and 111, respectively. Eight of those streams represent half of the 16 previously recognized local populations. In all four recent consecutive three-year periods the average basin-wide redd count

has declined; from about 222 in 1996-1998 when the first comprehensive counts were made, to 165 in 1999-2001, to 129 in 2002-2004, to 86 in 2005-2007. This sustained and precipitous decline indicates an adult population that may have declined from a previous estimate of 500-1,000 fish, to a more recent estimate in the range of 250-500 adult fish; a decline of well over half in adult abundance in a little more than a decade. The four strongest local populations, those which have typically registered double digit redd counts as high as 81 (East Fork 1996), are East Fork, Carpp, Middle Fork, and Stony Creeks. In these waters, redd counts that were typically in the mid-double digits (30-70) in 1996-2004, having generally declined into the teens (10-20) in years 2005-2007. There are some concerns that early redd counts (e.g., 1996-1998) may have been inflated, but regardless, the numbers are declining. If the strongest single local population in East Fork Reservoir is discounted, then the overall strength of the core area is further weakened. The East Fork population has been more stable than the main core area (6-81 redds annually 1995-2007; 47 redds in 2007 were second highest in 12-year period of record).

Annual population estimates in Rock Creek show brown trout populations are increasing and expanding their range upstream, dramatically in the middle reaches and encroaching into the upper reaches of Rock Creek. Brown trout spawning has been observed and documented (snorkeling and angling) in the upper Rock Creek mainstem, and brown trout redds are likely increasing (USFWS 2009). Historically, brown trout were not known to inhabit the upper basin. In addition, whirling disease has become very prevalent in the drainage, since about 2000, and implicated in declines of rainbow and cutthroat trout. While clear cause/effect can not be established, there appears to be relatively rapid replacement of bull trout by brown trout occurring. Furthermore, brook trout are known to occupy several tributary drainages throughout the Rock Creek drainage. Brook trout bull trout hybrids migrated to or were captured in Ranch Creek, Hogback Creek, Stony Creek and Upper Willow Creek (Carnefix 2002).

Rock Creek is a notable sport fishery that supported 27,400 angler days in 1993 (MBTSG 1995a). However, several mechanisms such as competition and/or hybridization with non-native species, and yearlong angler pressure may be affecting bull trout populations. In 1995 the MBTSG (Montana Bull Trout Scientific Group) recognized that the fishery management goal to maximize opportunities for anglers to catch large (>14 inches) rainbow and brown trout may conflict with the goal of restoring bull trout populations.

There is concern that steady increases in angling pressure in Rock Creek may be contributing to unsustainable levels of unintentional hooking mortality (and perhaps increased poaching) of bull trout in Rock Creek. While this does not fully account for a steep recent decline, the angler use is very high for a stream this size. MFWP angler mail surveys, conducted every two years to estimate angler use, document this high rate of use (Table IV-7; MFWP 2006).

Table IV-7. Angler Days in the lower and upper sections of Rock Creek.

Year	Lower Section Mouth to Hogback	Upper Section Hogback to Headwaters	Total
1983	6,320	4,210	10,530
1985	15,349	12,532	27,881
1987	NA	NA	NA
1989	22,448	11,310	33,758
1991	14,661	9,302	23,963
1993	16,898	10,507	27,405
1995	29,047	12,770	41,817
1997	22,390	8,117	30,507
1999	27,129	12,979	40,108
2001	27,516	12,631	40,147
2003	25,326	11,139	36,465
2005	21,701	14,244	35,945

Connectivity is generally good throughout the Rock Creek drainage with the exception of the East Fork which is isolated from the rest of Rock Creek by the East Fork Reservoir Dam. The reservoir above the dam supports an adfluvial population of bull trout that spawn upstream of the reservoir in the East Fork and in the lower end of Page Creek. A division structure immediately below the East Fork dam entrains bull trout.

The cumulative impact of expansion of introduced brown trout and brook trout, along with whirling disease, is not readily separable from issues of heavy angler use and/or angler-induced mortality of bull trout in this core area. Rock Creek is a highly valued fishery that may be experiencing a level of use that is beyond what an aggressive and naïve predator like bull trout can sustain in a stream system this small.

Main habitat issues pertaining to this core area include the Rock Creek road and other forest development roads, private land development for recreational use, mineral exploration and development, including historic, present and future planned operations. The effects of past timber harvest and road construction and the effects of developed and dispersed recreation are also concerns.

Forest management in the drainage includes allocations for wilderness, roadless, undeveloped and custodial management. Forested uplands are comprised mostly of timber management lands whereas lower elevations are allocated to wildlife winter range with some spring-summer-fall range. Streamside areas are identified for riparian resource management. The Rock Creek corridor is allocated to recreation. There is a small piece allocated to riparian grazing near the mouth of Wyman Gulch. There are areas that also contain several patented mining claims and a past legacy of mining related impacts, some of which continue today.

The primary use of the private lands in the middle and lower section of Rock Creek is recreational development. The main Rock Creek road also allows heavy fishing and recreation access to the area. Residential development in the valley is increasing.

The Rock Creek road is the most significant road affecting sediment levels and confining the main channel in certain locations. Past timber harvest and road construction activities in the middle and lower sections of Rock Creek have ranged from negligible to very high. Road densities range from a low of 0.00 miles/mile^2 to a high of 2.66 miles/mile^2. Drainages with high road densities include Kitchen Gulch, Spring Creek, and Wahlquist Creek. The lower reach of Hogback Creek has been negatively impacted by past riparian activity including beaver dam removal, tree cutting, an irrigation diversion, and a problematic road crossing. For example, there are approximately 178 stream crossings in the middle and lower sections of the drainage, most of them culverts. Potential fish passage barriers to upstream migration have been identified in Cougar Creek, Little Hogback Creek, and Hogback Creek. The crossing at Hogback (double culvert) may be a barrier under certain flow conditions. There are other significant barriers that have been identified in these sections. Due to the current high quality of habitat and populations in the watershed it will be important to this core area to maintain the subwatersheds as strongholds for native fish species.

Developed and dispersed recreation sites are a significant issue in the lower Rock Creek reaches. There are numerous dispersed recreation sites and 22 developed sites in this area along with numerous dispersed sites. The majority of these sites are located along the mainstem of Rock Creek. Many of these are right on the stream bank and cause erosion, loss of bank stability, and a reduction in shade and woody debris. Cumulatively these sites may be causing some negative effects. There is also an extensive trail system throughout the subunits. Most of the impacts from trails are small, isolated effects, but as with recreations sites, they can cumulatively impact habitat.

A significant amount of private land has been developed along the mainstem of Rock Creek. While home construction itself may not be an issue, connected impacts such as access roads, septic systems, stream bank grazing, and rip rapping to protect developments and land are issues that have significant impacts on the stream. There is also a pond on private property about two miles up Ranch Creek. There are two sections of private land in the lower reaches of Gilbert Creek, which are managed for agriculture and aesthetics. Part of the riparian area is hayed each year, and at least two small ponds exist on the property. Until recently, the upper reaches of Gilbert Creek were inaccessible to migrating fish because of barriers at these ponds. These ponds can now be bypassed due to a project undertaken by MFWP in 1995.

In the Rock Creek core area a rather stark change in species composition has occurred over the past decade, with major reductions of rainbow trout and bull trout and a corresponding increase in brown trout. To what extent climate change has, or will play into enhancing that unidirectional change is unknown. The Rock Creek core area has a lot of built-in resiliency with a high number of local populations and a high level of connectivity. However, high elevation runoff is limited and streamflow decreases and temperature increases in the future could increasingly isolate these populations and lead to a trend toward resident populations isolated in

upper portions of tributaries (as has already occurred in the Bitterroot). Additional analysis of water temperatures may be important in the future.

Habitat conditions are generally good in most tributaries to Rock Creek, and it would be reasonable to assume that populations could recover within one generation following most types of short-lived disturbances to existing habitat conditions (USDA 2002c). The migratory form is present in all 7 subwatersheds (including Lower and Middle Rock Creek) in the Rock Creek drainage.

In general, the Rock Creek drainage has had relatively few human impacts compared to other western Montana drainages of similar size although there are some impacts from mining, logging, agriculture, and residential development (USDA 2002c). In summary, factors affecting the Rock Creek bull trout core area population include fragmentation, interactions with non-native species (competition, hybridization), sedimentation, large woody debris and water temperature (USDA 2000c, MBTSG 1995a, USFWS 2002a).

With the removal in 2008 of Milltown Dam on the mainstem Clark Fork River some migratory fish that have previously been lost downstream now have spawning access restored to this core area. Bull trout artificially passed over the dam in the past have been tracked to Rock Creek. This core area will directly benefit from improved fish passage at the Milltown damsite. The habitat trend could improve as this watershed is highly valued for recreation and largely protected from intrusive management and development. However, due to increasing human use and angler pressure, competition with nonnative fish, and other impacts, full recovery of bull trout to 1,000 or more adult fish remains problematic.

The Rock Creek AAU, which corresponds to this core area shows that 4,592 acres of the HCP occur within this AAU and that 4,059 acres are considered within bull trout habitat (see Table IV-5). In addition, 2.2 stream miles that support bull trout occur on HCP project lands within this AAU (see Table IV-6).

Status of the Upper Clark Fork River Core Area

Prior to the introduction of contaminated mining waste from Butte and Anaconda and the completion of Milltown Dam, bull trout were likely distributed throughout the upper Clark Fork River. There are no natural barriers that would have excluded bull trout from major portions of the river system. A century of mining and smelting has polluted streams in the upper Clark Fork River system with toxic metals, metalloids and other chemicals (MBTSG 1995a, USFWS 2002a). Degradation, resulting primarily from historic mining and associated water pollution, effectively extirpated migratory bull trout from much of the historic range in the upper Clark Fork River prior to the turn of the 20th century (MBTSG 1995a, USFWS 2002a), which was a condition that lasted into the 1950s (U.S. EPA 2004). Milltown Dam, approximately seven miles upstream from Missoula, has effectively blocked the passage of bull trout and other aquatic species from the middle Clark Fork River upstream to the upper Clark Fork River since its completion in 1907.

Bull trout are considered rare in the principal channel of the upper Clark Fork River. Twelve bull trout were sampled in the upper Clark Fork River between 1989 and 1994; eight of these fish

were found in vicinity of Warm Springs Creek and Racetrack Creek (PTS 2002), and are likely to be out migrants from these or other bull trout-bearing streams in the upper Clark Fork River watershed. Before the Milltown was removed in 2008, a small number of migratory bull trout were captured at the base of Milltown Dam and transported over the dam to release points on the upper Clark Fork River upstream from the dam (U.S. EPA and MDEQ 2003). These fish were observed in the Clark Fork River between the Milltown damsite and Rock Creek, in Rock Creek, and in the Blackfoot River (Swanberg 1997). Efforts to pass bull trout over Milltown Dam have occurred since 1997 (Swanberg 1997) and with the actual removal of the Milltown Dam recently completed (2008), it's likely some bull trout will migrate from the principal channel below the damsite to tributaries of the upper Clark Fork River. The degree to which this occurs or is influenced by the level of metals and arsenic in the principal channel of the Clark Fork River is speculative.

Bull trout in the tributaries of upper Clark Fork River consist mainly of small-sized, resident fish (MBTSG 1995a, USFWS 2002a). Upper Clark Fork River tributaries from Drummond upstream typically drain timbered, mountainous topography to the broad Clark Fork River valley. Principal tributaries in this upper reach include Warm Springs, Lost, Racetrack, Schwartz, Rock, Harvey, and Flint creeks, and the Little Blackfoot River. Harvey Creek contains resident bull trout, but a fish passage barrier prevents fish from the Clark Fork River from using this stream for spawning. Warm Springs Creek and its tributaries contain bull trout in the upper portion of this watershed. Lost, Racetrack, and Schwartz Creeks also contain bull trout. The Flint Creek drainage has been considerably impacted from human activity, and currently bull trout densities are considered very low. Populations are generally depressed and isolated from one another by human-created barriers to fish migration, with the exception of Rock Creek (MBTSG 1995a, USFWS 2002a). Seven local populations were designated in the Draft Bull Trout Recovery Plan (USFWS 2002a), but it is believed the only viable local populations that remain are in the Warm Springs Creek headwaters (Warm Springs and Twin Lakes Creeks) and in Boulder Creek.

There is a high degree of habitat fragmentation and much of the mainstem upper Clark Fork River as well as the lower reaches of many tributaries is unsuitable for bull trout (warm and dewatered) in midsummer. The fluvial migratory component of this population exists at low abundance, although documentation is poor. Adult bull trout to 21 inches total length are occasionally observed in the Clark Fork River, which may indicate a remnant migratory component that is too small to reliably monitor. Despite the restored connectivity through the removal of Milltown Dam, this core area remains heavily fragmented into resident populations due to a combination of thermal status (high summer water temperatures in mainstem and lower portions of tribs) and dewatering conditions.

Monitoring of bull trout redds in two local populations (Boulder and Warm Springs Creeks) has occurred regularly since 1999. Prior to 2004 total redd counts have ranged from 21-70, averaging 49 in the previous six years (MFWP 2004a). These represent a majority of the known spawning populations in this core area, indicating a total adult bull trout population of 100-200 fish. No trend is indicated by the short period of record. Most local populations are well below historical levels of natural abundance and some inadequate to maintain long-term genetic viability.

Redd counts (no counts in 2007) in three sections of the Warm Springs Creek headwaters were 31 (2003), 38 (2004), 28 (partial 2005), and 23 (2006), indicating a population that is roughly stable, but possibly declining. Redd counts in Boulder Creek declined from the teens in 1999-2003, to 9 in 2004 and 6 in 2006, the only two years when counts were conducted. Harvey Creek is not counted regularly, but numbers there are considered too low to monitor. In addition, bull trout had been formerly considered present in the headwaters of the little Blackfoot River, but extensive electrofishing surveys conducted there in 2007 failed to detect any bull trout (USFWS 2009). These results, taken together, indicate the adult bull trout population in this core area is at remnant status, perhaps fewer than 100 fish.

Milltown Dam, which had blocked fish passage at the lower boundary of this core area since 1908 (Schmetterling and McEvoy 2000), was removed in 2008. Approximately 6.6 million cubic yards of toxic sediments that accumulated behind Milltown Dam as a result of upstream copper mining and smelting operations at Butte and Anaconda was removed with the Milltown Dam removal project. The project has restored upstream connectivity to this core area, eliminated habitat for a predatory population of northern pike, and mitigated future potential for recurring fish kills during high flow events. All of these factors are expected to benefit the migratory bull trout population of the Blackfoot and Clark Fork Rivers.

There are many factors affecting bull trout and bull trout habitat in the upper Clark Fork River (USFWS 2009). The over-riding factors affecting bull trout and bull trout habitat are the conditions that are a product of mining, milling and smelting that occurred in the upper part of the watershed (MBTSG 1995a, USFWS 2002a). Water pollution essentially eliminated migratory bull trout from the upper Clark Fork River by 1892 (MBTSG 1995a, USFWS 2002a). Contaminated mine tailings and sediments have been deposited extensively throughout the Clark Fork River streambed, banks, and 100-year floodplain.

The deposition of tailings and contaminated sediments in the upper Clark Fork River valley resulted in a substantial portion of the floodplain and streambanks exhibiting varying degrees of phytotoxicity. The level of phytotoxicity of floodplain and streambank soils strongly influences the composition and density of riparian vegetation. Riparian vegetation, where it does exist under conditions of phytotoxicity, is likely not representative of the pre-contaminant composition and density, and is not optimum for stable streambanks under varying flow conditions. Phytotoxic streambanks in the Upper Clark Fork River valley and resulting impacts to the composition and density of riparian vegetation have caused excessive bank erosion, high suspended sediment concentrations, and high contaminant transport/redistribution rates (USFWS 1998a). Not only has this lead to degraded aquatic habitat conditions, but also has reduced the resistance of the Clark Fork River to catastrophic geomorphic change during large flood events (USFWS 2002a) and chronic effects of land use practices.

The U.S. EPA and the Department of Justice announced in February, 2008, that Atlantic Richfield had agreed to a consent decree requiring ARCO pay $187 million to finance major cleanup along the Clark Fork River and other areas in southwestern Montana. The State of Montana will be the lead government agency conducting the clean up of decades of mining activity in Butte and Anaconda, which contaminated the sediment, banks and floodplain of the

Clark Fork with heavy metals. The work will include extensive revegetation of stream banks and removal of areas devoid of vegetation contaminated with mine tailings. Contingency plans are in place for additional funding if the amount agreed upon is not sufficient. ARCO will also pay $26.72 million, plus interest, to the State for Clark Fork Site Restoration Work. The anticipated start of full-scale cleanup is scheduled to begin in 2009, and is anticipated to take 10 to 12 years.

Land use in the upper Clark Fork River valley is dominated by livestock grazing and livestock forage production. Phytotoxicity has directly impacted the forage available for domestic livestock, and has likely compounded the chronic impacts of livestock on the deterioration of streambanks. The destabilization and subsequent deterioration of streambanks typically results in streambank retreat and widening of the river channel. Stream flow in the tributaries is frequently intermittent in lower reaches during the summer, a result of water diversion for agricultural purposes. Diversions can displace fish from the Clark Fork River into canals and create seasonal fish migration barriers. The decreased water in stream channels from diverting water has increased stream temperature.

Alterations or impacts to riparian plant assemblages can result in elevated water temperatures. Elevated water temperature can adversely impact habitat suitability for bull trout and can adversely influence bull trout migration. Dewatering, warm irrigation water return, and lack of riparian vegetation contribute to elevated thermal regimes. Water temperature in the upper Clark Fork River commonly exceeds 68° F during the summer months. Temperature monitoring results in 2007 indicate much of the upper Clark Fork drainage (mainstem and tributaries) is thermally unsuitable for bull trout in midsummer and temperatures may be increasing (J. Lindstrom, MFWP, pers. comm.). Improvements to habitat, including restoration on USFS lands and lands recently acquired by the USFS in the headwaters of Warm Springs Creek are occurring.

Introduced species such as brook trout, brown trout and rainbow trout have been identified as a high risk to bull trout through hybridization (brook trout), predation (brown trout) and possible competition (brook, brown and rainbow trout) in this core area. Strong brook trout populations occur in most tributaries. Brown trout are distributed throughout the mainstem of the upper Clark Fork and lower portions of major tributaries (e.g., Warm Springs and Flint Creek). Since habitat availability and quality has been reduced through several factors (mining, forestry, agriculture, etc.), and since brook trout and brown trout habitat preferences overlap with bull trout, these interactions may reduce habitat carrying capacity for bull trout. Well established brown trout populations are stable or increasing as indicated by spawning surveys in the upper Clark Fork and several of its tributaries (R2 Resource Consultants 1999, 2002).

Riparian areas impacted by grazing and roads associated with forestry and mining present risks to bull trout. Man-made physical barriers to fish migration and intermittent stream flow are common in tributaries of the lower reach of the upper Clark Fork River. Impediments to migration and degraded habitat conditions likely limit potential of bull trout refounding the upper Clark Fork River.

The Upper Clark Fork River bull trout core area population is at risk because much of the existing watershed functions poorly for most bull trout habitat and bull trout population attributes. Bull trout populations are currently heavily fragmented in this core area, with a wide

variety of threats acting in synergy. The legacy effects of past smelting operations in Anaconda and irrigation withdrawals, in conjunction with the dominance of exotic species have resulted in watershed conditions that limit bull trout populations in terms of abundance and distribution. A century of widespread mining abuse is gradually being treated, but not fully removed. Brook trout and brown trout, which are widespread and abundant throughout much of the bull trout habitat in the upper Clark Fork core area, are able to thrive in degraded ecosystems (temperature, water quality, sediment) where native fish are less viable. Combined effects of over a century of farm and ranch-related land management uses, including irrigation dewatering, grazing, and water quality impairment (temperature, sediment and runoff), have created impacts to bull trout populations in the core area. The existing legacy of forest roads and forest practices are also an ongoing concern.

Many of the aforementioned problems are being systematically corrected, but their legacy endures and in combination, they make recovery of bull trout rather problematic. The removal of Milltown Dam and additional Fisheries Restoration and Irrigation Mitigation Program (FRIMA) passage projects and other efforts the extreme fragmentation of this core area is being improved. However, significant habitat limitations remain (e.g. dewatering, thermal enrichment, heavy metals, nonnative species) and full recovery of bull trout is an uncertain prospect. Some emphasis has been placed on protection of habitat in important spawning and rearing streams on both public and private lands (e.g. Plum Creek HCP), but more is needed, especially in the light of the increasing pace of development on private lands in the valley bottom. Population response as a result of these activities is not certain, given the nonnative species, habitat and connectivity concerns.

The Upper Clark Fork AAU, which corresponds to this core area shows that 47,173 acres of the HCP occur within this AAU and that 27,407 acres are considered within bull trout habitat (Table IV-5). In addition, 15.9 stream miles that support bull trout occur on HCP project lands within this AAU (Table IV-6).

<u>Status of the Middle Clark Fork River Core Area (Blackfoot River to Flathead River)</u>
Prior to 1907, bull trout from Lake Pend Oreille in northeastern Idaho moved throughout the Clark Fork River system (MBTSG 1996c, USFWS 2009). Construction of Thompson Falls (1916), Cabinet Gorge (1952) and Noxon Rapids (1958) dams essentially eliminated the natural upstream migration of adfluvial bull trout from Lake Pend Oreille, and greatly reduced the number of bull trout in the Clark Fork River basin upstream from the dams (USFWS 2009). As a result, bull trout currently found in the mainstem of the Clark Fork River downstream from the Blackfoot River and upstream from Thompson Falls Dam are predominately fish that spawn in direct tributaries to this section of the river. The life history form of bull trout that now occupies the Middle Clark Fork River is the fluvial migratory form.

Several of the tributaries to the Middle Clark Fork River such as Rattlesnake, Crow, Mission, Post, and Dry creeks were also dammed in the last century. With the exception of Crow Creek, these are historic bull trout spawning and rearing streams. Some of these dams block migratory fish from spawning habitat and have isolated bull trout upstream from the dams (MBTSG 1996c, USFWS 2009). The Montana Bull Trout Scientific Group recognized the existence of dams as

one of the primary causes of bull trout declines in this section of the Clark Fork River system (MBTSG 1996c).

The St. Regis River and Fish, Trout, Cedar, Petty, Ninemile, Tamarack, Grant, Dry (near Superior), and Rattlesnake Creek drainages also support resident bull trout populations. Bull trout densities in these populations range from rare to moderate. WCT and mountain whitefish (*Prosopium williamsoniy*) are the only other salmonid species native to the middle Clark Fork River (MBTSG 1996c).

Spawning migratory bull trout or redds have been observed in the St. Regis River and Fish, West Fork Fish, North Fork Fish, Trout, Cedar, Petty, Rattlesnake, Cache, and Montana Creeks (MBTSG 1996c). Extensive surveys have been conducted in this core area in recent years, largely by MFWP and USFS in association with a variety of inventory, management, and restoration efforts. Bull trout are generally scattered throughout suitable habitats at very low densities, making rigorous distribution and abundance estimates difficult. For example, adult bull trout density in the mainstem Middle Clark Fork River is only 1-3 per mile (USFWS 2009). A total of 17 adult bull trout were captured by electrofishing in the Middle Clark Fork River and implanted with radio transmitters in 2003-2005 (MFWP unpublished). The study highlighted the importance of coldwater sanctuaries at the mouths of tributaries as thermal refugia during summer months, when fish concentrated at the mouth of Trout, Cedar, and Dry Creeks and the Saint Regis River. These fish migrated to Fish, Trout and Cedar creeks to spawn.

Local spawning populations in this core area in Cedar Creek, Fish Creek, Rattlesnake Creek, and the Saint Regis River have been monitored sporadically in the past (MFWP 2004a). The surveys have identified up to 17 redds in Cedar Creek (2002), 20 redds in Fish Creek (2003), 33 redds in Rattlesnake Creek (2003), and 18 redds in the Saint Regis River (2003). More recent redd counts in 2005-2007 were generally consistent with the earlier record, seeming to indicate a population that is relatively stable at low abundance. Minimum total redd counts for the six monitored sections (not every section was counted every year) in the four drainages in 2003-2007 were 83, 25, 68, 61, and 70, respectively. This would indicate an adult population of around 200 fish if annual spawning occurs, somewhat higher if not.

These results indicate adult bull trout numbers in this core area range from roughly 100-200 fish, although there's uncertainty in that estimate. No trend is indicated by the short period of record. Most local populations are well below historical levels of natural abundance and inadequate to maintain long-term genetic viability.

Surveys conducted by MFWP (USFWS 2009) indicate widespread distribution of juvenile bull trout at low densities in many of the watersheds surveyed in this core area. Installation of a fish ladder on Rattlesnake Creek, near the city of Missoula, has reconnected an important drainage for spawning and rearing of migratory bull trout (Missoulian *in litt.* 05/16/02). A radio telemetry project was conducted on Rattlesnake Creek, implanting six adult fluvial bull trout in 2001 and 2002 beneath the MWC Dam. Telemetered fish that were transported around the dam moved upstream 4-7 miles to spawn. Telemetered fish remained upstream of the dam for at least two months after spawning, but generally returned to the Clark Fork River for 5-7 months over winter and spring, before returning to Rattlesnake Creek for consecutive year spawning runs.

This local population is an important stronghold for recovery in this core area due to the extent and quality of habitat in the watershed.

Several significant actions have been taken in the past few years to restore connectivity for migratory bull trout in the Clark Fork River drainage, including development of a trap and haul fish passage program at Cabinet Gorge and Noxon Rapids dams and installation of a new fish ladder in 2011 at Thompson Falls Dam downstream of this core area and the development of fish passage at MWC Dam on Rattlesnake Creek and removal of Milltown Dam in the upstream end of this core area. As a result, connectivity within the Middle Clark Fork River is now enhanced by improved fish passage on either end. Six of eight local populations are fully connected. The potential to restore an adfluvial form of bull trout to this core area now exists with the breach of these fish passage barriers on the mainstem which ostensibly connects Lake Pend Oreille to this core area for adult migratory bull trout attempting to return to Montana to spawn.

Forest habitat conditions have trended upward, with an improved baseline (USDA 2000c) and particular emphasis on road BMPs and improvement of fish passage in tributary systems. At the same time, private residential development and private logging have increased, much of which is concentrated at the lower ends of key tributaries in sites where bull trout are known to congregate and may be increasingly vulnerable. In balance, it would be difficult to determine whether or not the overall habitat trend is improving.

In the Clark Fork River, the temperature of main-channel water can vary greatly during periods of the year when bull trout are moving to or toward spawning habitat. During August and September, water in the river can range from 61° F to 67 ° F, leading Gillin (2002) to suggest that while bull trout are holding in the main channel of the Clark Fork River, they are finding cold water microhabitats associated with tributaries or upwelling in the main channel.

Angling pressure and both intentional and unintentional hooking-related mortality are also significant issues in this core area. Of the 17 bull trout captured and used in the radio telemetry study on the mainstem of the Middle Clark Fork River core area, overall mortality was greater than 50 percent. At a minimum, 10-15 percent mortality was due to illegal angling harvest (MFWP, unpublished), but there is cause to believe that the problem is even greater. Onsite angling surveys and enforcement checks verify these concerns are well founded and the problems are difficult to remedy. The situation is compounded due to the very low numbers of adult fish. Angling pressure in the Middle Clark Fork River core area has also increased to add to the concerns. In the 1980's, the reach of the Clark Fork from the Flathead River to the Bitterroot River averaged 31,320 angler days of use (MFWP 2006). In the 1990's this grew to an average of 51,383 angler days; an increase of 64 percent. Since 2000, angler use on this reach of river averaged 65,987 angler days; now over double the use seen in the 1980's. Given the low numbers of bull trout, this amount of angling pressure may be sufficient to limit recovery potential even if illegal activity is curbed.

Over half of the spawning and rearing habitat of the local populations as well as the entire mainstem foraging, migrating, and overwintering habitat are occupied by brown trout and/or brook trout. Roughly 50-75 percent of the tributary spawning and rearing habitat has high population levels of brook trout. This predation/competition/hybridization impact to these bull

trout populations is uncertain, but could limit or slow the rate of recovery of bull trout in the Middle Clark Fork core area.

There are a number of major water diversions from the Clark Fork and Bitterroot rivers upstream of the Big Flat and Frenchtown irrigations systems. A substantial portion of the volume of flow of each river is diverted, and is primarily used for irrigation. In the Missoula Valley, four major diversions in addition to the Frenchtown irrigation system carry water from the Clark Fork River. In addition, there are virtually hundreds of smaller diversions from tributaries to the Clark Fork River in this section.

The trend of the baseline habitat and population conditions for bull trout and its habitat is uncertain in this core area. Prospects for continued habitat conservation activities are good; however, population response as a result of these activities is not certain, given the nonnative species, habitat and connectivity concerns. Furthermore, the cumulative effect of impacts in this part of the Middle Clark Fork River system is problematic. A major concern exists with the mainstem Clark Fork River water temperatures that are marginally suitable for bull trout in midsummer; bull trout to congregate in a limited number of thermal refugia where they become vulnerable to angling overexploitation. Combined, these factors favor introduced species and increase fragmentation of bull trout.

The Middle Clark Fork AAU, which corresponds to this core area shows that 88,512 acres of the HCP occur within this AAU and that 60,237 acres are considered within bull trout habitat (see Table IV-5). In addition, 52.1 stream miles that support bull trout occur on HCP project lands within this AAU (see Table IV-6).

Status of the Lower Clark Fork River Core Area

The Lower Clark Fork River core area extends downstream from the confluence of the Flathead River, through Thompson Falls Reservoir, Noxon Rapids Reservoir, Cabinet Gorge Reservoir to Cabinet Gorge Dam in Idaho.

Until recently, fluvial and adfluvial fish were blocked from freely and extensively migrating in the Lower Clark Fork River (if not further upstream) by the three dams (Cabinet Gorge, Noxon Rapids, and Thompson Falls) that are positioned in sequence immediately upstream of Lake Pend Oreille. In the absence of the dams, it is likely the Lower Clark Fork Core Area population would have comprised a single Lake Pend Oreille Core Area population with local populations located in each of the watersheds. Despite these limitations, the Lower Clark Fork watershed continues to support bull trout that exhibit both resident and migratory life history forms. Most of the drainages occupied by bull trout in this watershed are believed to be dependent on migratory individuals to ensure long-term bull trout persistence. Fragmentation of the migratory corridor by mainstem dams is a major factor affecting the survival and recovery of bull trout in the Lower Clark Fork River drainage (MBTSG 1996b, USFWS 2002). However, in the last five years this threat has been addressed to a large degree at the Avista dams through current fish passage programs.

Adfluvial migratory bull trout is this core area are fish originating from the lake population of Lake Pend Oreille in Idaho or within other reservoirs behind the three major dams within this

core area. There is some evidence of fluvial as well as resident fish in this complex core area. Resident bull trout have been documented in upper reaches of Rock Creek and Prospect Creek, upstream of partial or complete barriers. The distinction between resident and migratory adults is primarily an issue of size.

In 2006, the USFWS determined that the Lower Clark Fork River should be reorganized into a single core area consistent with the original intent of the Draft Bull Trout Recovery Plan, based largely on the partial success of fish passage at the Avista dams. This decision resulted in the Lower Clark Fork River core area, previously described as four separate core areas, now being considered a single core area from Cabinet Gorge Dam up to (and including) the lower Flathead River. Avista is continuing to evaluate options for permanent volitional fish passage at Cabinet Gorge and Noxon Rapids dams, but no final decisions have yet been made. In the interim the trap and transport program will continue to move adult bull trout upstream of the dams and juvenile bull trout downstream to Lake Pend Oreille, providing a modicum of functional connectivity.

Upstream fish passage has been blocked at Thompson Falls Dam since 1913. Providing fish passage at Thompson Falls Dam is one more step towards reconnection of the Lower Clark Fork River core area and subsequent recovery of migratory bull trout. PPL Montana completed construction of a fish ladder in 2010 which became operational in spring of 2011. This is the largest operational fish passage ladder in the State of Montana that was designed specifically to pass bull trout. Results of its' first year of performance is expected in late 2011.

There are 14 local populations that occur in this core area; two in the Cabinet Gorge Reservoir segment (Bull River, Rock Creek); three in the Noxon Rapids Reservoir segment (Graves and Prospect creeks and the Vermilion River); two in the mainstem Clark Fork River (Fishtrap Creek and West Fork Thompson River); and seven in the lower Flathead River segment of the core area (Post, Mission and Dry Creeks; North, Middle and South Forks and mainstem Jocko River). In addition, Swamp Creek in the Noxon Reservoir segment may be considered a local population as more information is collected in this watershed.

The lower Flathead River portion of this core area is almost entirely on the Flathead Reservation of the CSKT. Extensive bull trout restoration activities are occurring in the Jocko River watershed, which is where most of the bull trout habitat in this core area occurs (CSKT 2000). Information from informal discussion with Tribal representatives indicates that numbers of adult bull trout in this core area are generally low, on the order of 100 adult fish or fewer in the migratory population. There is no available information on the population trend.

Comprehensive redd counts in three of the four portions of the Lower Clark Fork core area (lower Flathead River exception) have been conducted in recent years in association with the Avista Native Salmonid Restoration Program. Since 2001 redd counts have been conducted in full or partial index reaches of the mainstem, East Fork and South Fork Bull River, Rock Creek, Swamp Creek, Vermilion River, Graves Creek, Prospect Creek, Fishtrap Creek and West Fork Fishtrap, Beatrice Creek, and West Fork Thompson River (Storaasli and Moran 2008). Collectively, these redd counts have been estimated to include greater than 80 percent of the total bull trout spawning that occurs in the system (with exception of the lower Flathead).

The range of redd counts since 2001 for the core area is 81 to 145 with the strongest year on record occurring in 2006. Based on a standard expansion factor of 3.2 adults per redd, the 2006 data would indicate at minimum an adult population approaching 500 fish. The East Fork Bull River and the Vermillion River have the most significant and somewhat steady number of redd counts followed by the Prospect and Fishtrap creek systems. These results indicate that the total adult bull trout population for these portions of the core area is at least stable.

From 2001 to 2005, fish passage programs conducted within the Lower Clark Fork Core Area successfully passed between 29 and 42 adult bull trout annually (USFWS 2008a). Due to the fecundity of each adult female bull trout, each fish passed upstream to spawn has the potential to make a substantial genetic contribution. In addition, data collected between 2001 and 2006 have documented several juvenile bull trout captured from tributaries, tagged and transported downstream of Cabinet Gorge Dam, that were recaptured as adults at the base of dam; indicating that at least some migratory bull trout are now able to complete their normal lifecycle in the Lower Clark Fork Core Area.

In 2008, two adult bull trout captured below Noxon Rapids Dam were genetically assigned to tributaries upstream of Thompson Falls Dam (Meadow Creek and Cedar Creek) (Bernall and Lockard 2009). These data indicate bull trout movements are not limited to the lower Clark Fork River and that the adfluvial migratory life history of bull trout still exists in the Lower Clark Fork River Core Area. However, to continue to perpetuate the adfluvial life history traits, it's believed necessary to continue bull trout passage over the dams in the lower Clark Fork River, thus allowing adult bull trout to return to their natal streams to spawn (USFWS 2008a).

Considerable effort has been applied in the most recent five-year period toward developing a genetic baseline for most of the tributaries throughout the entire Clark Fork River basin (including Lake Pend Oreille and three upstream Clark Fork River core areas). The development of a rapid genetic assignment process has allowed researchers to capture individual bull trout at the base of Cabinet Gorge Dam, determine with high probability their stream of natal origin, and return those adults to the portion of the system upstream of the dam so they may complete their spawning migration (Bernall 2007, Bernall and Lockard 2008). Over time, the significant contributions from these adult bull trout to the gene pool and upstream population productivity, combined with enhanced survival of juveniles through downstream transport (Lockard et al. 2005, 2008) is expected to strengthen both overall numbers as well as genetic connectivity of the entire Clark Fork system.

In recent years this core area has received much habitat improvement and restoration efforts in the important bull trout streams and rivers. Surveys of the West Fork Thompson River and Fishtrap Creek drainages have been conducted under the Plum Creek Native Fish HCP program. Habitat protection and improvements to important bull trout spawning and rearing reaches are being evaluated on a case-by-case basis under this program. An extensive survey of the Prospect Creek drainage in 2003 led to a determination that bull trout habitat and use of this drainage was more extensive than previously known (Moran 2004a) and consequently more focused habitat needs have been and will continue to be addressed in this drainage. A TMDL has been instituted on Prospect Creek, which should result in long-term benefits of sediment reduction in this

drainage. The Avista studies have also collected extensive habitat information as part of an overall evaluation of many portions of the Bull River, Rock Creek, and other watersheds.

Extensive bull trout restoration activities are presently occurring in the Jocko River watershed (CSKT 2000). Prospects for continued habitat conservation activities are excellent, particularly in the Jocko River watershed. Additionally, CSKT has placed strong emphasis on protection of habitat in important spawning and rearing streams on Tribal lands. Some gains will be offset by increasing pace of land and water development in the valley and increasing recreational pressure on this resource. The CSKT have initiated a well-funded and prioritized recovery effort (CSKT 2000). Population response as a result of these activities is not certain, given the nonnative species, habitat and connectivity concerns.

Horn and Tholl (2008) systematically examine fish population data accrued over a 9-year period (1999-2007) in 12 tributary drainages to the Lower Clark Fork River core area. At some locations, changes in distribution or abundance are positively correlated with habitat restoration or improvement measures such as culvert passage improvements and sediment reduction. A TMDL for sediment reduction has been completed on Prospect Creek. Work also continues to identify causes and alleviate concerns about high levels of total dissolved gases that accrue through the hydropower system of the Lower Clark Fork River core area. Detailed measurements of ecosystem habitat quality are not generally available, but the weight of evidence indicates an overall improvement in habitat conditions (Gillin 2005).

Either Cabinet Gorge, Noxon, or Thompson Falls reservoirs provide an adequate surrogate for Lake Pend Oreille. Cool water habitat conditions are limited in the reservoirs. Reservoir habitat conditions are largely unsuitable for bull trout (USFWS 2009) and are considered degraded by State of Montana standards as they pertain to supporting a cold water fishery. Bull trout growth and survival rates are likely decreased from predevelopment conditions. This shift in habitat suitability is evidenced by the highly successful bass fishery and dominance by generalist fishes in these reservoirs (USFWS 2009).

Headwater bull trout streams in this region are typically groundwater-influenced, but climate change is expected to have a larger impact in this region than many other places in western Montana, due in part to lower elevations and precipitation patterns that appear conducive to high frequency of rain-on-snow conditions. In addition, there's already major concern with mainstem Clark Fork River water temperatures that are marginally suitable for bull trout during midsummer and a shrinking amount of habitat suitable for bull trout in the mainstem reservoirs. Suitability of the Clark Fork River habitat for adult bull trout is partially limiting, due to thermal and water quality concerns. Similarly, portions of the Thompson River watershed experience warm summer water temperatures. Combined, these factors favor introduced species and increase fragmentation of bull trout.

Kanda et al. (2002) reported on the evidence of introgressive hybridization between bull trout and brook trout in five local populations from Montana. A particularly interesting case occurs in Mission Reservoir, a small mountain lake in the headwater of the lower Flathead River portion of this core area, where an extremely high rate of hybridization occurred (71 hybrids from 164 suspected hybrid fish that were sampled) and 20 of the 71 hybrids were either backcrosses (15

cases) or second-generation (5 cases). These results provide documentation that first-generation bull trout X brook trout hybrids are capable of reproducing in some circumstances, furthering concern about the hybridization issue. However, the results still indicate the existence of reduced fitness or some other mechanism that precludes the two species from forming hybrid swarms.

Extensive information is being collected on the overlap with and potential superimposition of brown trout redds in important bull trout drainages (Moran 2004b). Studies are ongoing related to concerns that northern pike negatively interact with bull trout and predate on juvenile bull trout in Cabinet Gorge Reservoir (Bernall and Moran 2004). There are also concerns about negative interactions with high densities of brook trout in many watersheds and the potential for an increasing population of recently illegally introduced walleye that are reproducing in Noxon Reservoir. To date, control actions on these species have not been initiated, pending further analysis.

In 1997 and 1998 a total of 780 fish were collected among nine sites in Montana above Cabinet Gorge Dam and 384 fish from four sites in Idaho below the dam for pathogen surveys. Only one fish was a bull trout, but the study was conducted in response to concerns that transport of bull trout over the dam might introduce new fish pathogens upstream. The soluble antigen of *R. salmoninarum*, the causative agent for bacterial kidney disease, was detected in fish from all sample sites across the study area, though no clinical cases of the disease were found. *F. psychrophilum*, the bacterium that causes cold water disease, was isolated from samples below the dam, but not above. However, the pathogen is generally regarded as a widely distributed organism and because it's ubiquitous it was not determined to be an agent of concern for the fish transport program. IPN virus was also isolated from brook trout in the Mosquito Creek drainage, but previous cases had already occurred in the drainage and this pathogen was also known from upstream waters in Montana. No evidence of *M. cerebralis*, the parasite that causes whirling disease, was detected in any of the samples. With these findings, the fish transport program moved forward.

An active suppression project to remove brown trout and brook trout from the primary bull trout spawning and rearing habitat in the East Fork Bull River was initiated in 2007 (Moran and Storaasli 2008). In one year, 4,039 salmonids were captured by electrofishing. A total of 1,843 (46 percent) were nonnative brown (1,300), brook (539), and rainbow trout (4) that were removed from the population. Larger fish were salvaged and transported to a lower Bull River location where anglers would have an opportunity to fish for them. The removal and evaluation continued in 2008.

Nonnative species (brook trout, brown trout, lake trout, northern pike, walleye, etc.) are increasingly impacting efforts to recover bull trout and habitat conditions in the reservoirs favors many of those populations over native species. The establishment of illegally introduced walleye in Noxon Reservoir compounds the threat from nonnative species in this core area. Monitoring indicates that the introduced walleye population in Noxon Reservoir is continuing to grow. The magnitude and imminence of threats from nonnative species (brown trout and brook trout) is

elevated in this core area, based on evidence from the Jocko River and Mission Reservoir watersheds, respectively.

Cooperative efforts between Avista, MFWP, and local watershed groups are providing long-term habitat protection through land acquisition, conservation easements, and watershed restoration in this core area. Bull trout occurrence in the Lower Clark Fork Core Area could increase as a result of such activities. These efforts are highly important to the eventual recovery of bull trout in the lower Clark Fork River system once fish passage at Cabinet Gorge, Noxon, and Thompson Falls dams is attained permanently. The primary restoration actions needed to restore the original migratory life history functions of bull trout in the lower Clark Fork River system is habitat improvement, non-native species suppression, and fish passage at the dams.

The Lower Clark Fork AAU, which corresponds to this core area shows that 4,185 acres of the HCP project area occurs within this AAU and that 1,650 acres are considered within bull trout habitat (Table IV-5). In addition, only 0.2 stream miles that support bull trout occur on HCP project lands within this AAU (Table IV-6).

Status of the Lake Koocanusa Core Area

The Kootenai River is an international watershed that encompasses parts of British Columbia, Canada, Montana, and Idaho. Approximately 21 percent of the watershed lies within the state of Montana, and 6 percent falls within Idaho with the remainder located in Canada. The runoff volume of the Kootenai River makes it the second largest Columbia River tributary and in terms of the watershed area, ranks third (Knudson 1994 as cited in the USFS 2002) in the Columbia River Basin.

The Lake Koocanusa core area is artificially created by the presence of Libby Dam on the Kootenai River. The dam is located approximately 17 miles north of the town of Libby, Montana, and impounds Lake Koocanusa which extends 90 miles in length, the upper half of which is in Canada. In addition, there are impassable dams or diversions on some of the upstream spawning tributaries in British Columbia (B.C.) (e.g., Elk River, Bull River).

MFWP reported that prior to the construction of Libby Dam in 1972, WCT, rainbow trout and mountain whitefish were the dominant species in the upper Kootenai River. Ten years after the creation of Lake Koocanusa, WCT, rainbow trout, and mountain whitefish remained the dominant species but bull trout showed a slight increase from pre-impoundment levels. This was probably due to the creation of rearing habitat for the Canadian portion of the Kootenay and Elk River bull trout populations. Nonetheless, the expanded foraging, migrating, and overwintering habitat for bull trout created by a large reservoir (Lake Koocanusa), with abundant forage (kokanee salmon) and high quality upstream spawning and rearing habitat has currently created an unusually productive environment, allowing this bull trout population to expand to many times its previous natural capacity in the riverine environment. The Lake Koocanusa core area contains one of the strongest populations of bull trout in the conterminous U.S. The USFWS (2009) reported this population represents the "single most significant recovery success story in the entire range of the species."

The strongest bull trout local populations in the U.S. that were identified by the MBTSG (1996f) in the upper Kootenai River are Grave Creek (a tributary to Lake Koocanusa) and the headwaters of the Wigwam River drainage. The nodal habitats, waters containing migratory corridors, overwintering areas, and other critical habitats, are in Lake Koocanusa and the Tobacco River within the U.S. and the Kootenay River in British Columbia. Only one stream system in the U.S. supports a local population in this core area. At a minimum, on the B.C. side there is Skookumchuck Creek, White River, Saint Mary River, Blackfoot Creek, and probably 6 to 8 more.

Westover and Heidt (2004) detailed findings of a radio telemetry project that tracked adult bull trout throughout the upper portions of the Kootenai watershed, primarily in B.C. Through this project they were successful in identifying several previously unknown spawning areas in the White River, Blackfoot Creek, and Verdant Creek, expanding the known range of bull trout in this core area. The information indicated that about 80 percent of the bull trout they tracked exhibited fluvial, rather than adfluvial behavior, though the transition between this large river and the head of the reservoir is transitory, depending on reservoir levels.

Based on data collected from 1995 to 2004 in the Wigwam River drainage (mostly in B.C.) and in the Grave Creek drainage in the U.S., bull trout redd counts exhibited a strong, and increasing population of bull trout. The Wigwam River trend was particularly impressive, where the redd count was 247 in 1995, and increased every year to a total of 2,133 in 2004. Over 300 additional redds were counted in the Skookumchuck and White Rivers and Blackfoot Creek in B.C. in 2004. In the Grave Creek system the total redd count was as low as 16, in 1995, but exceeded 100 each year since 1999 to a high count of 245 in 2003. The general rising trend during this period was similar to that for the Wigwam River, though not as steep in the Grave Creek watershed.

Continuing redd counts for this core area in 2005 through 2008 indicate that the population appears to be relatively stable, maintaining itself at a very high level. Redd counts in index reaches (three sections) of Grave Creek, the sole U.S. tributary, were 194, 148, 208, 207 in 2005 through 2008, respectively (MFWP, unpublished). For the Wigwam River, the primary spawning population in B.C., redd counts dipped precipitously in 2005 to 642, from an all-time high of 2,133 the previous year. This decline was attributed primarily to an unusual landslide event that partially blocked access to the primary spawning reach. The stream subsequently cleared itself and in 2006-2008 the Wigwam River redd counts rebounded to 2,298, 1,883, and 1,833 in the last three years, respectively. Additional redd counts in other major B.C. spawning tributaries were as follows: Skookumchuck Creek – 111, 163, 144, and 137 in 2005-2008, respectively; White River – 137, 167, 193, and 137 in 2005-2008, respectively; and Blackfoot Creek – 106, 144, 73 and 73 in 2005-2008, respectively.

Combining all these index reaches into a comprehensive summary of bull trout redd counts for the Upper Kootenai River core area, estimated to include roughly 75 percent of known spawning, the total number of redds over the most recent five-year period averages 2,319 redds annually (2004 = 2,598; 2005 = 1,190; 2006 = 2,920; 2007 = 2,501; 2008 = 2,387). During that period, roughly 197 redds per year (8.5 percent of the total) occur on the U.S. side of the International

Border. The indication is that the adult bull trout population in this core area is likely over 10,000 fish and these data generally reflect a population trend that seems to be exhibiting stability, perhaps at or near maximum carrying capacity, in the most recent 5-year period.

These robust redd count data were used in part as the basis for proposing reestablishment of an experimental bull trout sport fishery in the reservoir, which was permitted by the USFWS beginning in 2004. The recreational bull trout fishery on Lake Koocanusa has continued and is being closely monitored (Hensler and Benson 2007, 2008). Angler catch and harvest (in parentheses) of bull trout from Lake Koocanusa has been estimated as follows: 2004-05 catch not estimated, harvest of 650 fish; 2005-06 catch = 3,595 (371); 2006-07 catch = 1,349 (180); 2007-08 catch = 1,484 (267). The fishery is continuing. Starting with the Spring, 2009 season anglers will be allowed 2 poles each (as opposed to 1 under the old regulation), which may lead to increased bull trout catch and harvest.

Environmental instability does not represent a threat to bull trout within the upper Kootenai River system due to: 1) stable landforms and soils, 2) heavy vegetation throughout the area, and 3) topographical location of local watersheds. Generally, the watersheds in this core area drain high elevation mountainous terrain which is less susceptible to rain-on-snow events (resulting in a rapid snow melt and increase in flow rates). Connectivity within the drainage allows for escapement from fire and therefore minimizes most negative impacts a fire may cause (MBTSG 1996f). Furthermore, efforts to improve habitat in lower Grave Creek and further stabilize the channel have been underway for several years and are continuing. A potential new diversion (rebuilding an historical structure) is a new threat that could further deplete instream flow in Grave Creek.

The Glen Lake Irrigation District diversion on Graves Creek entrains young-of-the-year (YOY) bull trout annually. Although a fish screen was installed several years ago, it is not effective on this particular age class because of design limitations. However, some of the entrained YOY bull trout are captured in the irrigation ditch and returned to the creek. In 2001 through 2008 MFWP has operated a screw trap in the ditch downstream of the diversion, during May-September, to assess the effectiveness and the rate at which juvenile bull trout are bypassing the fish screen. Bull trout catch declined initially, from 204 in 2001, to 178 in 2002, 55 in 2003, and 85 in 2004 (unpublished 2008 trapping data, provided by MFWP). However, due in part to improper operations the numbers rebounded to 191 in 2005, 338 in 2006, 171 in 2007, and 744 in 2008. This necessitated partial reconstruction of the diversion structure and bypass channel, which occurred in late 2008, and a plan is being developed which, if followed, is expected to resolve the problem. Bull trout which go down the diversion end up in an off-basin reservoir (Glen Lake) and are essentially lost to the core area.

Ardren et al. (2007) examined genetic structure and genetic diversity of bull trout from 15 sampling locations spread throughout spawning and rearing habitat in three of the four bull trout core areas in the Kootenai River Basin (Sophie Lake excepted) in both Montana and British Columbia. DNA was extracted and individuals were genotyped at a core set of 12 standard microsatellite loci. Amongst the 15 samples were subsets from the following tributaries to Lake Koocanusa, in upstream order: Grave Creek, Bloom Creek, Wigwam River (Bighorn and

Lodgepole Creeks), St. Mary River (Redding Creek), Skookumchuck Creek, and White River (Middle Fork and North Fork). Analysis showed that these populations grouped together and formed two recognizably separate (upriver and downriver) branches of the tree, well apart from stocks collected in the Kootenai River (downstream of Libby Dam) and the other isolated Bull lake core area. The data suggest there is a high degree of genetic variation among different bull trout populations within the Kootenai River basin (Ardren et al. 2007). The data also supported the hypothesis that there is restricted gene flow, but some level of historical connectivity, between most of these populations. This was anticipated as the Libby Dam is a relatively recent feature on the landscape.

Genetic analysis of bull trout sampled immediately downstream of Libby dam in 2004-2007 has also been conducted in an attempt to determine how significant the entrainment issue is through Libby Dam. Of 62 unknown adults from the sample that were genetically assigned, exactly half (31 fish) assigned to most likely population origin upstream of the dam and the other half to likely population origin downstream of the dam (Ardren et al. 2007). The majority of the 31 fish assigned upstream (17 of 31) were assigned to the strongest known population, the Wigwam River. Most of the rest assigned to the other local populations nearest the dam, Grave Creek in the U.S. and Bloom Creek just upstream of the Border in B.C. It is clear that some bull trout are being entrained, but given the robust condition of the Lake Koocanusa core area these losses are not known to represent a problem. There were no brook trout hybrids detected in any of the samples upstream of Libby Dam and brook trout are generally not prevalent in drainages inhabited by bull trout in this core area.

In 2007 and 2008 at least three lake trout, a species which if established could threaten bull trout, were caught by anglers immediately below Libby Dam (2) and Kootenai Falls (1). The source of these introduced fish is unknown. To date, lake trout have not been documented in Lake Koocanusa, upstream of Libby Dam. There is growing concern that a lake trout population may establish in Kootenay Lake, B.C. with possible implications upstream in this core area.

There is now up to 14 years of accumulated redd count data for individual local populations in this core area. These data generally reflect a population trend that seems to be exhibiting stability, perhaps at or near maximum carrying capacity, in the most recent 5-year period. This core area exhibits the strongest record of an increasing trend that exists anywhere across the entire U.S. range of the species. The USFWS has determined that the robust bull trout population status and strong increasing population trend throughout in this core area as well as the current ecosystem conditions are adequate for bull trout to achieve full recovery status.

The Upper Kootenai River AAU, which corresponds to this core area shows that 11,153 acres of the HCP project area occurs within this AAU and that 7,076 acres are considered within bull trout habitat (see Table IV-5). In addition, only 7.3 stream miles that support bull trout occur on HCP project lands within this AAU (see Table IV-6).

<u>Status of the Kootenai River Core Area and the Bull Lake Core Area</u>
The AAUs identified in the Final EIS/HCP (2010) for the Kootenai River below Libby Dam are divided into two segments – the middle and the lower Kootenai River AAUs. These two analysis units correspond to the USFWS's Kootenai River Core Area and the Bull Lake Core

Area described in the Draft Bull Trout Recovery Plan (USFWS 2002a). Below is a description of the baseline conditions for both core areas and, by extension, baseline conditions for bull trout for both AAUs.

Status of the Kootenai River Core Area The Kootenai River core area was isolated from the upper Kootenai River watershed by the construction of Libby Dam in 1972 and the impoundment of Lake Koocanusa. The Kootenai River Core Area stretches from Libby Dam downstream to the Canadian border with Idaho. Streamflow, discharge patterns, spill, and other parameters are in constant flux in this heavily regulated riverine system downstream of Libby Dam. Recent information, documenting upstream passage of bull trout over Kootenai Falls, which bisects this core area, led to reclassification of this as a single core area population. In addition, constraints are applied due to power needs, endangered Kootenai River white sturgeon, downstream fish concerns (salmon and steelhead flows), water quality (gas supersaturation), reservoir levels, and recreation. The combined effects lead to sometimes erratic and often unpredictable water flows. Some of these actions may benefit bull trout and some may not. An attempt is made to balance these concerns, but impacts of flow regulation on bull trout in this section of the Kootenai River are not well documented.

There are six identified local populations, all of which have received some degree of monitoring through redd counts, with continuous counts extending as far back as 1990 in some streams (MFWP 2004a). Available data indicate that numbers of adult bull trout in this core area may have expanded during the late 1990's, with total redd counts approaching 250. This indicates the adult population may have exceeded 1,000 individuals by 1999. However, between 2002-2004 only about 150 redds were located in the six spawning streams annually. In 2005, 2006, 2007, and 2008 index reaches of the six spawning streams that are monitored in Montana (Quartz, O'Brien, Pipe, Bear (Libby), West Fisher and Callahan Creeks) contained an annual total of 209, 173, 142, and 164 bull trout redds, respectively (MFWP, unpublished). Limited redd counts are also conducted in Boulder Creek in Idaho. The total redd counts for years 2005-2008 appear to be lower than peaks in the late 1990's (approaching 250) and consistent with or slightly higher than values in 2002-2004 (see above). The total redd count may suggest an abundance of around 1,000 adult bull trout, though substantial hybridization with brook trout may be occurring (see below) and the number of adults need to be evaluated with some caution.

MFWP has collected annual data on juvenile bull trout abundance estimates in this core area using electrofishing multiple-pass estimate techniques in sections of the same six index streams (MFWP, unpublished). They have also conducted twice annual mark-recapture estimates for a 2.86 mile section of the Kootenai River in the vicinity of the Libby Dam tailrace downstream to the Fisher River confluence during April since 2004, and also August-September in some years. Bull trout are known to concentrate in this location (likely in response to abundant food source from entrained kokanee). The estimate of total numbers of bull trout, most of which are adult sized fish (16 inches and longer), typically has ranged from about 347 (2007) to 1,079 (2005) fish, or 99-308 per mile (Dunnigan et al. 2008). At least a portion of these fish are believed to be bull trout from the upstream core area that have been entrained through Libby Dam.

There is now up to 14 years of accumulated redd count data. These data generally reflect a population trend that seems to be exhibiting some level of decline in the most recent 5-year period. The level of bull trout abundance is lower than historical natural levels in this core area, which is largely due to dramatic ecological changes and the decoupling of this core area from the upper watershed as a result of Libby Dam construction. Interpretation of the population trend is clouded by the immigration of fish from the upstream core area and high prevalence of brook trout and brook trout hybrids in some local populations.

Genetic analysis of bull trout sampled immediately downstream of Libby dam in 2004-2007 has also been conducted in an attempt to determine how significant the entrainment issue is through Libby Dam. Of 62 unknown adults from the sample that were genetically assigned, exactly half (31 fish) assigned to most likely population origin upstream of the dam and the other half to likely population origin downstream of the dam (Ardren et al. 2007). The majority of the 31 fish assigned upstream (17 of 31) were assigned to the strongest known population, the Wigwam River. Of the 31 unknown adults assigned to populations downstream of Libby Dam, 25 (81 percent) were assigned to populations upstream of Kootenai Falls (Libby, Bear, Quartz, West Fisher Creeks) and the other 6 were assigned to O'Brien Creek, downstream of the falls. These data have been extremely useful in providing insight into bull trout movement patterns, indicating first that the bull trout population in the Kootenai River is being supplemented by entrainment of fish through Libby Dam (with unknown consequences to genetics), and secondly that Kootenai Falls is probably a partial, but incomplete barrier to upstream passage of bull trout.

In order to better evaluate the potential threat of hybridization between bull trout and brook trout in sample sites identified in potential problem areas, MFWP collected random samples of 50 juvenile *Salvelinus spp* from three Kootenai River core area streams, Pipe Creek, West Fisher Creek, and O'Brien Creek (USFWS 2009). Using PCR techniques at seven diagnostic loci, the sample results indicated proportions that were bull trout, brook trout, and hybrids. Results for a randomly collected 50 fish sample from Pipe Creek found 48 brook trout and two F1 X BR hybrids (backcrosses), with no pure bull trout (Leary et al. 2008). Results for a 49 fish sample in West Fisher Creek found 36 bull trout, 12 brook trout, and 1 F1 X BR hybrid (backcross). Results for a 49 fish sample in O'Brien Creek found 2 bull trout, 24 brook trout, 17 BU X BR, and six backcrosses (2 F1 X BU and 4 F1 X BR). Further analysis indicated that all the backcross fish with brook trout conformed to expected Mendelian proportions and were likely first generation backcrosses. While additional interpretation is needed, these results are at once very concerning. O'Brien Creek, West Fisher Creek, and Pipe Creek individually accounted for 44 percent, 9 percent, and 2 percent of all bull trout redds counted in the Kootenai River core area in 2005-2007.

Collectively, this means 55 percent of the redds that were considered bull trout redds in 2005-2007 were in drainages where juvenile bull trout were found in very low numbers in the spawning and rearing habitat. One possible interpretation is that the bull trout redd counts in these drainages are misleadingly high, as they may contain a very high proportion of brook trout and hybrids. A second possible interpretation is that bull trout recruitment from these three local populations (half of the total of six) is in steep decline and may be a precursor of a major constriction of the distribution of bull trout in the Kootenai River core area.

Of 31 bull trout sampled from the Kootenai River below Libby Dam that were genetically assigned downstream, 3 were assigned to the population isolated in Libby Creek upstream of the falls, leaving 28 samples assigned from the interconnected Kootenai River core area. Of those 28 samples, the highest number (9 fish or 32 percent) were assigned to the West Fisher, 7 fish (25 percent) were assigned to Quartz Creek, 6 fish (21 percent) were assigned to O'Brien Creek, 4 fish (14 percent) were assigned to Bear Creek (tributary to Libby Creek downstream of the falls), and 2 fish (7 percent) were assigned to Pipe Creek. While proximity of sample location (closest to West Fisher Creek) may no doubt bias the distribution in favor of that population, Quartz and O'Brien creeks appear to be the strongholds for bull trout recruitment to the Kootenai River, as the redd counts reflect. Given hybridization concerns in O'Brien Creek, Quartz Creek is an especially important bull trout stronghold.

Because this core area has been artificially decoupled from robust upstream populations of bull trout by the presence of Libby Dam, and is now functioning as a separate stand-alone unit, some of the threats may have greater magnitude and imminence than what occurred in the system naturally. The fate of mainstem habitat in this core area is strongly tied to Libby Dam operations and despite the fairly large expanse of this core area, the fate of bull trout is tied to a few spawning and rearing streams. The operations of the dam are reviewed on a regular basis and the USFWS is routinely consulted on operational changes that are constantly needed in an attempt to balance species needs against other downstream fish concerns (salmon and steelhead), hydropower demand, flood control and storage, and other factors.

Status of streamflow, discharge patterns, spill, and other parameters are in constant flux in this heavily regulated riverine system downstream of Libby Dam. In addition, constraints are applied due to power needs, endangered Kootenai River white sturgeon, downstream fish concerns (salmon and steelhead flows), water quality (gas supersaturation), reservoir levels, and recreation. The combined effects lead to sometimes erratic and often unpredictable water flows. Some of these actions may benefit bull trout and some may not. An attempt is made to balance these concerns, but impacts of flow regulation on bull trout are not well documented.

A spill event was conducted at Libby Dam for 20 days in June and July 2002, as a result of unexpectedly high runoff exceeding inflow forecasts to the reservoir. Monitoring downstream of the dam indicated gas bubble disease (caused by nitrogen supersaturation) developed rapidly in captive fish held for observation and 80 percent of wild bull trout collected by electrofishing below the dam exhibited symptoms (Dunnigan et al. 2003). Fish with radio tags did not exhibit avoidance behavior, and investigators continue to express concern over the impacts of spill events on the resident fish population.

In recent years, the USFS has conducted a number of habitat restoration projects in Pipe Creek, West Fisher Creek, and O'Brien Creek as well as road decommissioning in Callahan Creek. In addition, a fish screen has been installed on a major irrigation diversion in Libby Creek, reducing or eliminating entrainment. The overall habitat trend condition for bull trout streams in this core area is considered to be stable to slightly improved (USFWS 2009).

As discussed, it appears brook trout hybridization is having serious impacts on approximately half of the local populations. These impacts may already be manifested in recent short-term

declines and an apparent dearth of juvenile bull trout in the spawning and rearing habitat. The greater relative stability of bull trout juvenile populations and lack of apparent influence by brook trout to date in Quartz Creek and Libby Creek indicate that the problem may be somewhat tributary-specific and should preclude a complete collapse of all spawning and rearing populations for the near future.

In 2007 and 2008 at least three lake trout were caught by anglers immediately below Libby Dam and Kootenai Falls. Two were killed; the 28 inch (711mm) and 29 inch (737 mm) specimens were both adult sized females in good condition (USFWS 2009). The source of these fish is unknown. To date, lake trout have not been documented in Lake Koocanusa, upstream of Libby Dam. There is growing concern that a lake trout population may establish in Kootenay Lake, B.C. with possible implications upstream in this core area. Brown trout have also been documented migrating downstream out of Lake Creek (from the Bull Lake core area) into the Kootenai River and are infrequently encountered in the Kootenai River downstream of Kootenai Falls, but not above (USFWS 2009). The evidence is very compelling that the introduced species threat is growing, based on 2007-2008 samples.

Despite angling regulations that make it illegal to "fish for" bull trout in this core area, there is a very popular fishery downstream of Libby Dam in the winter that targets large rainbow trout. The use of similar methods by anglers results in high by-catch of bull trout, some of which are of trophy proportions. Impacts are undocumented, but data since 2004 suggest a possible decline in the bull trout population in this area. At this time, there are multiple factors that may affect these fish (e.g., angling, dam discharge and flow patterns, entrainment through Libby Dam, etc.) that cannot be independently assessed.

Status of the Bull Lake Core Area Bull Lake and its tributaries form the headwaters of Lake Creek, a tributary of the Kootenai River. Lake Creek, which begins at Bull Lake and flows 17 miles north where it is tributary to the Kootenai River just east of the town of Troy, is a fifth-order stream with a 204 square mile watershed encompassing Iron, Keeler, Stanley, Thicket, Ross, Camp, and Dry Creek drainages, as well as several smaller tributaries to Bull Lake and Lake Creek. Bull Lake is about 4.5 miles long and 0.5 miles wide and has a surface area of about 1,200 acres. It has an average depth of 24 ft. and a maximum depth of 60 ft.

Most of the drainage is administered by the USFS (79 percent). A portion of the east side of the drainage lies in the Cabinet Mountains Wilderness Area. Some of the northwest end of the drainage (Scotchman Peaks area) and some of the area bordering the Cabinet Wilderness Area has been recommended by the Kootenai National Forest for Congressional designation as wilderness and the goal for managing this area is to retain wilderness characteristics and values (USFS 1987). Elevations range from 1,900 feet at the mouth of Lake Creek to 7,568 feet at the top of Sugarloaf Mountain in the Cabinet Mountains. The Cabinet Mountains are very steep and the southwest portion of the Lake Creek drainage is steep and rugged. The Lake Creek valley bottom is very broad and gentle, averaging 2-3 miles wide with an average gradient of 0.05 percent with a classic meandering. Lakes and wetlands are scattered throughout the valley.

Bull trout in the Bull Lake Core Area exhibit a complex and relatively unique migratory strategy. Adults from the lake migrate approximately 8 miles downstream via Lake Creek, and then up Keeler Creek where most of the known spawning and rearing occurs. There are no obstacles to this migratory pattern. Further downstream in Lake Creek (river mile 13), there is a natural falls believed to be a barrier, which is now the site of the Northern Lights, Inc. Hydroelectric facility. This barrier is located less than 1.2 miles from the Kootenai River. Consequently, bull trout that pass over the dam or are entrained in the intake and survive cannot return. The barrier is impassable to migrating bull trout migrating from the Kootenai River to return upstream in Lake Creek. The Bull Lake core area bull trout population is principally isolated from the Kootenai River population by the barrier waterfall.

The current understanding of bull trout life history in Lake Creek is that the majority of spawning adults migrate downstream from Bull Lake in the fall to spawn in Keeler Creek (USFWS 2010, MBTSG 1996d, USWS 2002). Bull trout spawn in the Keeler system in early to mid-October depending on flows. The extent of their migration up the Keeler tributaries is limited by flow. The spawning population consists of large, 5-10 pound, migratory fish that enter the system immediately prior to spawning. These fish build redds and spawn within a couple of days after entering the Keeler system and then leave. There is only a single spawning stream, Keeler Creek, for this entire core area bull trout population.

Young of the year (YOY) fish probably move into Lake Creek shortly after emergence from the gravels. Electrofishing done in 1999 did not reveal any bull trout in the Keeler system or nearby tributaries. Numerous brook trout were collected. Juvenile fish probably utilize available habitat in Lake Creek as they move upstream into Bull Lake. Bull Lake is the primary rearing habitat for this disjunct population.

Stanley Creek would appear to provide suitable habitat as its source is Spar Springs. These springs provide constant flows of cold water throughout the year. Stanley Creek has abundant large wood, side channels and prime habitat throughout its length to its confluence with Fairway Creek. From that point, Stanley Creek dries up and Fairway Creek supports fish habitat similar to that downstream. Electrofishing did not reveal any bull trout in Stanley or Fairway Creeks. The only salmonid present was brook trout; however, it is assumed that bull trout could occur in Stanley Creek because they have access from Lake Creek.

There may be a resident population of bull trout in the mainstem of Lake Creek between river mile 1.0 and 9.7; however, the presence of this particular life history in Lake Creek has not been confirmed (MFWP 2007). There have also been reports of adult bull trout entering Lake Creek from the mainstem Kootenai River to feed on spawning kokanee salmon in the lower most reach of Lake Creek near or below the Lake Creek Hydroelectric Project (USFWS 2010a).

Juvenile bull trout have been found in the bypass reach of the Lake Creek hydro project and it is assumed that they have spilled over the dam during periods of high flow in the spring. Sustained and continuous spill occurs at the spillway of the hydro project concurrently with the period during which YOY bull trout would be expected to emigrate from spawning tributaries upstream of the project (i.e., Keeler Creek). Although the primary bull trout migratory pattern in Lake Creek is in an upstream direction towards Bull Lake, it is possible that some level of stray

occurs, whereby juvenile bull trout are moved downstream towards the hydro project. It is unknown whether this straying is effective and contributes to the genetic composition of the Kootenai River population, or ineffective, resulting in a loss to both populations. In all likelihood, straying of bull trout from the upper watershed would also have occurred historically, prior to the construction of the Lake Creek dam in the early 1900s.

Redd counts in three Keeler Creek index sections have been conducted annually since 1997 (MFWP 2004a). Redd counts through 2004 have ranged from 11 to 126, but typically were in the high double digits and averaged 83. More recently, in 2005 and 2006 redd counts exceeded the historical high number for the previous eight years. In 2005 – 2007, bull trout redd counts in Keeler Creek were 170, 142, and 84 redds, respectively. There is now 11 years of accumulated redd count data. These data generally reflect a favorable population trend that is at least stable, or possibly increasing.

It appears that this bull trout core area contains several hundred adult fish (200-500). It is not known whether this core area is functioning at levels of natural abundance, but given the size of the adult habitat in Bull Lake (1,250 acres) the number of adult bull trout in the spawning population is average or above (USFWS 2009).

Ardren et al. (2007) examined genetic structure and genetic diversity of bull trout from 15 sampling locations spread throughout spawning and rearing habitat in three of the four bull trout core areas in the Kootenai River Basin in both Montana and British Columbia. Keeler Creek bull trout samples exhibited the second lowest levels of genetic diversity and heterozygosity amongst the 15 sample sites (Ardren et al. 2007), which was not unexpected and attributed to the long-term isolation of this population upstream of a barrier falls (and more recently, a hydroelectric facility). A neighbor-joining tree constructed based on chord distance showed that Keeler Creek bull trout were markedly different genetically from other populations sampled either upstream or downstream of Kootenai Falls and Libby Dam.

The USFS has conducted a number of projects in the Keeler Creek drainage involving road decommissioning and road BMPs in the recent past, with the expectation that habitat conditions for bull trout in this important drainage will gradually improve. To date, there has been limited onsite documentation of changing conditions.

Particular attention is focused on water quality in this area due to the history and future prospective activity of hard rock mining in the Lake Creek watershed. Lake Creek is listed as a Water Quality Limited Segment partially because siltation could be affecting cold-water fisheries. Water temperatures in Keeler Creek appear to be relatively cold and stable, due to large amounts of groundwater infiltration.

A commercial operation is licensed to “pick rocks” for decorative use off gravel bars in the Lake Creek drainage. To date, thousands of tons of rocks have been harvested. The USFS and Lincoln County Conservation District have attached conditions to the operation to minimize any potential habitat impacts and to date no problems have been reported.

Recently, northern pike up to approximately 8 pounds were documented caught in Bull Lake. There may be an established and expanding population and the south end of the lake appears to provide suitable spawning habitat for the species. Brown trout occur in Bull Lake and Lake Creek, but have not been found in Keeler Creek, possibly due to colder water temperatures.

The Revett Silver Troy Mine is a copper and silver mine that was in maintenance mode since April 1993 when Asarco suspended operations due to low mineral prices. However, it was re-opened in 2005 when metal prices increased. Prior to closure in 1993, the ore mill processed 8,500 tons per day working on a 24-hour, 7-day schedule. This produced 60,000 tons of concentrate annually. The mine also generated 2,930,000 tons of tailing annually. The tailing pond is located adjacent to Lake Creek and covers 365 acres. Past water quality impairment in Lake Creek is the result of the tailings impoundment; however, effects on fish have not been documented. Upon completion of the mine the tailing pond would be treated under the reclamation plan, which would address revegetation needs, water quality issues, removal of structures, plugging portals, and reclaiming unneeded roads and landings.

Resuming operations at the Troy Mine was assessed by the USFS to not cause direct effects to bull trout in the Lake Creek watershed (Fisheries Biological Assessment, Kootenai National Forest, 9/10/04). The removal of ore and transport from the mine to the mill would have no effect on bull trout. The physical transfer of concentrate has been a problem in the past as spilled concentrate was washed into the open stormwater drain system and discharged directly into Stanley Creek. This situation has since been corrected and the surface area around the transfer site stormwater drainage system has been effectively isolated to prevent future concentrate spills from reaching surface waters. Additional improvements were made in 1998 at the request of the Kootenai National Forest. Nevertheless, in 2009 a slurry pipeline transporting concentrate to the tailing pond ruptured and poured concentrate directly into Thicket Creek, a tributary to Stanley Creek, causing significant habitat degradation in the affected stream segments and sending a plume of turbidity into Lake Creek. Reclamation and cleanup is expected to restore the habitat and additional warning systems changes expected to prevent further spill events caused by pipeline breaks.

Barriers to migration are caused mainly by beavers, exacerbated by low flows in Keeler Creek. This appears to be a sporadic problem that is unlikely to impact multiple generations or occur annually. The threat caused by nonnative brook and brown trout as well as northern pike may be increasing and could prove to be greater in the future, but has not been well documented to date.

The Middle and Lower Kootenai River AAUs, which corresponds to the Kootenai River and the Bull Lake core areas combined, shows that 32,294 acres of the HCP project area occurs within both of these AAUs and that a total of 17,732 acres are considered within bull trout habitat (Table IV-5). In addition, 16.2 stream miles that support bull trout occur on HCP project lands within these two AAUs combined (see Table IV-6).

Summary of Factors, Threats, and Conservation Actions Affecting Bull Trout Environment Within the Action Area

Within the action area, the existing status of bull trout in a given core area (population abundance, distribution, and trend) is a direct reflection of the threats that are present and a measure of how those threats are arrayed both spatially and temporally on the landscape. Each core area has different geographic and spatial dimensions as well as variability in biological complexity of an individual watershed. Furthermore, bull trout are an apex predator species that tend to exist at naturally low densities. Due to their somewhat narrow habitat tolerance (i.e., cold, clean, complex, and connected) they naturally occur in a patchy fashion within the action area and are seldom distributed throughout all waters they may have access to (Rieman and McIntyre 1995, Dunham and Rieman 1998). Note that within the action area, critical habitat is designated in areas that bull trout are known to occur.

Most of the threats to bull trout that are described and characterized in the draft recovery plan (USFWS 2002), the final critical habitat rule (USFWS 2010b), the updated Bull Trout Core Area Templates (USFWS 2009), and the Bull Trout Core Area Conservation Status Assessment (USFWS 2005b) fall into the category of destruction, modification, or curtailment of habitat. Most of these impacts (e.g., dewatering, sedimentation, thermal modification, water quality degradation) are human-caused and are a consequence of specific land and water management activities. These unavoidable consequences frequently are minimized on both Federal and private lands within the action area. In some cases, management actions such as restoration of degraded habitat and improvement of fish passage are occurring, such as in the Lower Clark Fork River core area, but even though these actions are occurring for the most part it is too soon to measure significant results from those activities. The threatened destruction, modification, or curtailment of bull trout habitat, including its designated critical habitat, must be considered a significant determinant of the current status of bull trout core areas within the action area at present and likely into the foreseeable future.

Predation was considered a significant threat to bull trout in the original listing (63 FR 31647). Nonnative lake trout, brown trout, and northern pike have all been documented as predators on juvenile bull trout. The 2010 designation of bull trout critical habitat (75 FR 63898) included a new PCE (9) which identified “sufficiently low levels of occurrence” of nonnative predatory species as essential for the conservation of bull trout. In some core areas in the action area, the entire range of the core area is co-occupied by one or more of these species. In addition, illegal introductions of walleye are continuing to spread into western Montana lakes and reservoirs. The complex species interactions that lead to bull trout decline are often not well understood, but there is widespread concern that predation on bull trout by other piscivorous nonnative species may play a role. At this time, the management application of predator removal (largely by State and Tribal mangers) has been limited and broader application remains problematic due to the fact that many of the predator species are also highly sought after sport fish species and may even be promoted by some State managers. The magnitude, severity, and intensity of this threat is relatively high in specific core areas within the action area such as the Flathead, Stillwater, and Lower Clark Fork River core areas, where predation may be an increasingly important factor in bull trout declines (USFWS 2005b).

The presence of non-native species, primarily other fish in the genus *Salvelinus* (e.g., brook trout and lake trout) and other fish species have high potential to be competitors or predators (e.g., brown trout, northern pike, walleye) that threaten bull trout even in areas of otherwise secure habitat. This threat is clearly demonstrated to have increased significantly since the 1998 listing. Flathead Lake, Swan Lake, and Stillwater lakes, and have all experienced increased impacts of lake trout population expansion since the listing (Fredenberg 2002), This threat is relatively widespread and is growing (USFWS 2005a), particularly in systems that contain adfluvial bull trout populations, which is nearly half of the core areas within the action area.

Nonnatives occur in all the core areas in the action area with possibly one exception, the Upper Kootenai core area. The magnitude, severity, and intensity of this threat factor are high and pressure from nonnative species is increasing. At present, the nonnative species threat is considered the most significant determinant of the status of bull trout core areas within the action area and likely for the foreseeable future. Furthermore, nonnative species may exacerbate stresses on bull trout from habitat degradation, fragmentation, isolation, and species interactions. These activities can over time directly threaten the integrity of the essential physical or biological features related to PCE 9, which may require special management needs such as avoiding future introductions, eradicating or controlling introduced species, and managing habitat to favor bull trout over other species (75 FR 63898).

Hydrologic connectivity is essential to the conservation and recovery of bull trout within the action area (USFWS 2002, 75 FR 63898). Connectivity of habitats within core areas, and in some cases with habitats outside of core areas is critical for migratory bull trout to successfully complete their life history (Rieman and McIntyre 1993; MBTSG 1998, 75 FR 63898). It has been identified as a PCE (#2) and therefore an essential need for bull trout to complete life-history functions. Connectivity among local populations is also important to provide the opportunity for genetic exchange within core areas and for refounding after local extinction events (Rieman and McIntyre 1993; Rieman et al. 1997). Multiple local populations distributed throughout a watershed provide a mechanism for spreading risk because the simultaneous loss of all local populations is unlikely; and if well connected, provide for the resiliency of the core area through potential refounding. In some cases, connectivity among adjacent core areas is important for maintaining/restoring the original population structure that existed prior to fragmentation by artificial barriers. Connectivity among the core areas also provides for the opportunity of genetic exchange (one or two-way) to maintain diversity and allows the potential for refounding (USFWS 2005b).

The maintenance of migratory forms of bull trout and the related connectivity requirements to support these forms are important factors determining the persistence and conservation of the species within the action area. With fragmentation, loss, and/or degradation of habitats within a core area (particularly key migration corridors between foraging and overwintering habitats), the migratory form may no longer be dominant. The resident form is inherently at greater risk of loss to stochastic events than the migratory life history form (Rieman and McIntyre 1993, 1995; Rieman et al. 1997; USFWS 2002). If dominant within a core area, residency reduces the likelihood of persistence when compared to core areas supporting migratory forms.

Past forestry practices have been a significant risk to bull trout with harvest related activities (such as road construction and clearcutting) increasing sediment levels in streams and increasing peak flows which can result in the loss of in-stream woody debris and can trigger channel instability (MBTSG 1996). However, forestry practices have improved since the time of listing such that current forest road construction and timber harvest activities on Federal, state, tribal, and private timberlands have likely reduced the risk to bull trout considerably. These practices are typically incorporated into forest management HCPs on private lands in the action area (e.g., Plum Creek, Stimson) to reduce impacts to bull trout and other native fish. As indicated above, other significant risks include illegal bull trout harvest, introduced species (such as brook trout and lake trout), thermal barriers, rural residential development, mining, transportation and angling (MBTSG 1996).

While the USFWS's core area status assessment confirms that the factors identified above are still impacting bull trout, the short-term population trend (since listing) of core area populations within the action area is considered stable (USFWS 2005b). However, most of the core areas are still considered "at risk" because of very limited and/or declining numbers, range, and/or habitat, making the bull trout in the action area somewhat vulnerable unless baseline conditions improve.

In addition to consultation with other Federal agencies within the action area, particularly the USFS, the USFWS has engaged private timber companies in the habitat conservation planning (HCP) process to provide for the conservation of bull trout. The development of the Plum Creek and Stimson timber companies in HCPs on their private timber lands in the action area has resulted in land management practices that generally exceed State regulatory requirements. As is the case with consultation with Federal agencies under the Act to conserve and protect bull trout and its designated critical habitat, the development of HCPs within the action area has reduced the threats and avoided adverse impacts to bull trout core area populations.

Environmental Baseline for Designated Critical Habitat for Bull Trout

On October 18, 2010, the USFWS published notice in the Federal Register of the final rule revising and expanding the designation of critical habitat for bull trout in the coterminous United States (FR 75, 63898-64070). This final designation totals approximately 19,729 miles (31,751 kilometers) of streams (including 754 miles [1213 kilometers] of marine shoreline) and 488,252 acres (197,589 hectares) of lakes in Washington, Oregon, Nevada, Idaho and Montana. In Montana, the 2010 final designation totals approximately 3,057 miles (4,919 kilometers) of streams and 221,471 acres (89,626 hectares) of lakes. There are 3 critical habitat units located mostly (Kootenai and Clark Fork) or entirely (St. Mary) in Montana: 1) Kootenai River Basin with 324 miles of streams and 29,873 acres of lakes/reservoirs; 2) Clark Fork River Basin with 3,328 miles of streams and 295,587 acres of lakes/reservoirs; and 3) the Saint Mary River Basin with 22 miles of streams and 4,125 acres of lakes/reservoirs. (Note that downstream portions of the Clark Fork and Kootenai River Basins extend into northern Idaho, hence the above statistics are not directly additive).

Location and distribution of designated bull trout critical habitat is shown in the Final EIS/HCP (2010) Appendix D, Figure D-14. Critical habitat in the HCP project area is primarily

concentrated in three AAUs - Stillwater, Swan, and North Fork Flathead. Total critical habitat within the HCP project area is shown in Table IV-8.

Based on general baseline habitat conditions for bull trout, it is presumed PCEs in the migratory corridor are in adequate or optimal condition for all sections designated as critical habitat for bull trout. We did not attempt to analyze conditions on a segment by segment basis in Part IV of this BO as there is not adequate information available within the action area which includes only a small proportion of the amount of critical habitat totaled across all the AAUs (Table IV-8).

Table IV-8. Stream Miles of bull trout critical habitat (2010 final rule) in the HCP project area by aquatic analysis unit.

	Stream Miles		
EIS Aquatic Analysis Unit	**HCP Project Area**	**Total Critical Habitat**	**Percent in the HCP Project Area**
Bitterroot	1.3	514.5	0.3
Blackfoot	5.4	352.9	1.5
Flathead Lake	0.1	53	0.2
Lower Clark Fork	0	130.8	0
Lower Kootenai	1	62.2	1.7
Middle Clark Fork	6.4	480.2	1.3
Middle Kootenai	1.6	149.9	1.1
North Fork Flathead	15.7	205.4	7.6
Rock Creek	0.3	189.2	0.2
Stillwater	35.4	58	61.1
Swan	16.4	147.2	11.2
Upper Clark Fork	1.5	187.3	0.8
Upper Kootenai	0	38.8	0
TOTAL	85.1	3,095.90	2.8

Source: Final EIS/HCP (2010), Chapter 4, Table 4.8-17

Relationship of Bull Trout Critical Habitat PCEs to the HCP

Bull trout habitat consists of two primary use types, both of which are found in the HCP project area: spawning and rearing, and foraging, migration, and overwintering. All nine PCEs (Part IV Section B) may be found in, or be essential to, bull trout in either of these two habitat use types. Factors such as time of year, seasonal precipitation, drought conditions, and other phenomenon can influence the essential physical and biological features present at any particular location at any particular time across the species range, given the variability of habitats used by bull trout. In addition, attributes such as streamflow and substrate size and composition are influenced by underlying geology, stream order and gradient. Accordingly, establishing an upper and lower range of conditions for specific attributes in some cases may be impractical.

Within the large expanse of the HCP project area, bull trout habitat preference ranges from small headwater streams used largely for spawning and early rearing to downstream mainstem portions

of river networks used for later rearing, foraging, migration, or overwintering. There are factors specific to each river system, such as size (i.e., stream order), gradient, channel morphology, connectivity to other aquatic habitats, and habitat complexity and diversity that determine the overall functions of the nine PCE's for bull trout critical habitat and the importance of each critical habitat unit to the conservation (i.e., recovery) of bull trout.

The baseline condition for bull trout critical habitat within the HCP project area varies depending on the specific stream segment under consideration. Similar to the status of the core area (i.e., AAU), the baseline status of the critical habitat unit depends on the overall function of the PCEs for that unit. Not all critical habitat units will function equally in the HCP project area. Some may contribute more to conservation and recovery than others. Furthermore, this value may change over time and switch back and forth depending on the level of function of the PCEs at any particular point in time. In addition, the two primary critical habitat units in Montana, the Clark Fork and Kootenai, are partially dependent on habitat conditions and support from downstream areas in Idaho as well as upstream areas in British Columbia, where bull trout are not listed under the Act. The greater the collective health and function of the PCEs the greater the overall capability of the critical habitat unit to contribute to the conservation and ultimately to the recovery of the bull trout.

As described in Part IV Section B, the role of critical habitat is to support the life-history needs of the species and provide for the conservation of the species. Generally, the conservation role of bull trout critical habitat units is to support viable core area populations ((FR 75, 63898-64070). In turn, this depends on the existing functional condition of critical habitat PCEs in the specific area affected by the management activity covered under the HCP. How impactful that management activity is on the affected critical habitat PCEs could influence the conservation role of critical habitat units in support of viable core area populations.

Given that context, one can examine the status of the existing habitat conditions of the individual bull trout core area (i.e., AAU) and infer the level of function of the collective PCEs supporting that core area (i.e., AAU). A management action covered under the HCP could alter the existing function of an individual PCE or several or all of the PCEs. Depending on the effects of the management action, the alteration could improve or degrade, either temporarily or permanently, the baseline habitat conditions of the affected local population. For example, connectivity (PCE 2) could be re-established through replacement of a culvert barrier resulting in improvement of the baseline conditions by allowing bull trout more access to spawning habitat, thus improving conservation value through enhancement of the distribution and abundance of bull trout Alternatively, this same project could become a detriment to bull trout conservation if the culvert removal allowed expansion of brown trout distribution, a non-native species that is known to compete directly with bull trout (PCE 9).

<u>Assessment of Critical Habitat by Core Area</u>

The following is the assessment of critical habitat. It begins with a general assessment of the baseline conditions for each of the PCEs by core area. This is based on the status of the core area with emphasis on the major threats to the core. *Note that bull trout core areas generally correspond with or are subsets of HCP aquatic analysis units or AAUs*. Insight about the habitat

indicators based on this information can help infer whether a particular PCE is functioning appropriately or at some diminished level. It is likely that if the status of a core area indicates that it is currently supporting a population of bull trout that is at risk, it is probable that one or more PCEs are functioning at an unacceptably low level.

In an interagency review of bull trout core areas and their status compiled by the USFWS in 2008 (USFWS 2009), management activities or their outcomes that were considered to induce limiting factors that represented the greatest current threats to bull trout were assessed. For each core area those threats were described and summarized in rank order. The following core area summaries are taken, in part, from that analysis.

Bitterroot River Bull Trout Core Area – Major threats to this core area ranked in order of importance (USFWS 2009) were dewatering, proliferation of nonnative fish species, and residential development. As previously mentioned, many of the lower tributary connections to the mainstem Bitterroot River have been seasonally or permanently severed by habitat degradation, dewatering and other passage barriers, which have resulted in fragmented populations of small resident bull trout (rarely over 12 inches in length) that are isolated in the upper reaches. Brook trout are common in streams in the Bitterroot Valley and may be expanding their range and numbers in some compromised habitats (MBTSG 1995b, USFWS 2002). Some tributaries contain hybrids between these two species. The lower Bitterroot River has been determined to be a major non-point source of nutrient pollution in the Middle Clark Fork basin, primarily from low dilution rates of sewage effluent from towns and also land development along the river. There are a number of major water diversions from the Bitterroot and several of its tributaries, which claim a substantial portion of the volume of flow and contribute to the water quality problems in this core area. There are about 39 miles of stream, including the entire mainstem of the Bitterroot that are impaired or partially impaired for beneficial uses of the water. Sources of impairment are primarily from agriculture (siltation and flow modification), silviculture (siltation and habitat modification) and resource extraction. However, land development, road and highway modifications and wastewater effluent also contribute significantly to impairment (MBTSG 1995b, USFWS 2002). In addition, the already-stressed Bitterroot has suffered from decreased instream flows and relatedly, warmer water temperatures, resulting from a decadal drought pattern (perhaps a manifestation of climate change). Based on these existing threats, one can infer that PCEs 2, 5, 7, 8, and 9 are likely functioning at greatly diminished levels and that diminished PCEs 1, 3 and 4 contribute in at least portions of the core area to the primary risks to bull trout populations in this core area.

Blackfoot and Clearwater River Core Areas – Major threats to these core areas, ranked in order of importance were dewatering, water quality impairment, livestock grazing, proliferation of nonnative fish species, forestry management impacts, and angling (USFWS 2009. Previously mentioned, the combined effects of over a century of farm and ranch-related land management uses, including dewatering, grazing, and water quality impairment (elevated water temperature, sediment and runoff), are considered to have the greatest existing impacts on the Blackfoot and Clearwater River core areas. Many of these problems are being systematically corrected through watershed-based prioritization and remediation efforts, but their legacy endures. The recent population downturn of bull trout (reflected in declining redd counts since about 2002, but

perhaps now reversing) was believed related more to decreased instream flow and relatedly, warmer water temperatures, resulting from a decadal drought pattern (perhaps a manifestation of climate change). Intertwined with these impacts are the effects of introduced species, primarily brook trout and brown trout, which are notoriously able to thrive in degraded ecosystems (temperature, water quality, sediment) where native fish are less viable. The existing legacy of forest roads and forest practices are also an ongoing concern as well as issues with angling overutilization. In the Clearwater, nonnative species, especially predatory northern pike, are believed to have directly impacted the adfluvial stocks of bull trout where they share the same FMO habitat in the lakes. In addition, angler use is high on the Blackfoot River and overutilization of bull trout by anglers remains a serious concern, despite fishing regulation changes designed to address these concerns. At minimum, PCEs 2, 5, 7, 8, and 9 are likely functioning at reduced levels for bull trout in the Blackfoot, which if improved, may help the bull trout population rebound quicker from the years of drought. PCE 9 may be the most limiting at this time.

Flathead Lake Core Area and Several Other Small Core Areas – Major threats to this group of mostly interconnected core areas, of which Flathead Lake is by far the largest and most complex, ranked in order of importance were the proliferation of nonnative fish species, the legacy of past forest management, and angling. Bull trout in the Flathead Lake core area are much diminished from historic levels largely as a result of nonnative species threats, mainly lake trout but including northern pike (USFWS 2009). Intense predation and competition between lake trout, an introduced nonnative species, and bull trout in Flathead Lake is the highest ranking threat in this core area and far exceeds other impacts. It has also radiated outward into adjacent core areas in Whitefish and Stillwater Lakes and throughout smaller core areas in Glacier National Park.

Because of the high amount of HCP project area that is bull trout critical habitat in the Stillwater State Forest (35.4 miles, or nearly 40 percent of the total for the project), discussion of the bull trout status in the Upper Stillwater Lake core area deserves special consideration. Lake trout have invaded the Upper Stillwater Lake core area becoming increasingly evident over the past 15 years. The invasion probably originated from Flathead Lake and a reproducing population of lake trout has been established. Combined with the already high density of northern pike that were established by illegal introduction in the 1970's, former foraging and migratory habitat for bull trout in Upper Stillwater Lake and portions of the Stillwater River (e.g. area known as Duck Lake) has been severely compromised. Bull trout are increasingly isolated in the headwaters of this core area and, while they appear to be still thriving there based on recent redd counts and juvenile abundance surveys, the life history form that was formerly predominantly adfluvial has been increasingly relegated to fluvial/resident form. Relatedly, a century of degradation of the 55 miles of the valley portion of the Stillwater River, downstream of Upper Stillwater Lake to its eventual junction with the Flathead River some 22 miles upstream from Flathead Lake, render it mostly unsuitable for bull trout and it is increasingly unlikely that migration of bull trout from the Flathead ever occurs in the Stillwater. As such, likelihood of persistence of the headwater Stillwater core area is compromised. A similar set of circumstances occur in the adjacent Swift Creek drainage associated with the Whitefish Lake bull trout core area.

Roads exist throughout the upper Stillwater and Whitefish River drainages. There are legacy concerns associated with past land management (i.e., forestry) practices and roads, on both DNRC state lands, National Forest, and private lands. Several major runoff events have occurred in recent years that resulted in exceeding the routine BMP applications to portions of the road system, which have prompted enhanced BMP design and restoration actions. Precipitation patterns (perhaps related to changing climate) appear increasingly conducive to higher frequency of rain-on-snow conditions. The natural hydrograph (e.g., peak flows, base flows) may have been further altered due to changing runoff patterns influenced by the cumulative high levels of past timber harvest in these watersheds.

The magnitude of the lake trout threat has increased in the Flathead core areas since the early 1990's and some local populations of bull trout, particularly in the North Fork Flathead, are at precariously low levels. In the near term, some local populations of bull trout in this core area should be able to sustain a continuation of limited short-term impacts from land management activities in the watershed, especially if the current trend of long-term habitat improvement results. However, due to the above-described threats from nonnative species invasion, there is ongoing uncertainty whether all local bull trout populations will remain viable in this core area. For the most part, the habitat remains capable of supporting a much larger bull trout population than currently exists. It is clear that PCE 9 is the single greatest limiting factor to support bull trout in this AAU. Other PCEs that are habitat related such as PCE 4, 5, 6, 7 and 8 and which are influenced by forest management activities appear to be improving but probably function at a slightly lower level than optimum for bull trout in some local populations. Because angling is a popular recreational pursuit and bull trout are especially vulnerable in the migratory corridors (mainstem, North and Middle Forks of the Flathead) there is some associated concern about angling overutilization.

Lower Clark Fork Core Area from Cabinet Gorge Dam to Thompson Falls Dam – Major threats to this core area, ranked in order of importance were migration barriers, proliferation of nonnative fish species, and the legacy of past forest management (USFWS 2009). Until recently, fluvial and adfluvial fish were blocked from migrating from lake Pend Oreille and through the lower Clark Fork River (if not further upstream) by the three dams (Cabinet Gorge, Noxon Rapids, and Thompson Falls) that are positioned in sequence immediately upstream of Lake Pend Oreille. Despite these limitations, the lower Clark Fork watershed continues to support bull trout that exhibit both resident and migratory life history forms. Most of the drainages occupied by bull trout in this watershed are believed to be dependent on migratory individuals to ensure long-term bull trout persistence. Adfluvial migratory bull trout in this core area are fish originating from the lake population of Lake Pend Oreille in Idaho or within other reservoirs behind the three major dams within this core area.

Fragmentation of the migratory corridor by mainstem dams is a major factor affecting the survival and recovery of bull trout in the lower Clark Fork River drainage (MBTSG 1996b, USFWS 2002). The reservoir habitats created by the dams do support some bull trout but in general are not highly suitable (particularly Cabinet Gorge) due primarily to a lack of depth resulting in warmer than preferred water temperatures, a proliferation of nonnative species (brook, lake and brown trout as well as northern pike and walleye) and due also to the effects of

fragmentation that separates bull trout in the reservoir from returning to natal spawning and rearing habitats upstream. In addition, the dams themselves cause issues with entrainment loss and gas supersaturation. However, in the last five years this threat has been an increasing focus at the Avista dams (Noxon Rapids and Cabinet Gorge dams) through current fish passage programs and a new fish ladder at Thompson Falls dam constructed and operated by PPL Montana.

In the past decade this core area has also benefitted from extensive habitat improvement and restoration efforts in important bull trout tributaries such as the Bull River, Rock Creek, Prospect Creek, and Vermilion River, largely as a result of the Avista Fish Passage and Native Salmonid Restoration program. Habitat protection and improvements projects to bull trout spawning and rearing reaches on federal lands by the USFS have also occurred almost annually since the listing of bull trout.

Nonnative species (brook trout, brown trout, lake trout, northern pike, walleye, etc.) are increasingly impacting efforts to recover bull trout and habitat conditions in the reservoirs favor many of those populations over native species. The establishment of illegally introduced walleye in Noxon Reservoir compounds the threat from nonnative species in this core area. Monitoring indicates that the introduced walleye population in Noxon Reservoir is continuing to grow. The magnitude and imminence of threats from nonnative species is elevated in this core area.

The most important PCE affecting the needs of bull trout in this core area is PCE 2 because of the migration barriers caused by the mainstem dams in the Lower Clark Fork River. The potential to improve this function is high with the anticipated and ongoing fish passage developments at all three lower Clark Fork River dams. PCE 9 is also functioning poorly in this core area. There have been attempts to suppress brook trout and brown trout, both nonnatives, in key bull trout watersheds, but results on the effectiveness of these efforts are as yet unknown. Very little has been done to address the nonnative reservoir predator problems; consequently, PCE 9 will likely be functioning to limit bull trout conservation and recovery for some time. Forest management activities and the legacy of past activities are likely causing some diminishment of the function of PCE's 1, 4, 5, 6, 7, and 8. However, habitat restoration and road obliteration projects, mainly on Federal lands and to a lesser degree on HCP private lands, are helping to improve baseline habitat conditions for bull trout in key watersheds, which is likely to address the legacy problems and contribute to an upward trend in the function of these six PCEs in the foreseeable future.

Lower Kootenai and Bull Lake Core Areas – Major threats to both of these core areas for bull trout, ranked in order of importance were similar with proliferation of nonnative fish species, water quality impacts and degradation, and forest management in order of importance (USFWS 2009). These two core areas are isolated from the upper Kootenai River watershed by Libby Dam, constructed in 1972. Non-natural streamflow discharge patterns and water temperatures, spill and occasional gas entrainment, and other parameters are in constant flux in this heavily regulated riverine system downstream of Libby Dam. The operations of the dam to meet downstream demands can lead to sometimes erratic, unnatural, and often unpredictable water flows in the mainstem. The fate of mainstem habitat in this core area is strongly tied to Libby

Dam operations and despite the fairly large expanse of this core area, bull trout are tied to only a few accessible spawning and rearing streams. Some of these important streams are in heavily managed watersheds and have a high prevalence of brook trout and brook trout/bull trout hybrids. Brook trout hybridization may be having serious impacts on approximately half of the local populations, though the problem may be somewhat tributary-specific. The presence of Libby Dam precludes bull trout in the lower Kootenai from accessing high quality spawning and rearing habitat upstream in Canada, thereby placing inordinate importance on the currently functioning local populations. In recent years, the USFS has conducted a number of habitat restoration projects as well as road decommissioning in several of these key bull trout watersheds. The overall habitat trend condition for bull trout streams in these core areas is considered to be stable to slightly improved (USFWS 2009).

PCEs 2, 7 and to a lesser extent PCE 8 are functioning at a low level due to the existence and operations of Libby Dam. It is apparent that PCE 9 is also functioning poorly and appears to be increasingly contributing to reduced abundance of bull trout. Hybridization with brook trout in the spawning and rearing bull trout streams is not being addressed and the reduced function of PCE 9 will likely continue for the foreseeable future in this core area. PCE's 4, 5, and 6, which are habitat related, are also functioning at diminished levels in some of the key tributaries and due to the long-term and extensive nature of the problems they appear limiting in terms of future bull trout conservation and recovery in this core area. In addition, these problems (dewatering, sedimentation, thermal effects) contribute to the proliferation of nonnative brook trout.

It appears brook trout hybridization is having serious impacts on approximately half of the local populations in this core area. These impacts may already be manifested in recent short-term declines and an apparent dearth of juvenile bull trout in the spawning and rearing habitat. Collectively, 55 percent of the total redds considered bull trout redds in 2005-2007 were in drainages where juvenile bull trout were found in very low numbers in the spawning and rearing habitat. One possible interpretation is that the bull trout redd counts in these drainages are misleadingly high, as they may contain a very high proportion of brook trout and hybrids. A second possible interpretation is that bull trout recruitment from these three local populations (half of the total of six) is in steep decline and may be a precursor of a major constriction of the distribution of bull trout in the Kootenai River core area. For example, genetic studies have shown that Libby Creek exhibited the lowest amount of genetic diversity, as measured by allelic diversity and observed heterozygosity. In order to better evaluate the potential threat of hybridization between bull trout and brook trout, three Kootenai River core area streams, Pipe Creek, West Fisher Creek, and O'Brien Creek were studied and results showed significant presence of hybridization with brook trout.

Upper Clark Fork River Core Area – The Upper Clark Fork River core area includes the mainstem and its tributaries upstream of the Flathead River. Major threats to this core area are diverse and interrelated; ranked in order of importance the were the proliferation of nonnative fish species, forest management (both past legacy and current), dewatering, water quality degradation, and angling (USFWS 2009). Secondary threats that are also important on a more localized basis are agricultural impacts, migration barriers, livestock grazing and residential development. Extensive surveys have been conducted in this core area in recent years and bull

trout are generally scattered throughout suitable habitats, but present at very low densities. Most spawning and rearing habitat as well as the entire mainstem foraging, migrating, and overwintering habitat is occupied by brown trout and/or brook trout. The former appear to be expanding their range and numbers, especially upstream, and are suspected to predate on and replace bull trout.

Forest habitat conditions in the middle reaches of the Clark Fork, however, have trended upward, with an improved baseline (USFWS 2009) and particular emphasis on road BMPs and improvement of fish passage in tributary systems. Angling pressure and both intentional and unintentional hooking-related mortality are also significant issues in this core area. Of the 17 bull trout captured and used in a radio telemetry study on the mainstem of the Middle Clark Fork River core area, overall mortality was greater than 50 percent. Some of that mortality was conclusively attributed to illegal angling harvest (MFWP, unpublished), but there is cause to believe that the problem is more significant than documented. The situation is compounded due to the very low numbers of adult fish.

Several historic bull trout spawning and rearing tributary streams to the Middle Clark Fork River were dammed in the last century. Some of these dams block migratory fish from spawning habitat and have isolated bull trout upstream from the dams (MBTSG 1996c, USFWS 2002). A major concern exists with the mainstem Clark Fork River water temperatures that are marginally suitable for bull trout in midsummer; bull trout congregate in a limited number of thermal refugia where they become vulnerable to angling overexploitation. There are a number of major water diversions from the Clark Fork and several tributaries, which claim a substantial portion of the volume of flow and contribute to the water quality problems in this core area. Instream flow depletion and relatedly, warmer water temperatures, have been aggravated in recent times by a decadal drought pattern (perhaps a manifestation of climate change). At the same time, private residential development has increased, much of which is concentrated at the lower ends of key tributaries in sites where bull trout are known to congregate and may be increasingly vulnerable.

In the uppermost reaches of the Clark Fork, the core area is heavily fragmented into resident populations of bull trout due to a combination of thermal status (high summer water temperatures in mainstem and lower portions of tributaries) due to dewatering conditions. Elevated water temperature can adversely impact habitat suitability for bull trout and can adversely influence bull trout migration. Dewatering, warm irrigation water return, and lack of riparian vegetation contribute to elevated thermal regimes. Major factors affecting the quality of bull trout habitat are contaminated mine tailings and sediments that have been deposited extensively throughout the Clark Fork River streambed, banks, and 100-year floodplain and that are products of the mining and smelting industry since 1892 (MBTSG 1995a, USFWS 2002). The deposition of tailings and contaminated sediments in the upper Clark Fork River valley resulted in the alteration of the composition and density of riparian vegetation which has led to excessive bank erosion, high suspended sediment concentrations, and high contaminant transport/redistribution rates (USFWS 2009). Not only has this led to degraded aquatic habitat conditions, but also has reduced the resistance of the Clark Fork River to catastrophic geomorphic change during large flood events (USFWS 2002) and chronic effects of land use practices.

Milltown Dam, approximately seven miles upstream from Missoula, blocked the passage of bull trout and other aquatic species from the Middle Clark Fork River upstream to the Upper Clark Fork River since 1907. Milltown dam was removed in 2008 and now that connectivity has been restored, it's likely some bull trout could now migrate from the principal channel below the damsite to tributaries of the Upper Clark Fork River. Trap and transport as well as the Thompson Falls fishway may eventually restore full connectivity all the way to Lake Pend Oreille.

Riparian areas throughout this core area, and especially in the upper reaches, are extensively impacted by grazing and by roads associated with forestry and mining. The combined effects of over a century of farm and ranch-related land management uses, including irrigation dewatering, grazing, and water quality impairment (temperature, sediment and runoff), have created impacts to bull trout populations in the core area. Bull trout populations and habitat availability and quality have been reduced through several factors related to mining, forestry, agriculture, grazing, and residential development.

Management efforts to restore lost fisheries in the Upper Clark Fork are focusing on brown trout as the species most capable of thriving and producing a fishery in this impaired habitat. Over half the tributary spawning and rearing habitat has high population levels of brook trout and bull trout-brook trout hybrids are common. The nonnative fish interactions are likely to continue to grow.

The Upper Clark Fork River bull trout core area is considered at elevated risk, in part because most of the existing PCEs for bull trout function poorly. As described above, bull trout populations are currently heavily fragmented in this core area, with a wide variety of threats acting in synergy. PCE 9 is functioning poorly because brook trout and brown trout, which are widespread and abundant throughout much of the bull trout habitat in the Upper Clark Fork core area, are able to thrive in degraded habitats (temperature, water quality, sediment) where native fish are less viable. All the remaining PCEs 1, 2, 3, 4, 5, 6, 7, and 8 are functioning at various degrees of impairment because of the legacy effects of past smelting operations, livestock grazing, forest roads and forest practices, residential development, and irrigation withdrawals. PCEs 5 and 7 are functioning very poorly due to dewatering causing lower than normal river base flows and higher than normal stream temperature in the Upper Clark Fork River. Much of the Clark Fork mainstem and lower tributary reaches are thermally unsuitable for bull trout in midsummer, causing the few fish that remain to cluster near the confluences of coldwater tributaries where they become susceptible to overfishing and other factors. PCE 8 is also functioning at a very low level due to water pollution resulting from mining contamination of the aquatic environment.

Existing watershed conditions favor the existing complex of nonnative species (brook trout, brown trout, and rainbow trout). Bull trout populations will continue to be limited in terms of abundance and distribution but may thrive in stronghold local populations and should benefit from increased migratory connectivity.

Rock Creek Core Area – Major threats to this core area ranked in order of were proliferation of nonnative fish species, angling, residential development, and livestock grazing importance

(USFWS 2009). In the Rock Creek core area a rather stark change in species composition has occurred over the past decade, with major reductions of bull trout and even larger corresponding increases in brown trout. At least a portion of this transformation is attributed to the impacts of whirling disease which entered the drainage a decade or so ago and was credited with dramatic reduction of the rainbow trout population, but Rock Creek has also been subjected to decreased instream flow and relatedly, warmer water temperatures, as a result of the recent decadal drought pattern (perhaps a manifestation of climate change). Brown trout redds have been steadily increasing in the upper portions of Rock Creek mainstem and brown trout are being found with increasing frequency in the lower reaches of Rock Creek tributaries. The cumulative impact of expansion of introduced brown trout and brook trout is not readily separable from issues of heavy angler use and/or angler-induced mortality of bull trout in this core area. There is concern that steady increases in angling pressure in Rock Creek may also be contributing to unsustainable levels of unintentional hooking mortality (and perhaps increased poaching) of bull trout in Rock Creek. While this does not fully account for a steep recent decline in bull trout abundance, the angler use is very high for a stream this size.

Watershed conditions in the Rock Creek drainage are generally healthier than in surrounding watersheds such as the Bitterroot, with higher instream flows, colder water temperatures, and fewer impacts from historical land and water management actions. However, a significant amount of private land has been developed along the mainstem of Rock Creek. The associated developments such as access roads, septic systems, streambank livestock grazing, and rip-rapping to protect developments are issues that have increasingly significant impacts on the stream. The Rock Creek Road is the most significant road affecting sediment levels and confining the main channel in certain locations. Road construction activities in the middle and lower sections of Rock Creek have ranged from negligible to very high. Contributing to the higher than normal sediment levels is the riparian grazing allocations scattered throughout the watershed.

PCE 9 is functioning at low levels in the Rock Creek core area as evidenced by the annual population estimates in Rock Creek that show brown trout populations are increasing and expanding their range upstream, dramatically over the past decade in the middle reaches and encroaching into the upper reaches of Rock Creek and lower reaches of its tributaries. Interrelated with increasing human use and angler pressure, nonnative fishes are likely a major factor preventing a full recovery of bull trout populations in Rock Creek and are foreseeably likely to remain problematic. Furthermore, PCEs 2, 4, 5, 6, 7, and 8 are functioning at suboptimal levels due to increased sediment levels above normal background values largely resulting from increasing residential development, existing riparian livestock grazing, and a poorly designed and located road system in the watershed. Other related factors include fish barriers caused by perched culverts, and decreased large woody debris recruitment along with increased stream temperatures due to streambank clearing, although many of those factors are being systematically remedied, at least on National Forest lands. Cumulatively, the decreased function of the aforementioned PCEs and related factors affecting the biology of bull trout in this core area (fragmentation, interactions with non-native species [competition, hybridization], sedimentation, large woody debris and water temperature) are all contributing to increased risk for the Rock Creek core area bull trout population.

Swan, Holland and Lindbergh Lake Core Areas – Major threats to these core areas are the proliferation of nonnative fish species, the legacy of past forest management, and angling. Secondary threats are residential development and water quality concerns. At the time of listing, we considered nonnative lake trout to be the single greatest threat to bull trout in this area (USFWS 2002). As with Stillwater and Whitefish Lakes (discussed above), the relatively high amount of HCP project area that is bull trout critical habitat in the Swan River State Forest (16.4 miles, or nearly 18 percent of the total for the project) deserves special consideration.

In 1998, lake trout were first detected in Swan Lake (likely originating from either illegal stocking or accidental transport over Bigfork Dam some years earlier) and by 2010 exponential growth of the population had led to circumstances where experimental suppression efforts were able to remove over 10,000 juvenile lake trout and over 400 mature adults from the population in a single fall netting season. Lake trout expansion over the past decade had not previously resulted in detectable impacts to the bull trout population, though 2010 bull trout redd counts for the ten Swan River local populations annually counted were 378, continuing a four-year decline and approaching the lows on record going back to the 1980s.

The Swan Lake bull trout fishery has remained open to angler harvest, despite the concerns about impacts of lake trout in the drainage, largely because until very recently spawning runs have remained stable and there was no evidence anglers were impacting the number of spawners. However, recent developments may force a reevaluation of angling regulations and could result in future restrictions on the recreational bull trout fishery. If the lake trout population can be dramatically reduced in the near term through the ongoing experimental program of suppression, the threat may be moderated and would probably not lead to irreversible declines in the bull trout population. But there remains considerable uncertainty about the efficacy and costs of a long-term lake trout suppression program. Compounding this is the recent discovery of lake trout in at least one of the upstream core areas (Lindbergh Lake).

Forest management practices on public and private lands in the Swan River drainage has been a historical and ongoing concern. Strong emphasis has been placed on protection of habitat in important spawning and rearing streams on both public and private lands. Through recent conservation planning and agreements on private lands to protect riparian areas related to timber harvest, expanded protection along bull trout streams in this core area is occurring. Nevertheless, some of those gains could be offset by increasing pace of development on private lands in the valley bottom. The large amount and wide distribution of groundwater-fed spawning and rearing streams in the Swan River drainage is considered relatively unique and apparently has contributed to the relatively robust status of bull trout in this AAU to date, despite intensive forestry management activities.

PCE 9 has functioned at relatively low levels in this AAU for some time due to the widespread abundance of brook trout. That circumstance is now exacerbated due to the recent lake trout expansion in this core area and is far and way the greatest threat to bull trout persistence at this time. Unless a successful suppression effort is sustained on lake trout there is considerable uncertainty whether bull trout will remain relatively robust in these core areas in the near term and whether the populations will even persist in the future. PCEs 6, 7, and 8 are likely also

functioning below optimum levels, mostly due to legacy roads and other past forest management practices. However, current declines in bull trout populations are largely being influenced by the ecological changes in Swan Lake and not local habitat conditions.

Lake Koocanusa Core Area – Threats to this core area are currently not considered significant, but ranked in order of importance were forest management, angling, and entrainment (USFWS 2009). Other risk factors include those from mining, and water quality impairment. Lake Koocanusa was artificially created by the construction of Libby Dam in 1972, which impounds the lake and extends 90 miles, the upper half of which is in Canada at full pool. Libby Dam expanded greatly the foraging, migrating, and overwintering habitat for bull trout in the pool of Lake Koocanusa. Combined with the accidental introduction and proliferation of an abundant and high quality forage species (kokanee salmon) and associated high quality upstream spawning and rearing habitat (mostly in Canada) this core area has created an unusually productive, albeit mostly artificial environment allowing this bull trout core area population to expand to many times its previous natural capacity in the riverine environment. The Lake Koocanusa core area contains one of the strongest populations of bull trout in the conterminous U.S. Most of the spawning and rearing habitat is upstream in British Columbia, Canada, though Grave Creek (a U.S. tributary to Lake Koocanusa) and the headwaters of the Wigwam River drainage are on this side of the international border.

Bull trout are not listed under either the Act or Species At Risk Act (SARA; the Canadian equivalent of Act) but because of the high profile this core area population of bull trout has attained, the B.C. government has studied the important spawning tributaries (particularly the Wigwam River, White River, and Skookumchuck Creek) and has undertaken further protective restrictions on angling and habitat impacts. On the U.S. side, Act restrictions do pertain and the Grave Creek drainage has been the focus of several major land and water restoration projects. One such project was reconstruction and screening of the Glen Lake Irrigation District diversion on Grave Creek and several miles of associated channel and floodplain restoration work. The system is functional but operational issues remain problematic.

Forest management impacts to this core area are largely from forest roads that have been constructed in the headwater drainages in British Columbia. Also, headwater bull trout streams in this region are typically groundwater-influenced. Climate change could have a larger impact in this region than elsewhere, due to lower elevations and precipitation patterns that appear conducive to higher frequency of rain-on-snow conditions. There is now up to 18 years of accumulated redd count data for individual local populations in this core area. These data generally reflect a robust population that may have reached or exceeded carrying capacity, with some decline in the most recent 5-year period. As a result of the robust population status, an experimental bull trout sport fishery in the reservoir was permitted by the USFWS beginning in 2004. The recreational bull trout fishery on Lake Koocanusa has continued and is being closely monitored (Hensler and Benson 2009).

This core area exhibits perhaps the strongest record of an increasing trend across the entire U.S. range of the species. The adult bull trout population in this core area is likely over 10,000 fish. Consequently, the PCEs in this core area appear to be functioning appropriately for the most

part, albeit somewhat artificially in relation to the reservoir. Risk to the function of the PCEs appears minimal. It appears that this core area has achieved or exceeded full recovery status.

Summary of PCEs Related to Baseline by AAU for Bull Trout Critical Habitat

Table IV-9 provides a summary of the primary PCE limitations by AAUs (directly translatable to bull trout core areas) as described in the HCP.

Table IV-9. Primary Constituent Elements (PCEs) most at risk for bull trout in the HCP Project Area by Aquatic Analysis Unit (AAU).

	Primary Constituent Elements (PCE's)[1]								
EIS Aquatic Analysis Unit	1	2	3	4	5	6	7	8	9
Bitterroot	*	**	*	*	**		**	**	**
Blackfoot		*			*		*	*	**
Flathead				*	*	*	*	*	**
Lower Clark Fork	*	**		*	*	*	*	*	**
Lower Kootenai		**		*	*	*	**	*	**
Upper Clark Fork	**	**	**	**	**	**	**	**	**
Rock Creek		*		*	*	*	*	*	**
Swan						*	*	*	**
Upper Kootenai		*				*	*	*	

[1]Double asterisk indicates dominant impact and single asterisk indicates secondary level of impact.

Critical habitat in the HCP project area is primarily concentrated in three AAUs - Stillwater, Swan, and North Fork Flathead. The total amount of stream miles of critical habitat in these AAUs is shown in Table IV-8. The proportion of stream miles that are critical habitat in the HCP project area for each of these AAUs is 61.6 percent, 11.2 percent, and 7.6 percent respectively, for the Stillwater, Swan, and North Fork Flathead. These are the AAUs where the DNRC HCP would have the most influence on critical habitat and the PCEs that support it. On average the remaining AAUs contain less than 1 percent (~0.7 percent) critical habitat in the HCP project area.

Table IV-9 displays the PCEs most at risk in each of the AAUs. Noteworthy, is that PCE 9 is at most risk across all the AAUs, but one. In the Bitterroot AAU, PCEs 2, 5, 6, and 7, which are habitat-related PCEs, are also at high risk of impacts; however, only about 1 stream mile in total of critical habitat occurs within the HCP project area. All the PCEs in the Upper and Middle Clark Fork AAUs are subject to high risk of impacts under existing conditions. Again, a total of a little over 1 mile of critical habitat combined occurs in these AAUs within the HCP project area. With the exception of the North Fork Flathead, Stillwater, and Swan AAUs the PCEs at-risk in the remainder of the AAUs is associated with a very small amount of critical habitat. Therefore, this evaluation of affected PCEs in this part of the BO (Part IV) will focus on the 3 AAUs where the majority of critical habitat occurs within the HCP project area.

Environmental Baseline for Westslope Cutthroat Trout

Similar to bull trout, but at a different scale, the baseline discussions below are grouped on the basis of major river subbasins of the 4th-field HUCs in the USGS system for classifying watersheds. This is because most of the existing baseline information for WCT in Montana was analyzed with this approach. More detailed information is provided at the finer scale of the 6th - field HUC watershed level (subwatersheds) if the information is available and adds to the characterization of baseline habitat and/or population conditions.

Status of Westslope Cutthroat Trout in the Action Area

Within their primary range in western Montana and within the HCP project area, WCT occur in the Kootenai River, Flathead River, Clark Fork River, and Upper Missouri River subbasins (Behnke 1992). WCT are widely distributed throughout many of the river drainages in these major subbasins (mainstems and tributaries). WCT are a native trout that provides much of the recreational fishery throughout the HCP Project Area. The status of WCT in western Montana is described in Section B above.

The fourteen AAUs identified in the Final EIS/HCP (2010) include either major tributaries or major segments of the mainstem river within these four subbasins: 1) Clark Fork River Subbasin – Bitterroot River, Blackfoot River, Lower Clark Fork, Middle Clark Fork, Upper Clark Fork, and Rock Creek; 2) Kootenai River Subbasin - Upper Kootenai, Middle Kootenai, and Lower Kootenai: 3) Flathead River Subbasin – Flathead Lake, North Fork Flathead, Stillwater, and Swan: and 4) Upper Missouri River Subbasin. The discussion for each subbasin is based on the most recent information and is cited. However, a note about the information available for the Kootenai and Flathead

assessments that resulted in separate plans for 58 tributary watersheds or mainstem segments of the Columbia River. An individual subbasin plan for the Kootenai River system and for the Flathead River system in Montana was completed in 2004. The NPPC Kootenai and Flathead rivers subbasin assessments examined the status of WCT, among other fish species. The assessments included a detailed aquatic evaluation of each 6th-field HUC in the subbasin and a ranking of the restoration potential and protection value of each 6th field HUC. These assessments are the most recent and comprehensive information available on a landscape scale and form the basis for describing the environmental baseline for the WCT in the Kootenai and Flathead River subbasins. Part IV of this BO does not repeat all the detailed information about WCT from those assessments, but instead provides a summarization and incorporates by reference from the subbasin plans (KTOI and MFWP 2004 and CSKT and MFWP 2004).

The status of WCT in the four river subbasins in the action area is described below.

Status of Westslope Cutthroat Trout in the Clark Fork River Subbasin

Lee et al. (1997b) classified 436 of 541 (81 percent) subwatersheds in the Clark Fork River basin as depressed, and acknowledge few strong populations are left in Montana. Principal tributaries of the Clark Fork River are Flint-Rock Creek, and the upper Clark Fork, Blackfoot, middle Clark Fork, Bitterroot, and lower Clark Fork rivers. Land ownership in the drainage is 55.8 percent

USFS, 1.7 percent BLM, < 0.1 percent tribal, 4.7 percent State of Montana, and 37.8 percent private and other public entities (Appendix Table 4; MFWP, in litt. 1998 as cited in USFWS 1999).

WCT are believed to have historically occupied all of the streams and lakes to which they had access in the Clark Fork River sub-basin (MFWP, in litt. 1998 as cited in USFWS 1999). In the drainage, however, only 5,847 miles (35.1 percent) of the estimated 16,667 miles of historic stream habitat have been surveyed for WCT. Thus, WCT could occupy additional stream miles that have not yet been surveyed. Among those 5,847 surveyed stream miles, WCT have been documented in 5,166 miles of stream (88.4 percent). Those WCT stocks have various degrees of genetic purity or have not yet been tested genetically (USDI 1999). Of the total linear amount of stream habitat known to be occupied by WCT in the Clark Fork River sub-basin, 57.5 percent lies on lands administered by federal agencies (USDI 1999).

WCT stocks are strong or predicted strong in 79 HUCs, depressed or predicted depressed in 353 HUCs, and absent or predicted absent in the remaining 42 HUCs that collectively constitute the Clark Fork River sub-basin (USFWS 1999b). Among the 5,847 miles of stream surveyed, stocks of genetically pure WCT occupy 1,330 miles (316 stream reaches); stocks that are 99.9 to 90.0 percent pure occupy 227 miles; and stocks that are < 90.0 percent pure occupy 208 miles (MFWP, in litt. 1998 as cited in USFWS 1999). WCT stocks inhabiting 3,401 miles of stream (975 stream reaches) remain untested genetically (USFWS 1999b). Among the 5,166 miles of stream occupied by WCT stocks, 1,099 of the stream miles have stocks that are genetically pure and considered abundant; genetically pure stocks in the remaining 231 miles of stream are considered rare. Of the 557 stream miles with WCT stocks that have genetic purity of 90 percent, fish in 1,262 miles of stream are considered abundant.

In the upper Clark Fork River sub-basin, stocks of genetically pure WCT occupy 224 miles (39 stream reaches); stocks that are 99.9 to 90.0 percent pure occupy 26 miles; stocks that are < 90.0 percent pure occupy 39 miles; and stocks in 290 miles of stream (84 stream reaches) remain untested genetically (Appendix Table 3; MFWP, in litt. 1998 as cited in USFWS 1999b). Among the total 579 miles of stream occupied by WCT stocks, 542 of the stream miles have stocks that are considered abundant; stocks in the remaining 37 miles of stream are considered rare. Of the total linear amount of stream habitat known to be occupied by WCT in the upper Clark Fork River sub-basin, 28.8 percent lies on lands administered by federal agencies (Appendix Table 4; MFWP, in litt. 1998 as cited in USFWS 1999b). WCT stocks are strong or predicted strong in 10 HUCs; depressed or predicted depressed in 39 HUCs; and absent or predicted absent in the remaining 18 HUCs that collectively constitute the upper Clark Fork River sub-basin (USFWS 1999b).

In the Flint-Rock Creek sub-basin stocks of genetically pure WCT occupy 144 miles (23 stream reaches); stocks that are 99.9 to 90.0 percent pure occupy 30 miles; stocks that are < 90.0 percent pure occupy 6 miles; and stocks in 449 miles of stream (125 stream reaches) remain untested genetically (Appendix Table 3; MFWP, in litt. 1998 as cited in USFWS 1999). Among the total 629 miles of stream occupied by WCT stocks, 489 of the stream miles have stocks that are considered abundant; stocks in the remaining 140 miles of stream are considered rare. Of the

total linear amount of stream habitat known to be occupied by WCT in the Flint-Rock Creek sub-basin, 57.9 percent lies on lands administered by federal agencies (Appendix Table 4; MFWP, in litt. 1998 as cited in USFWS 1999b). WCT stocks are strong or predicted strong in 28 HUCs; depressed or predicted depressed in 13 HUCs; and absent or predicted absent in the remaining 8 HUCs that collectively constitute the Flint-Rock Creek River sub-basin (USFWS 1999b).

In the Blackfoot River sub-basin, stocks of genetically pure WCT occupy 255 miles (60 stream reaches); stocks that are 99.9 to 90.0 percent pure occupy 59 miles; stocks that are <90.0 percent pure occupy 39 miles; and stocks in 666 miles of stream (170 stream reaches) remain untested genetically (Appendix Table 3; MFWP, in litt. 1998 as cited in USFWS 1999b). Among the total 1,019 miles of stream occupied by WCT stocks, 638 of the stream miles have stocks that are considered abundant; stocks in the remaining 381 miles of stream are considered rare. Of the total linear amount of stream habitat known to be occupied by WCT in the Blackfoot River sub-basin, 41.1 percent lies on lands administered by federal agencies (Appendix Table 4; MFWP, in litt. 1998 as cited in USFWS 1999b). WCT stocks are strong or predicted strong in five HUCs; depressed or predicted depressed in 77 HUCs; and absent or predicted absent in the remaining 10 HUCs that collectively constitute the Blackfoot River sub-basin (USFWS 1999b).

The middle Clark Fork River sub-basin, stocks of genetically pure WCT occupy 105 miles (21 stream reaches); stocks that are 99.9 to 90.0 percent pure occupy 28 miles; stocks that are < 90.0 percent pure occupy 32 miles; and stocks in 702 miles of stream (201 stream reaches) remain untested genetically (Appendix Table 3; MFWP, in litt. 1998 as cited in USFWS 1999b). Among the total 867 miles of stream occupied by WCT stocks, 479 of the stream miles have stocks that are considered abundant; stocks in the remaining 388 miles of stream are considered rare. Of the total linear amount of stream habitat known to be occupied by WCT in the middle Clark Fork River sub-basin, 56.2 percent lies on lands administered by federal agencies (Appendix Table 4; MFWP, in litt. 1998 as cited in USFWS 1999b). WCT stocks are strong or predicted strong in 11 HUCs; depressed or predicted depressed in 55 HUCs; and absent or predicted absent in the remaining one HUC that collectively constitute the middle Clark Fork River sub-basin (USFWS 1999b).

The Bitterroot River sub-basin, stocks of genetically pure WCT occupy 353 miles (115 stream reaches); stocks that are 99.9 to 90.0 percent pure occupy 53 miles; stocks that are < 90.0 percent pure occupy 73 miles; and stocks in 886 miles of stream (284 stream reaches) remain untested genetically (Appendix Table 3; MFWP, in litt. 1998 as cited in USFWS 1999b). Among the total 1,365 miles of stream occupied by WCT stocks, 1,109 of the stream miles have stocks that are considered abundant; stocks in the remaining 256 miles of stream are considered rare. Of the total linear amount of stream habitat known to be occupied by WCT in the Bitterroot River sub-basin, 67.7 percent lies on lands administered by federal agencies (Appendix Table 4; MFWP, in litt. 1998 as cited in USFWS 1999b). WCT stocks are strong or predicted strong in 10 HUCs; depressed or predicted depressed in 86 HUCs; and absent or predicted absent in the remaining two HUCs that collectively constitute the Bitterroot River sub-basin (USFWS 1999b).

The lower Clark Fork River sub-basin, stocks of genetically pure WCT occupy 249 miles (58 stream reaches); stocks that are 99.9 to 90.0 percent pure occupy 31 miles; stocks that are < 90.0

percent pure occupy 19 miles; and stocks in 408 miles of stream (111 stream reaches) remain untested genetically (Appendix Table 3; MFWP, in litt. 1998 as cited in USFWS 1999b). Among the total 707 miles of stream occupied by WCT stocks, 474 of the stream miles have stocks that are considered abundant; stocks in the remaining 233 miles of stream are considered rare. Of the total linear amount of stream habitat known to be occupied by WCT in the lower Clark Fork River sub-basin, 56.3 percent lies on lands administered by federal agencies (Appendix Table 4; MFWP, in litt. 1998 as cited in USFWS 1999b). WCT stocks are strong or predicted strong in 15 HUCs; depressed or predicted depressed in 83 HUCs; and absent or predicted absent in the remaining three HUCs that collectively constitute the lower Clark Fork River sub-basin (USFWS 1999b).

In summary, WCT in the Clark Fork River sub-basin occur in about 1,291 tributaries or stream reaches that collectively encompass 5,166 linear miles of stream habitat, distributed among 6 watersheds (USFWS 1999b). Of the total linear amount of stream habitat known to be occupied by WCT in the drainage, 57.5 percent lies on lands administered by federal agencies (USFWS 1999b). The DNRC HCP project area supports 181.4 stream miles of WCT habitat in the Clark Fork River subbasin (derived from Table IV-6 above).

Status of Westslope Cutthroat Trout in the Upper Missouri Subbasin

The Upper Missouri subbasin (Upper Missouri AAU) does not occur within the range of bull trout or RBT; but does occur within the range of WCT; consequently, WCT is the only HCP fish species present in this subbasin. Therefore, the description of baseline conditions for this subbasin will rely on the latest information from state and federal WCT status assessments for this area (Tews et al. 2000, USFWS 1999b, Shepard at al. 2003, Leary et. al 1998). Also, recent information was gleaned where appropriate from other literature sources regarding the status of WCT.

The historic range of WCT occurs both east and west of the Continental Divide in the Missouri, Saskatchewan, and Columbia River basins. However, it is believed periodic connections between headwater streams allowed WCT from the Columbia River basin to enter the Missouri and Saskatchewan River basins until soon after the last glacial period (i.e. the Pleistocene Epoch), 7,000 to 10,000 years ago (Behnke 1979, 1992; Trotter 1987). As the post-glacial waters receded, however, stocks of WCT east of the Continental Divide became isolated from those in the Columbia River basin (USFWS 1999b).

WCT have probably been reproductively isolated among the Missouri and upper Columbia River basins, the disjunct drainages in Washington and Oregon, and the Saskatchewan River basin for thousands of years. Shepard et al. (2003) estimated that about 17,500 miles of habitat within the Missouri River basin of Montana were historically occupied. Subsequent genetic testing performed on WCT that included more numerous samples from the Missouri River basin revealed little genetic variation between WCT from the Missouri and Columbia basins (Leary et. al 1998). However, the data also indicated that little gene flow has occurred among westslope stocks and that, even over short geographic distances, WCT stocks can differ genetically. Thus, Leary et al. (1998) recommended that conservation programs for WCT focus on ensuring the continued existence of all remaining genetically pure WCT stocks.

WCT are believed to have historically occupied all of the streams and lakes to which they had access in the Missouri River headwaters drainage (MFWP, *in litt.* 1998). WCT were likely the only trout in streams and rivers in south-central Montana when first described by Lewis and Clark in 1805. It is estimated that only 6,290 miles (34 percent) of the estimated 18,634 miles of historic stream habitat have been surveyed for WCT. Thus, WCT could occupy additional stream miles that have not yet been surveyed. Among those 6,290 surveyed stream miles, WCT have been documented in 2,279 miles of stream (36 percent) (USFWS 1999b).

North-Central Montana - The North-Central Montana region includes the Missouri River and most of its tributaries from Canyon Ferry Dam downstream to the Musselshell River. Major tributaries include the Dearborn, Smith, Sun, Belt, Teton, Two Medicine, Judith and Musselshell drainages. The WCT stocks in north-central Montana that have been surveyed have various degrees of genetic purity or have not yet been tested genetically. Pure WCT are now confined to about 5 percent of their historical range and are found in only about 200 miles of small headwater streams. Stable populations of pure WCT probably exist in only 1 percent of the original habitat in this area. There are only about 72 known genetically pure WCT populations remaining in north-central Montana. Most of these populations are found in isolated stream reaches less than 5 miles long on federal lands and have a high risk of extirpation due to their small habitat and population size. An additional 168 miles (4 percent) is occupied by 39 populations of slightly hybridized WCT (Tews et al. 2000).

WCT appear to have experienced an abrupt and drastic decline early in the twentieth century. This decline coincided with the stocking of non-native rainbow trout, brook trout and brown trout. By the 1950's, these non-native salmonids had colonized most of the cold-water fish habitat in the Missouri drainage and WCT were confined to a few headwater populations. Most of these streams no longer contain native WCT because of competition with brook trout and hybridization with rainbow trout.

The decline of the WCT is continuing. For example, Hanzel (1959) found exclusively cutthroat trout in Rock Creek (Smith drainage) and West Fork of Lost Fork Judith where only remnant (if any) WCT populations remain in 2000. WCT have nearly disappeared from Deadman Creek (Smith River) within the past ten years (Tews et al. 2000). Most WCT populations in north-central Montana are in Lewis and Clark National Forest streams but the Helena National Forest has about 7 populations located in the Upper Missouri and the Big Belt Mountains. Some populations on federal land extend downstream to private land. Only about five populations are known to be located primarily on private land while one population is located on BLM land and two populations are in streams on State of Montana Wildlife Management Areas (Tews et al. 2000).

Southwest Montana – Shepard et al. (1997) modeled viability of 144 existing WCT populations in the Upper Missouri River and found that 71 percent had a very high risk of extinction within the next 100 years. The model found grazing and presence of non-native trout had the most influence on WCT populations. Nearly all of these streams now have extensive brook trout populations. Today the nonnative trout threat comes primarily from hybridization with rainbow

trout and competition with brook trout. In addition, over-fishing and habitat loss due to mining, irrigation, grazing and logging probably also contributed to their decline (Tews et al. 2000).

MFWP is currently preparing a draft status assessment of WCT jointly with other resource agencies in southwest Montana (pers. comm., Lee Nelson, Region 3, MFWP). Although not yet finalized, the draft assessment, which will be updated and revised annually or semi-annually, provides a preliminary overview of the status of WCT populations in nine subbasins that incorporate the Missouri River headwater drainages (Beaverhead, Big Hole, Boulder, Gallatin, Jefferson, Madison, Red Rock, Ruby, and Upper Missouri). Within the nine subbasins, all identified WCT conservation populations presently occupy an estimated 944 stream miles, or about 9 percent of their historic range. However, when considering only "*genetically unaltered*" WCT populations, 430 stream miles are occupied or about 4 percent of the historic range. The assessment identified 188 individual "conservation populations" (Table IV-10). These are the WCT populations in need of protection to meet the primary management goal to ensure the "*long-term self-sustaining persistence of the susbspecies in its historical range*." Remaining WCT populations in these basins may face extinction over the next 100 years due to nonnative trout and habitat fragmentation (Shepard et al. 2007).

Table IV-10. Threat status of conservation populations (<10 percent hybridization) in the southwest Montana assessment area.

Subbasin	Status of Conservation Populations[1]				
	Total Number	Number At Risk (percent)	Number Protected (percent)	Number Secured[2] (percent)	Number with Unknown Status (percent)
Beaverhead	18				
Big Hole	45	37 (82.2%)	5 (11.1%)	-	3 (6.7 %)
Boulder	8	6 (75.0%)	1 (12.5%)	1 (12.5%)	-
Gallatin	11	8 (72.7 %)	1 (9.1%)	2 (18.2%)	-
Jefferson	4	1 (25.0%)	3 (75.0%)	-	-
Madison	14	7 (50.0%)	5 (35.7%)	2 (14.3%)	-
Red Rock	37				
Ruby	19	12 (63.2%)			7 (3.7 %)
Upper Missouri	32	18 (56.3%)	11 (34.4%)	1 (3.1%)	2 (6.3 %)
Total	**188**				

1. Status information based on quantitative information and qualitative judgment from biologists familiar with the population.
2. "*Secured*" populations are those where minimal management is required to maintain the population over the long-term (<100 years).

Source: Table excerpted directly from "Draft Status and Conservation Needs for Westslope Cutthroat Trout in Southwest Montana" and may be subject to change (pers. comm., Lee Nelson, Region 3, MFWP).

Each of the nine subbasins has been appraised in the draft status assessment to determine the list of individual streams that maintain WCT conservation populations and to characterize their status according to existing population and habitat parameters (e.g., abundance, distribution, threats, barriers, etc.) (pers. comm., Lee Nelson, Region 3, MFWP). The highest number of conservation populations (i.e., genetically unaltered) occurs in the Big Hole, Red Rock, and Upper Missouri subbasins and the fewest in Boulder, Gallatin, and Jefferson subbasins. The remaining populations are isolated in small headwater streams and are highly vulnerable to disappearance. Significant conservation efforts such as nonnative trout removal and habitat enhancement will be needed to "protect and secure" WCT populations in the short-term and long-term in southwest Montana (pers. comm., Lee Nelson, Region 3, MFWP).

Status of Westslope Cutthroat Trout in the Kootenai River Subbasin

Principal tributaries of the Kootenai River sub-basin are the upper Kootenai, Fisher, Yaak, lower Kootenai, and Moyie rivers. Twenty-five percent of the Kootenai River sub-basin streams are occupied by WCT and of these 13 percent were found to be pure (MFWP 1998). Land ownership in the drainage is 74.2 percent USFS, 1.5 percent State of Montana, and 24.3 percent private and other public entities (USFWS 1999b).

WCT are believed to have historically occupied all of the streams and lakes to which they had access in the Kootenai River sub-basin (MFWP, in litt. 1998 as cited in USFWS 1999). In the sub-basin, however, only 1,615 miles (39.2 percent) of the estimated 4,119 miles of historic stream habitat have been surveyed for WCT. Thus, WCT could occupy additional stream miles that have not yet been surveyed. Among those 1,615 surveyed stream miles, WCT have been documented in 1,051 miles of stream (65.1 percent). Those WCT stocks have various degrees of genetic purity or have not yet been tested genetically. Of the total linear amount of stream habitat known to be occupied by WCT in the Kootenai River sub-basin, 74.2 percent lies on lands administered by federal agencies (Appendix Table 4; MFWP, in litt. 1998 as cited in USFWS 1999b).

WCT stocks are strong or predicted strong in 15 HUCs, depressed or predicted depressed in 159 HUCs, and absent or predicted absent in the remaining 11 HUCs that collectively constitute the Kootenai River sub-basin (USFWS 1999). Among the 1,615 miles of stream surveyed, stocks of genetically pure WCT occupy 138 miles (31 stream reaches); stocks that are 99.9 to 90.0 percent pure occupy 32 miles; and stocks that are < 90.0 percent pure occupy 309 miles (MFWP, in litt. 1998 as cited in USFWS 1999b). WCT stocks inhabiting 572 miles of stream (196 stream reaches) remain untested genetically (Appendix Table 3 USFWS 1999b). Among the 1,051 miles of stream occupied by WCT stocks, 104 of the stream miles have stocks that are genetically pure and considered abundant; genetically pure stocks in the remaining 34 miles of stream are considered rare. Of the 170 stream miles with WCT stocks that have genetic purity of 90 percent, fish in 125 miles of stream are considered abundant.

In the upper Kootenai River watershed, stocks of genetically pure WCT occupy 43 miles (7 stream reaches); stocks that are 99.9 to 90.0 percent pure occupy 26 miles; stocks that are < 90.0 percent pure occupy 250 miles; and stocks in 355 miles of stream (115 stream reaches) remain untested genetically (Appendix Table 3; MFWP, in litt. 1998 as cited in USFWS 1999b).

Among the total 674 miles of stream occupied by WCT stocks, 512 of the stream miles have stocks that are considered abundant; stocks in the remaining 162 miles of stream are considered rare. Of the total linear amount of stream habitat known to be occupied by WCT in the upper Kootenai River watershed, 47.2 percent lies on lands administered by federal agencies (Appendix Table 4; MFWP, in litt. 1998 as cited in USFWS 1999b). WCT stocks are strong or predicted strong in 15 HUCs; depressed or predicted depressed in 159 HUCs; and absent or predicted absent in the remaining 18 HUCs that collectively constitute the upper Kootenai River watershed (USFWS 1999b).

In the Fisher River watershed genetically pure WCT occupy 9 miles (5 stream reaches); stocks that are 99.9 to 90.0 percent pure occupy 2 miles; stocks that are < 90.0 percent pure occupy 20 miles; and stocks in 142 miles of stream (43 stream reaches) remain untested genetically (Appendix Table 3; MFWP, in litt. 1998 as cited in USFWS 1999b). Among the total 173 miles of stream occupied by WCT stocks, 97 of the stream miles have stocks that are considered abundant; stocks in the remaining 76 miles of stream are considered rare. Of the total linear amount of stream habitat known to be occupied by WCT in the Fisher River watershed, only 18.2 percent lies on lands administered by federal agencies (Appendix Table 4; MFWP, in litt. 1998 as cited in USFWS 1999b). WCT stocks are strong or predicted strong in none of the HUCs; depressed or predicted depressed in 29 HUCs; and absent or predicted absent in the remaining four HUCs that collectively constitute the Fisher River watershed (USFWS 1999b).

In the Yaak River watershed, stocks of genetically pure WCT occupy 86 miles (18 stream reaches); stocks that are 99.9 to 90.0 percent pure occupy 4 miles; stocks that are <90.0 percent pure occupy 39 miles; and stocks in 75 miles of stream (35 stream reaches) remain untested genetically (Appendix Table 3; MFWP, in litt. 1998 as cited in USFWS 1999). Among the total 204 miles of stream occupied by WCT stocks, 125 of the stream miles have stocks that are considered abundant; stocks in the remaining 79 miles of stream are considered rare. Of the total linear amount of stream habitat known to be occupied by WCT in the Yaak River watershed, 81.1 percent lies on lands administered by federal agencies (Appendix Table 4; MFWP, in litt. 1998 as cited in USFWS 1999b). WCT stocks are strong or predicted strong in five HUCs; depressed or predicted depressed in 15 HUCs; and absent or predicted absent in the remaining two HUCs that collectively constitute the Yaak River watershed (USFWS 1999b).

In the lower Kootenai River watershed, stocks of WCT are known to occur in three stream reaches but remain untested genetically (Appendix Table 3; MFWP, in litt. 1998 as cited in USFWS 1999b). WCT stocks are strong or predicted strong in two HUCs and depressed or predicted depressed in the remaining 31 HUCs that collectively constitute the Lower Kootenai River watershed (USFWS 1999b).

The Moyie River watershed encompasses 208 square miles most of which is mostly under the jurisdiction of the USFS. WCT stocks are strong or predicted strong in two HUCs and depressed or predicted depressed in the remaining six HUCs that collectively constitute the Moyie River watershed (USFWS 1999b).

In summary, WCT in the Kootenai River sub-basin, Montana, occur in about 227 tributaries or stream reaches that collectively encompass 1,051 linear miles of stream habitat, distributed

among 5 watersheds (USFWS 1999b). Of the total linear amount of stream habitat known to be occupied by WCT in the drainage, 74.2 percent lies on lands administered by federal agencies (USFWS 1999b). The DNRC HCP project area supports 35.1 stream miles of WCT habitat in the Kootenai River subbasin (derived from Table IV-6 above).

Status of Westslope Cutthroat Trout in the Flathead River Subbasin

In the Flathead River sub-basin, 26 percent of the streams surveyed had WCT and of these populations 14 percent were considered pure. Principal tributaries of the Flathead River are the North Fork Flathead, Middle Fork Flathead, South Fork Flathead, Stillwater, Swan, and lower Flathead rivers, and Flathead Lake. Land ownership in the drainage is 44.2 percent USFS, 11.7 percent National Park Service (NPS), 11.9 percent tribal, 4.4 percent State of Montana, and 27.8 percent private and other public entities (Appendix Table 4; MFWP, in litt. 1998 as cited in USFWS 1999b).

WCT are believed to have historically occupied all of the streams and lakes to which they had access in the Flathead River sub-basin (MFWP, in litt. 1998 as cited in USFWS 1999b). In the sub-basin, however, only 3,489 miles (33.9 percent) of the estimated 10,288 miles of historic stream habitat have been surveyed for WCT. Thus, WCT could occupy additional stream miles that have not yet been surveyed. Among those 3,489 surveyed stream miles, WCT have been documented in 2,609 miles of stream (74.8 percent). Those WCT stocks have various degrees of genetic purity or have not yet been tested genetically. Of the total linear amount of stream habitat known to be occupied by WCT in the Flathead River subbasin, 55.9 percent lies on lands administered by federal agencies (Appendix Table 4; MFWP, in litt. 1998 as cited in USFWS 1999b).

WCT stocks are strong or predicted strong in 55 HUCs, depressed or predicted depressed in 220 HUCs, and absent or predicted absent in the remaining 37 HUCs that collectively constitute the Flathead River sub-basin (USFWS 1999b). Among the 3,489 miles of stream surveyed, stocks of genetically pure WCT occupy 564 miles (148 stream reaches); stocks that are 99.9 to 90.0 percent pure occupy 87 miles; and stocks that are < 90.0 percent pure occupy 54 miles (MFWP, in litt. 1998 as cited in USFWS 1999b). WCT stocks inhabiting 1,904 miles of stream (528 stream reaches) remain untested genetically (USFWS 1999b). Among the 2,609 miles of stream occupied by WCT stocks, 500 of the stream miles have stocks that are genetically pure and considered abundant; genetically pure stocks in the remaining 64 miles of stream are considered rare. Of the 651 stream miles with WCT stocks that have genetic purity of 90 percent, fish in 577 miles of stream are considered abundant (USFWS 1999b).

In the North Fork Flathead River sub-basin, stocks of genetically pure WCT occupy 67 miles (27 stream reaches); stocks that are 99.9 to 90.0 percent pure occupy 27 miles; stocks that are < 90.0 percent pure occupy 6 miles; and stocks in 344 miles of stream (84 stream reaches) remain untested genetically (Appendix Table 3; MFWP, in litt. 1998 as cited in USFWS 1999b). Among the total 444 miles of stream occupied by WCT stocks, 266 of the stream miles have stocks that are considered abundant; stocks in the remaining 178 miles of stream are considered rare. Of the total linear amount of stream habitat known to be occupied by WCT in the North

Fork Flathead River sub-basin, 81.9 percent lies on lands administered by federal agencies (Appendix Table 4; MFWP, in litt. 1998 as cited in USFWS 1999b).

WCT stocks are strong or predicted strong in four HUCs; depressed or predicted depressed in 31 HUCs; and absent or predicted absent in the remaining one HUC that collectively constitute the North Fork Flathead River sub-basin (USFWS 1999b). Within that portion of the sub-basin that lies in Glacier National Park, genetically pure WCT naturally inhabit 10 lakes that have a total surface area of 2,407 acres (Marnell 1988).

In the Middle Fork Flathead River subbasin, stocks of genetically pure WCT occupy 19 miles (4 stream reaches) and stocks in 452 miles of stream (131 stream reaches) remain untested genetically (Appendix Table 3; MFWP, in litt. 1998 as cited in USFWS 1999b). Among the total 471 miles of stream occupied by WCT stocks, 246 of the stream miles have stocks that are considered abundant; stocks in the remaining 225 miles of stream are considered rare. Of the total linear amount of stream habitat known to be occupied by WCT in the Middle Fork Flathead River sub-basin, 94.1 percent lies on lands administered by federal agencies (Appendix Table 4; MFWP, in litt. 1998 as cited in USFWS 1999b). WCT stocks are depressed or predicted depressed in 41 HUCs and absent or predicted absent in the remaining one HUC that collectively constitute the Middle Fork Flathead River sub-basin (USFWS 1999b). Within that portion of the watershed that lies in Glacier National Park, genetically pure WCT naturally inhabit 10 lakes that have a total surface area of 2,940 acres (Marnell 1988).

In the Flathead Lake watershed, stocks of genetically pure WCT occupy 66 miles (9 stream reaches); stocks that are < 90.0 percent pure occupy 2 miles; and stocks in 69 miles of stream (10 stream reaches) remain untested genetically (Appendix Table 3; MFWP, in litt. 1998 as cited in USFWS 1999b). Among the total 137 miles of stream occupied by WCT stocks, 70 of the stream miles have stocks that are considered abundant; stocks in the remaining 67 miles of stream are considered rare. Of the total linear amount of stream habitat known to be occupied by WCT in the Flathead Lake sub-basin, 7.2 percent lies on lands administered by federal agencies (Appendix Table 4; MFWP, in litt. 1998 as cited in USFWS 1999b). WCT stocks are depressed or predicted depressed in 19 HUCs and absent or predicted absent in the remaining 14 HUCs that collectively constitute the Flathead Lake sub-basin (USFWS 1999b).

The upper two-thirds of the South Fork Flathead sub-basin lie entirely within the Bob Marshall Wilderness Area. In the watershed, stocks of genetically pure WCT occupy 289 miles (89 stream reaches); stocks that are 99.9 to 90.0 percent pure occupy 44 miles; stocks that are < 90.0 percent pure occupy 32 miles; and stocks in 244 miles of stream (29 stream reaches) remain untested genetically (Appendix Table 3; MFWP, in litt. 1998 as cited in USFWS 1999b). Among the total 609 miles of stream occupied by WCT stocks, 559 of the stream miles have stocks that are considered abundant; stocks in the remaining 50 miles of stream are considered rare. Of the total linear amount of stream habitat known to be occupied by WCT in the South Fork Flathead River sub-basin, 97.4 percent lies on lands administered by federal agencies (Appendix Table 4; MFWP, in litt. 1998 as cited in USFWS 1999b). WCT stocks are strong or predicted strong in 51 HUCs and depressed or predicted depressed in the remaining 22 HUCs that collectively constitute the South Fork Flathead River sub-basin (USFWS 1999b).

In the Stillwater sub-basin, stocks of genetically pure WCT occupy 12 miles (3 stream reaches); stocks that are 99.9 to 90.0 percent pure occupy 9 miles; and stocks in 425 miles of stream (132 stream reaches) remain untested genetically (Appendix Table 3; MFWP, in litt. 1998 as cited in USFWS 1999b). Among the total 446 miles of stream occupied by WCT stocks, 261 of the stream miles have stocks that are considered abundant; stocks in the remaining 185 miles of stream are considered rare. Of the total linear amount of stream habitat known to be occupied by WCT in the Stillwater River sub-basin 42.8 percent lies on lands administered by federal agencies (Appendix Table 4; MFWP, in litt. 1998 as cited in USFWS 1999b). WCT stocks are depressed or predicted depressed in 29 HUCs and absent or predicted absent in the remaining three HUCs that collectively constitute the Stillwater River sub-basin (USFWS 1999b).

In the Swan River sub-basin, stocks of genetically pure WCT occupy 23 miles (7 stream reaches); stocks that are 99.9 to 90.0 percent pure occupy 7 miles; stocks that are < 90.0 percent pure occupy 4 miles; and stocks in 271 miles of stream (96 stream reaches) remain untested genetically (Appendix Table 3; MFWP, in litt. 1998 as cited in USFWS 1999b). Among the total 305 miles of stream occupied by WCT stocks, 126 of the stream miles have stocks that are considered abundant; stocks in the remaining 179 miles of stream are considered rare. Of the total linear amount of stream habitat known to be occupied by WCT in the Swan River sub-basin, 47.1 percent lies on lands administered by federal agencies (Appendix Table 4; MFWP, in litt. 1998 as cited in USFWS 1999b). WCT stocks are depressed or predicted depressed in the 29 HUCs that constitute the Swan River sub-basin USFWS 1999b).

In the lower Flathead River sub-basin, stocks of genetically pure WCT occupy 88 miles (9 stream reaches); stocks that are < 90.0 percent pure occupy 10 miles; and stocks in 99 miles of stream (16 stream reaches) remain untested genetically (Appendix Table 3; MFWP, in litt. 1998 as cited in USFWS 1999b). Among the total 197 miles of stream occupied by WCT stocks, 185 of the stream miles have stocks that are considered abundant; stocks in the remaining 12 miles of stream are considered rare. Of the total linear amount of stream habitat known to be occupied by WCT in the lower Flathead River sub-basin, 42.9 percent lies on lands administered by federal agencies (Appendix Table 4; MFWP, in litt. 1998 as cited in USFWS 1999b). WCT stocks are depressed or predicted depressed in 49 HUCs and absent or predicted absent in the remaining 18 HUCs that collectively constitute the lower Flathead River sub-basin (USFWS 1999b).

Hybridization between rainbow trout and WCT is prevalent in the mainstem Flathead River drainage. In the mainstem segment of the river near Columbia Falls, and estimated 44 percent of the population are hybrid trout and in the Kalispell segment about 20 percent consist of hybridized trout (MFWP 1999). As a result, basin-wide genetics/telemetry survey is currently underway to quantify the degree of introgression by rainbow trout with native WCT in the tributaries and to locate spawning areas where hybridizations occurring. Early results have identified some individual tributaries (e.g. Mill and Abbot creeks) where hybrids have made extensive movements, but lack of movement from the mainstem by some fish suggest that some spawning between rainbow and hybrid trout may be occurring in the mainstem and side channels. More research is anticipated through spring of 2000 (MFWP 1999).

In summary, WCT in the Flathead River sub-basin occur in about 676 tributaries or stream reaches that collectively encompass 2,609 linear miles of stream habitat, distributed among 7 watersheds (USFWS 1999b). Of the total linear amount of stream habitat known to be occupied by WCT in the sub-basin, 55.9 percent lies on lands administered by federal agencies (USFWS 1999b). In addition, WCT are known to occur naturally in at least 20 lakes that total 5,347 surface acres in Glacier National Park. The DNRC HCP project area supports 210.8 stream miles of WCT habitat in the Flathead River subbasin (derived from Table IV-6 above).

Summary of Factors and Threats Affecting Westslope Cutthroat Trout in the Action Area

The problems facing WCT are numerous and vary by location, and many are site specific. These include, but are not limited to the following: 1) habitat loss and degradation, 2) recreational over-fishing, 3) predation, particularly by non-native introduced species, 4) disease, especially whirling disease which can affect WCT populations where they overlap with rainbow trout, 5) inadequacy of existing regulatory mechanisms, 6) introduced species which compete for food resources and hybridize with WCT, and 7) fragmentation of habitat due to human-caused physical barriers, thermal barriers, and dewatered sections of streams. Strongholds of WCT are generally in unroaded areas that have potential to maintain natural processes and function as refugia (Liknes and Graham 1988, Marnell 1988, Van Eimeren 1996).

Although there is little data available regarding trends in individual populations, it is apparent that the population of WCT as a whole has declined dramatically over the past several decades. As inferred above past and current causes of decline include habitat degradation resulting from a variety of land management practices, construction of dams and other barriers, alteration of water quality and quantity, overutilization, and introduction of normative fishes that compete with, prey on, and hybridize with WCT. Increased attention to the plight of native fishes has slowed the decline of WCT in Montana, although populations continue to become extirpated (MFWP 1998).

Factors affecting the four subbasins occupied by WCT in MT are summarized below and are primarily based on the Status Review for Westslope Cutthroat Trout in the United States (USFWS 1999b).

<u>Factors Affecting Westslope Cutthroat Trout in the Clark Fork River Subbasin</u>
Major land-use activities in the Clark Fork River sub-basin that may adversely affect WCT include forestry practices, mining, livestock grazing and other agricultural practices, and urbanization. The MDEQ (1998) lists 143 streams in the Clark Fork River sub-basin as being water-quality impaired as the result of agricultural practices, 99 impaired by water withdrawals, 71 impaired by roads, and 73 impaired by mining, and 77 streams impaired by forestry (USFWS 1999b). Many of these streams are impaired by more than one activity. Information on the possible occurrence of WCT in these streams is presently unavailable, however.

The MBTSG (1995c) ranked mining in the Blackfoot River watershed as a high risk to bull trout restoration, and similarly poses a high risk to WCT. Mining of gold, silver, lead, and copper has occurred in the Blackfoot River headwaters during the past century, and effluents from the mines continue to result in the loss of habitat for bull trout (MBTSG 1995c, USFWS 2002) and

presumably for WCT. Altogether, 153 miles of streams in the Middle Clark Fork River watershed are water-quality impaired because of mining (MDHES 1994) and likely adversely affecting WCT populations if present.

Most of the large tributaries in the northern region of the Bitterroot River watershed are diverted for irrigation (MBTSG 1995d, USFWS 2002). Nearly 65 miles of stream in the Bitterroot River and at least 18 of its tributaries experience chronic low-flow conditions during the irrigation season (MBTSG 1995d, USFWS 2002). Intensive livestock grazing, particularly in the Deerlodge valley, Flint Creek valley, and parts of the Rock Creek valley, has adversely affected water quality and fisheries habitat, most of which is occupied by WCT, in those areas of the upper Clark Fork watershed (MBTSG 1995b, USFWS 2002).

The human population and associated rural residential development have been increasing rapidly in the Bitterroot Valley (MBTSG 1995d, USFWS 2002). Development can lead to alteration of WCT stream and riparian habitats. The lower Bitterroot River is a major non-point source of nutrient pollution, primarily from sewage effluents and land development (U.S. EPA 1993 as cited in MBTSG 1995d).

Angler harvest is closely regulated in the Clark Fork River sub-basin and is not considered a threat to WCT (MTFWP, in litt. 1999 as cited in USFWS 1999b). In many waters in the sub-basin, fishing for WCT is restricted to catch-and-release. Existing regulatory mechanisms failed to prevent the illegal stocking of northern pike into the Clearwater River system. Predation on WCT by normative predatory fishes poses a threat to WCT in a few localized areas. The highly predacious northern pike, for example, was illegally introduced into the Clearwater River system (MBTSG 1995c, USFWS 2002). There are no other evident, inherent inadequacies in existing federal, state or local regulatory mechanisms that affect WCT in the drainage. However, effective implementation of the various regulatory mechanisms that potentially affect WCT depends largely upon the appropriation of adequate funding and, ultimately, commitment on the part of the management or regulatory agencies to fulfill their respective responsibilities. Where these responsibilities are not being fulfilled, WCT may be threatened by ongoing or planned, adverse changes in their habitat or by chronic, adverse effects that remain unabated.

In the Clark Fork River sub-basin, whirling disease has been detected in the Blackfoot River watershed, the Flint Creek-Rock Creek watershed, and the upper Clark Fork River watershed (Gustafson 1996 as cited in USFWS 1999b). Extensive research is being conducted to determine the distribution of whirling disease in Montana, the susceptibility of WCT (a close relative of rainbow trout) to whirling disease, and possible control measures. Research suggests that WCT in headwater streams will not be affected by whirling disease because these streams are not suitable for colonization by the intermediate host for the whirling disease organism. Moreover, current research suggests that, although the whirling disease organism may be present in streams, low levels of the organism are unlikely to result in deleterious infections in fish, including cutthroat trout. Consequently, whirling disease is not considered an important threat to extant WCT stocks in the Clark Fork River sub-basin.

Stocking of normative fish species in Clark Fork River sub-basin began in the 1890s. As a result, normative brook trout, brown trout and rainbow trout became established long ago in

many streams and lakes throughout Montana (MFWP, in litt. 1999 as cited in USFWS 1999b). Although such stocking has not occurred in the drainage for more than two decades, the normative fishes that became established probably constitute the greatest contemporary threat to the maintenance and restoration of WCT in the drainage.

Many people in the Bitterroot River watershed are building private fish ponds on their property and stocking them with brook trout, leading to concern that these introduced fish could spread into tributaries where they do not already exist (MBTSG 1995d, USFWS 2002). In addition, the genetic integrity of WCT can be threatened by interbreeding with normative rainbow trout and Yellowstone cutthroat trout (MFWP, in litt. 1999 as cited in USFWS 1999b).

Factors Affecting Westslope Cutthroat Trout in the Missouri River Subbasin

Shepard et al. (1997) modeled viability of 144 existing WCT populations in the Upper Missouri River and found that 71 percent had a very high risk of extinction within the next 100 years. The model found grazing and presence of non-native trout had the most influence on WCT populations. Today the nonnative trout threat comes primarily from hybridization with rainbow trout and competition with brook trout. In addition, over-fishing and habitat loss due to mining, irrigation, grazing and logging probably also contributed to their decline (Tews et al. 2000).

According to the "Draft Status and Conservation Needs for Westslope Cutthroat Trout in Southwest Montana," (pers. comm., Lee Nelson, Region 3, MFWP) the main reasons for the decline of WCT populations in southwest Montana are generally well understood in each subbasin. However, the causes of the decline continue (and some are increasing) and consequently the threats in the short-term and conceivably in the long-term of many WCT populations remain present. The main threat factors are related to nonnative trout; degraded habitats; and fragmentation resulting in small, isolated populations.

Major land-use activities in the Missouri River Headwaters drainage in southwest Montana that may currently adversely affect WCT include livestock grazing and other agricultural practices, mining, and forestry practices. The Montana Department of Environmental Quality (MDEQ 1998) lists 171 streams in the Missouri River drainage as being water-quality impaired as the result of agricultural practices, 107 impaired by water withdrawals, 60 impaired by roads, 50 impaired by mining, and 37 impaired by forestry practices (MDEQ 1998). Many of these streams are impaired by more than one activity.

Whirling disease has been detected in all the major rivers the Missouri River Headwaters drainage in southwest Montana (Gustafson 1996). Extensive research is being conducted to determine the distribution of whirling disease in Montana, the susceptibility of WCT (a close relative of rainbow trout) to whirling disease, and possible control measures. Research suggests that WCT in headwater streams will not be affected by whirling disease because these streams are not suitable for colonization by the intermediate host for the whirling disease organism. Moreover, current research suggests that, although the whirling disease organism may be present in streams, low levels of the organism are unlikely to result in deleterious infections in fish, including cutthroat trout. Consequently, whirling disease is not considered an important threat to extant WCT stocks in the Missouri River Headwaters drainage (USFWS 1999b).

Although angler harvest of WCT may have negatively affected some stocks of WCT earlier in this century, angler harvest is now closely regulated. In all of the waters in the Missouri River Headwaters drainage, fishing for WCT is restricted to catch-and release (USFWS 1999b).

Nonnative fish species were extensively stocked in many areas of the Missouri River Headwaters drainage, beginning in the 1890s, and as a result, nonnative brook trout, brown trout and rainbow trout became established long ago in many streams and lakes throughout the drainage. Although such stocking has not occurred in Montana for more than two decades, the nonnative fishes that became established probably constitute the greatest contemporary threat to the maintenance and restoration of WCT in the drainage (USFWS 1999b).

Factors Affecting Westslope Cutthroat Trout in the Kootenai River Subbasin

Forestry practices, an extensive road system, and associated timber management activities have had adverse effects on the habitats of WCT in some areas of the Kootenai River sub-basin. Seven streams (95 miles) in the upper Kootenai River sub-basin, 5 streams (124 miles) in the middle Kootenai River sub-basin, and one stream (7 miles) in the lower Kootenai River sub-basin are considered water-quality impaired as a result of forestry practices (MDHES 1994). Twenty-three streams in the Kootenai River sub-basin are listed as being water-quality impaired as the result of forestry practices; nine impaired by agricultural practices; and 18 impaired by water withdrawals; additional impairments result from other land-use practices (USFWS 1999b). Many of these streams are water-quality impaired by more than one activity. Information on the possible occurrence of WCT in these streams is presently unavailable, however.

Although angler harvest of WCT may have caused appreciable declines in some westslope stocks earlier in this century, angler harvest is now closely regulated in Montana and is not considered a threat to the subspecies (MTFWP, in lift. 1999 as cited in USFWS 1999b). In many waters in the Kootenai River sub-basin, fishing for WCT is restricted to catch-and-release. Elsewhere in the drainage, harvest is greatly restricted. There are no evident, inherent inadequacies in existing federal, state or local regulatory mechanisms that affect WCT in the sub-basin (USFWS 1999b).

Whirling disease has not been found in the Kootenai River sub-basin (Gustafson 1996 as cited in USFWS 1999b). No one is aware of other diseases or predators than pose threats to WCT in the drainage.

As the result of stocking for recreational purposes, normative brook trout, brown trout and rainbow trout became established long ago in many streams and lakes throughout the Kootenai River sub-basin. Although such stocking has not occurred for more than two decades, the normative fishes that became established probably constitute the greatest contemporary threat to the maintenance and restoration of WCT in the Kootenai River sub-basin and the state (MTFWP, in lift. 1999 as cited in USFWS 1999).

Factors Affecting WCT in the Flathead River Subbasin – Timber management is the dominant land use in the Flathead River subbasin, where an extensive road system to support forestry practices and other forest uses exists. In addition, rural residential development is increasing, particularly in the Flathead Lake area, resulting in domestic sewage and human-caused changes

to stream morphology which are threats to water quality (MBTSG 1995d, USFWS 2002). The MDEQ (1998) lists 17 streams in the Flathead River sub-basin as being water-quality impaired as the result of forestry practices and 16 streams impaired by agricultural practices; additional impairments result from other land-use practices (USFWS 1999). Many of these streams are water-quality impaired by more than one activity. Information on the possible occurrence of WCT in these streams is presently unavailable, however.

Angler harvest of WCT is closely regulated in Montana and not considered a threat to the subspecies in the Flathead River sub-basin (MFWP, in litt. 1999 as cited in USFWS 1999). In many WCT waters in the drainage, fishing for WCT is restricted to catch-and-release. Elsewhere in the sub-basin, only limited harvest of WCT is allowed. Existing regulatory mechanisms failed to prevent the more than 100 illegal fish introductions that have been documented in northwest Montana during the past 20 years. There are no other evident, inherent inadequacies in existing federal, state or local regulatory mechanisms that affect WCT in the sub-basin. However, effective implementation of the various regulatory mechanisms that potentially affect WCT depends largely upon the appropriation of adequate funding and, ultimately, commitment on the part of the management or regulatory agencies to fulfill their respective responsibilities. Where these responsibilities are not being fulfilled, WCT may be threatened by ongoing or planned, adverse changes in their habitat or by chronic, adverse effects that remain unabated.

Whirling disease has been detected in trout in the Swan River watershed of the Flathead River sub-basin (Gustafson 1996 as cited in USFWS 1999). Where WCT coexist with both the protozoan that causes the disease and the protozoan's intermediate host, whirling disease poses a threat to WCT. However, extensive research is being conducted to determine the distribution of whirling disease in Montana, the susceptibility of WCT (a close relative of rainbow trout) to whirling disease, and possible control measures. Research suggests that WCT in headwater streams will not be affected by whirling disease because these streams are not suitable for colonization by the intermediate host for the whirling disease organism. Moreover, current research suggests that, although the whirling disease organism may be present in streams, low levels of the organism are unlikely to result in deleterious infections in fish, including cutthroat trout. Consequently, whirling disease is not considered an important threat to most extant WCT stocks in the Flathead River sub-basin.

Predation on WCT by normative predatory fishes poses a threat to WCT in a few localized areas. In the Flathead Lake basin, there are 13 introduced, normative species of fish with which WCT must coexist (MBTSG 1995d). Among these is lake trout, which has become the dominant species in Flathead Lake. Juvenile lake trout have also been found in major tributaries to the lake (MBTSG 1995d, USFWS 2002). Hungry Horse Dam protects native fishes in the South Fork Flathead River watershed, the most intact native fish assemblage in western Montana, by preventing the upstream movement of normative fishes, particularly lake trout, into the watershed (MBTSG 1995e, USFWS 2002). Bigfork Dam has benefitted the Swan River watershed because the dam prevents the upstream movement of normative fishes, particularly lake trout, into the Swan drainage (MBTSG 1996a, USFWS 2002). Over 100 illegal fish introductions have been documented in northwest Montana during the past 20 years (MBTSG 1995d, USFWS 2002). MFWP does not stock normative predatory fishes into waters harboring

genetically pure WCT and aggressively prosecutes anyone caught illegally transferring live fish or attempting to do so (MFWP, in litt. 1999 as cited in USFWS 1999).

Although authorized stocking of nonnative fish species has not occurred for more than two decades, the nonnative fishes that became established probably constitute the greatest contemporary threat to the maintenance and restoration of WCT in the drainage. Nonnative fish species that have become established in the drainage include lake trout, kokanee salmon, northern pike, and largemouth bass (MBTSG 1995d, USFWS 2002).

Summary of Programs and Actions Addressing Westslope Cutthroat Trout Issues in Montana

In 2003 a group of State and Federal agencies joined in the development and signing of a rangewide Conservation Agreement dedicated to the protection and restoration of WCT. That agreement was revised and recommitted to in 2008 by Idaho Department of Fish and Game, MFWP, Oregon Department of Wildlife and Fish, Washington Department of Fish and Wildlife, USFS, USDI- Agencies (USFWS, BLM, Natural Resources Conservation Service, Bureau of Reclamation, and NPS), Nez Perce Tribe, Shoshone-Bannock Tribes of Fort Hall, Coeur D'Alene Tribe of Idaho, Kootenai Tribe of Idaho, Blackfeet Tribe of Montana, and CSKT of the Flathead Reservation. Goals and strategies under the plan are highlighted as follows: **GOAL:** Assure the long-term persistence of the WCT subspecies within its historical range.

1. Sub-Goal: Identify WCT conservation populations and manage these populations to optimize WCT numbers at levels consistent with maintaining long-term persistence and viability and recreational opportunities.

2. Sub-Goal: Manage WCT conservation populations to preserve genetic integrity.

3. Sub-Goal: Expand WCT distribution within the broad boundary of the historical range through expansion of some populations and restoration of other populations.

4. Sub-Goal: Reduce and/or eliminate interaction of non-native fish with WCT populations.

5. Sub-Goal: Preserve and protect WCT watersheds and habitats.

6. Sub-Goal: Initiate WCT conservation education and public outreach efforts.

7. Sub-Goal: Develop and maintain databases that track WCT status and conservation accomplishment information.

8. Sub-Goal: Initiate an administrative framework that provides for development of a range-wide conservation strategy, sets up a formal range-wide conservation Working Group that holds annual administrative meetings, identifies geographical management units with associated conservation implementation teams and specific team leadership, and utilizes other administrative options (e.g., designation of standing committees, Ad hoc sub-committees and individual assignments) to accomplish the stated goal.

Further, the State of Montana and multiple partners have developed a formal MOU and Conservation Agreement for Westslope Cutthroat Trout and Yellowstone Cutthroat Trout in Montana, signed in 2007 (MFWP 2007). This Conservation Agreement (available online at: > http://fwpiis.mt.gov/content/getItem.aspx?id=28662<) has been developed to expedite implementation of conservation measures for WCT and Yellowstone cutthroat trout throughout their respective historical ranges in Montana. This Conservation Agreement is a collaborative and cooperative effort among resource agencies, conservation and industry organizations, tribes, resource users, and private landowners. Per this agreement, the management goal for WCT and Yellowstone cutthroat trout in Montana is to ensure long-term self-sustaining persistence of the subspecies within each of the five major sub-basins (Clark Fork, Kootenai, Flathead, upper Missouri, and Saskatchewan), and to maintain the genetic diversity and life history strategies of the local populations. Signatories to the agreement will address threats, to the extent they exist, with management and restoration actions.

Numerous management programs and other actions are being implemented to eliminate or ameliorate the adverse effects on WCT of past, present, and proposed land-management activities in Montana. On non-federal lands in the State, several mechanisms are being implemented to protect WCT, their habitat, and other aquatic resources. Forestry "Best Management Practices" (BMP) are being implemented on Montana State Forests to maintain water quality and reduce sediment input; audits of forestry practices indicate a high degree of compliance and grazing BMPs have also been developed and are being implemented on state grazing lands.

Montana has several laws and regulations directed toward protection of aquatic habitats that, if properly applied and enforced, reduce threats to WCT throughout the range of the WCT. The Montana Stream Protection Act requires a permit for any project that may affect the natural and existing shape and form of any stream or its banks or tributaries; the Streamside Management Zone Law permits only selective logging and prohibits clear cutting and heavy equipment operation within 50 feet of any lake, stream, or other body of water; the Montana Natural Streambed and Land Preservation Act requires private, non-governmental entities to obtain a permit for any activity that physically alters or modifies the bed or banks of a perennially flowing stream; and the Montana Pollutant Discharge Elimination System requires permits for all discharges to surface water or groundwater, including discharges related to construction, dewatering, suction dredges and placer mining. Before permits allowing activities covered under these regulations are issued, applications are reviewed by MFWP, DNRC, and the MDEQ. Recommendations to limit impacts to WCT and their habitat are mandated through the permitting process.

In 1997, the Montana Legislature passed House Bill 546, which strengthened the state's authority to develop Total Maximum Daily Loads (TMDLs) for Montana waters. Under this legislation, MDEQ is directed to identify impaired water bodies, identify the causes of impairment, and develop corrective actions. MDEQ's goal is to correct all impairments within the next 10 years. Such corrective actions will improve water quality in many streams and should result in enhancement of habitat for WCT.

Of the approximately 12,896 linear miles of stream occupied by WCT in Montana, 7,210 miles (55.9 percent) occur on Federal lands (USFWS 1999). Among the nearly 42 million acres of land that constitute the watersheds occupied by WCT in Montana, 36.6 percent are administered by the USFS, 4.1 percent by the BLM, and 2.7 percent by the NPS and the USFWS. Many of the lakes that are habitat for WCT are in Glacier National Park, where NPS policies preclude modification of WCT habitat and introduction of normative species.

On lands administered by the USFS and BLM in the Columbia River basin, where 5,253 (72.9 percent) of the 7,210 stream miles occupied by WCT on federal lands in Montana occur, numerous management programs and other actions are being implemented to minimize or ameliorate the adverse effects on WCT of past, present, and proposed forestry practices. The Inland Native Fish Strategy (INFISH) includes interim direction for riparian management objectives, standards and guidelines, and monitoring in the Columbia River basin (USFS 1995). Among other things, INFISH requires that 300 foot buffers be maintained along all streams. INFISH standards, which can only be modified following a watershed analysis or site-specific evaluation, are being implemented on USFS and BLM lands to minimize or eliminate present or potential destruction of WCT habitat and other aquatic resources.

Additional land-use restrictions and protections that benefit WCT on federal lands in Montana will result from the Federal listing of bull trout as a threatened species under the Act (63 FR 31647). Because the general distribution of bull trout overlaps that of WCT, section 7 actions directed toward the protection of bull trout and their habitats will also afford benefits to WCT.

In addition to those administrative protections, the national forests in Montana reported a total of 234 projects directed toward the protection and restoration of WCT and their habitats on forest lands (Bosworth, in litt. 1998 as cited in USFWS 1999). Similarly, the MFWP reported about 500 projects (MFWP, in litt. 1998 as cited in USFWS 1999) and the NPS, Yellowstone National Park, reported 12 projects (Finley, in litt. 1998 as cited in USFWS 1999)—all directed toward the protection and restoration of WCT and their habitats.

Extensive research is being conducted to determine the distribution of whirling disease in Montana, the susceptibility of WCT to whirling disease, and possible means to control the disease. MFWP has implemented policies and regulations to prevent the human transfer of potentially diseased fishes (or water that contains the protozoan that causes whirling disease) among streams and lakes (MFWP, in lift. 1999 as cited in USFWS 1999).

Restoration activities underway as part of the Blackfoot Challenge, a cooperative endeavor between private landowners and public agencies to restore and conserve streams and riparian environments in the Blackfoot River valley, include removal of fish-passage barriers; screening of irrigation diversions to prevent the loss of fish to canals; and general improvement of instream fish habitat (MBTRT 1997). The Blackfoot Challenge also works to acquire conservation easements.

In 2004, MFWP and USFWS negotiated a Candidate Conservation Agreement with Assurances (CCAA) for reestablished or introduced WCT. This agreement allows MFWP to set up criteria by which landowners who work with MFWP to expand or establish WCT populations can be

included under this CCAA (through a Certificate of Inclusion). As long as landowners meet agreed upon criteria, those included landowners will meet their obligations under the Act, should this subspecies be listed under the Act in the future. The signatories agree to work on developing additional CCAAs for cutthroat (e.g., for introduction of Yellowstone cutthroat trout or for enhancing existing cutthroat conservation populations) when appropriate.

Other programs and actions addressing WCT in the four subbasins occupied by WCT in MT are summarized below and are primarily based on the Status Review for Westslope Cutthroat Trout in the United States (USFWS 1999b).

Montana has taken a proactive approach to WCT restoration since the mid-1990's when a technical committee (1994) of fish biologists and a steering committee (1996) representing a wide variety of state and federal government agencies and non-government organizations were established. The collaboration of members of these groups resulted in the completion of a Conservation Agreement for WCT in Montana, which was signed in 1999. In July 2007, another follow-up agreement was signed that updated and combined two-earlier five-year agreements. This latest agreement included Yellowstone cutthroat trout and was signed as a collaborative and cooperative effort among key stakeholders to serve as part as a coordinated strategy to conserve cutthroat trout (MFWP 2007).

The 1999 WCT Conservation Agreement specifies at least four geographically separate interconnected pure WCT populations must be established in the Missouri drainage. Each of these populations should occupy at least 50 miles of connected habitat. In northcentral Montana, the 1999 WCT Conservation Agreement specifies one such population along the East Front (Sun, Teton or Marias drainages) and one population in the "Southern Tributaries" (Smith, Belt or Judith drainages). The updated 2007 Conservation Agreement acknowledged that in the original 1999 WCT Conservation Agreement it may not always be possible to achieve 50 miles of connected habitat and therefore the 2007 Conservation Agreement provides some flexibility for such instances. However, efforts will be made to connect as much habitat as feasible in these areas. Currently, projects are underway to restore WCT to over 50 miles of connected habitats in the Cherry Creek drainage, in the Madison River basin, and in about 30 miles of habitats in the South Fork Judith basin.

The north central region of Montana includes the Missouri River and most of its tributaries from Canyon Ferry Dam downstream to the Musselshell River. Major tributaries include the Dearborn, Smith, Sun, Belt, Teton, Two Medicine, Judith and Musselshell drainages. Montana Fish, Wildlife, and Parks and the USFS have indicated they will undertake three strategies for WCT conservation in North-Central Montana: 1) preserve all existing pure populations; 2) attempt to create two large populations as proposed in the conservation agreement; and 3) establish 2 to 4 additional secure viable populations (minimum of 2,500 individuals) each, in the Southern Tributaries and the East Front. Protection status of individual 90 – 99.9 percent pure populations will be further evaluated in drainage management plans for their role in WCT restoration. However, there are so few populations of WCT in northcentral Montana that MFWP and the USFS tentatively plan to preserve most and perhaps all of the existing populations that are 90 – 99.9 percent pure (Tews et al. 2000).

Restoration efforts in northcentral Montana began in the early 1970's when a WCT population in Elkhorn Creek (tributary to Holter Reservoir) was preserved by using chemical removal of non-native trout above a constructed barrier. WCT were also moved from the Highwood Mountains to a fishless reach of Birch Creek in the Two Medicine drainage in the 1970's. In the last decade WCT restoration efforts have intensified in streams to protect threatened WCT populations. These efforts have included: 1) movement of WCT into about 10 miles of suitable habitat in fishless areas on three streams; 2) extensive fish population and genetics surveys; 3) construction of a temporary barrier on Chamberlain Creek and 4) brook trout removal by electrofishing. Tissue samples for genetic analyses have been taken from more than 1000 fish in about 130 populations since 1980. In addition, more than 18,000 fish have been captured from hundreds of populations during fish surveys over the past 6 years. Barrier construction is planned on Cottonwood Creek (Arrow Creek Drainage) and Cottonwood Creek (Upper Missouri) and several other barrier sites are in the evaluation stages. Other projects include proposed rehabilitation of Hound Creek and Middle Creek Reservoirs in the Smith River drainage (Tews et al. 2000). Restoration of viable WCT populations in northcentral Montana will likely be a slow process.

One objective of the Conservation Agreements has been to protect all existing populations. Most populations in this subbasin have a high likelihood of extirpation on in the next 100 years (Shepard et al. 1997). Many populations in northcentral Montana have less than 3 miles of habitat and contain far less than 2500 individuals. Duplication of these pure populations by fish transfers to either fishless headwater reaches or to stream reaches that have undergone chemical treatment for trout removal will reduce the risk for each replicated population. Replicating individual populations will also help maintain genetic diversity of WCT, since the genetic structure of each population is unique (Leary et al. 1997). To maximize the number of replicated populations, different donor WCT populations will likely be used whenever practical for each expansion. Due to the possibility of local adaptations, donor populations living near the expansion site will be selected when practical. However, it may be necessary for the source WCT to be from a distant drainage, when a local pure population can not be found for the transfer. However, the Montana Technical Cutthroat Trout Committee has developed strict criteria to follow for WCT transfers (Tews et al. 2000).

The USFWS concluded in its 1999 status review of WCT that in the Missouri River basin there had been a conspicuous decline in the WCT population early in the twentieth century (USFWS 1999). That decline was largely attributed to rapid, abundant colonization of mainstem rivers and their major tributaries by one or more introduced, nonnative fish species that had adverse effects on WCT. The analysis showed that the rate of decline in the WCT population was much lower in recent times than it was earlier in that century. There was also evidence that many of the headwater streams inhabited by extant WCT stocks were relatively secure from colonization by nonnative fishes, primarily brook, brown and rainbow trout, because those headwater streams were not suitable habitat for the nonnative trout. Nonetheless, the USFWS recommended that additional actions (e.g., selective placement of barriers to prevent the upstream movement of nonnative fishes) should be taken to further protect extant WCT stocks throughout their historic range from the adverse effects of nonnative fishes, considered by many fisheries scientists to be the major threat to WCT. These adverse effects include predation, competition, and interbreeding

and subsequent genetic introgression. The USFWS indicated that the genetic characteristics of most extant WCT stocks are unknown and the genetic purity of some stocks could be threatened by interbreeding with nonnative fishes (USFWS 1999).

Environmental Baseline for Columbia Redband Trout

Status of Columbia Redband Trout in the Action Area

The information provided in this section on RBT is derived from several sources, including the Final EIS/HCP (2010), Kootenai River Subbasin Plan (KTOI and MFWP 2004), limited number of technical and research reports, a federal petition notice, and conversations with MWFP biologists. The distribution of RBT in Montana is restricted to a portion of the Kootenai River subbasin, which is located in the northwest corner of Montana. Not a great deal of information exists about this species that occupies this area.

While the RBT is ranked as an S1 SOC (critically imperiled because of extreme rarity or because of some factor(s) of its biology making it especially vulnerable to extinction) in Montana by MFWP, and as a sensitive species by DNRC and the USFS, the USFWS determined that listing the species under the Act was not warranted (65 FR 11 14932-14936, March 20, 2000). The USFWS was petitioned to consider the Kootenai River population of RBT as an endangered species under the Act on April 4, 1994. Recent concern has arisen that the Kootenai River Basin RBT population is at a high risk of extinction due to hybridization with non-native coastal rainbow trout, habitat fragmentation, and stream habitat degradation (Perkinson 1993; Muhlfeld 1999).

Quantitative empirical data on historic RBT abundance and productivity in the Kootenai subbasin are not available. It is known that historically, RBT occupied much of the Kootenai River system downstream from Kootenai Falls, including the Yaak River. Isolated populations exist today in the Fisher River drainage, which is upstream from Kootenai Falls, and it is believed the passage barrier preventing upstream movement in the Kootenai system existed in geologic time near the present day Libby Dam or Fisher River (Hensler et al. 1996). It is also assumed that historically (prior to European settlement) most of these streams were generally characterized by optimum habitat conditions and therefore likely supported abundant and productive native fisheries.

RBT were the most widely distributed salmonids in the Columbia River basin, historically occurring in 73 percent of the subwatersheds (Lee et al. 1997). Only the allopatric form, which once occupied about 18 percent of all Columbia River subwatersheds, is native to Montana. RBT remain the most widely distributed salmonids in the Columbia River basin, with sympatric and allopatric forms known or predicted to occupy 64 percent of their historical range, which is equivalent to 47 percent of the entire Columbia River basin (Lee et al. 1997). However, less is known about the current distribution of the different RBT forms than of other salmonids. This is due to lack of information and the inability to differentiate juvenile steelhead, sympatric RBT, and non-native strains of rainbow trout (Lee et al. 1997). Among allopatric RBT, substantial populations occur in about 9 percent of the historical range and 18 percent of the current known distribution.

In the Columbia River basin, RBT historically shared habitats with several potential predatory fish species, such as northern pikeminnow, bull trout, chinook salmon, and coastal rainbow trout (including steelhead). Hybridization and competition with other fish species, particularly introduced species, are biotic factors influencing the status of RBT populations. In general, introduced fish species create risks of genetic introgression, competition for food and space, predation, and increased exposure to disease (Lee et al. 1997).

Based on the analysis provided in the Kootenai River Subbasin Plan (KTOI and MFWP 2004), of the eleven stream habitat attributes considered key to resident salmonids, the most degraded for RBT in tributaries in the U.S. portion of the Kootenai River subbasin (when averaged across all the tributary HUCs) are fine sediment, riparian condition, altered thermal regime, and channel stability, in that order. In the regulated mainstem they are altered hydrograph, riparian condition, altered thermal regime, and fine sediment. In the B.C. portion of the subbasin they are riparian condition, channel stability, fine sediment, and habitat diversity. The rankings vary at the HUC-4 scale. Of the thirteen lake/reservoir-habitat attributes considered key to resident salmonids, the four most limiting to RBT in reservoirs are hydraulic regime, migratory obstructions, shoreline condition, and temperature. The habitat in lakes is in significantly better condition, and none of the lake habitat attributes scored low enough to be considered limiting.

In Montana, RBT only occur in the Kootenai River subbasin, which corresponds to the 3 Kootenai River AAUs – Upper, Middle, and Lower AAUs. These are the farthest inland populations of RBT in the Columbia River basin. Figure D-16, Appendix D, of the Final EIS/HCP (2010) shows the distribution of RBT in the HCP project area. The historical distribution is believed to have extended upstream of Kootenai Falls near the present-day Libby Dam or the Fisher River (Muhlfeld 2003). According to genetic surveys, historical RBT populations were likely native to low-gradient, valley bottom streams throughout the Kootenai River drainage (Knudsen et al. 2002; Muhlfeld 2003).

The Kootenai River population of RBT in Montana primarily consists of the resident form (Muhlfeld 1999). These resident RBT are isolated in small patches of habitat, often upstream of barriers, and are distinguished from other rainbow trout populations in the Kootenai River watershed by lack of genetic introgression with non-native rainbow trout stocks (Muhlfeld 2003). In general, the present distribution of RBT in Montana is characterized by widely disconnected remnant populations of genetically pure stocks (Muhlfeld 2003). These fish are largely restricted to some headwater areas, in large part due to the widespread introduction of hatchery rainbow trout, which has caused major genetic divergence among local RBT populations (Allendorf et al. 1980; Muhlfeld 2003).

Extensive ongoing genetic sampling is being conducted, which will aid in more accurately identifying the current distribution of genetically pure strains of RBT in the Kootenai River subbasin (Muhlfeld 2003). Genetic analyses have identified genetically pure redbands in Callahan Creek, the East Fork Yaak River and its tributaries, the Yaak River (downstream from Yaak Falls), the North Fork Yaak River, and tributaries to Libby Creek (upper Big Cherry Creek and Granite Creek) (Allendorf et al. 1980; Leary et al. 1991; Huston 1995; Hensler et al. 1996; Knudsen 2002). Currently, unintrogressed RBT populations are restricted to headwater reaches.

RBT inhabiting Callahan Creek and the upper Yaak drainage are isolated into two separate regions by Yaak River Falls, a falls-chute barrier located 2.5 miles from the mouth of Callahan Creek and a barrier falls located in the lower East Fork of the Yaak River. Telemetry-based research conducted by MFWP (1999) suggested that RBT in Basin Creek and East Fork Yaak River (upstream from the barrier falls) may represent a metapopulation of RBT that includes both resident and fluvial life history forms. RBT did not occur in the section of the Kootenai River above the current site of Libby Dam prior to impoundment but are now present, and they continue to be stocked.

Recent results of additional genetic testing conducted by MFWP (Allendorf 2003 unpublished) show the range of genetically pure populations of RBT also includes the upper Fisher River. The portions of the upper Fisher River include Wolf, Pleasant Valley, Island, and Silver Butte Creeks (Allendorf et al. 1980; Huston 1995).

As previously mentioned, genetically pure populations of RBT have been identified in Callahan Creek, Basin Creek, the upper north (British Columbia) and east forks of the Yaak River as well as upper areas of the Libby Creek drainage such as upper Big Cherry Creek and Granite Creek. Populations of RBT inhabiting Callahan Creek and the upper Yaak River drainage are isolated by barrier falls in each system. These remnant populations, which are spatially fragmented and isolated from genetic exchange, represent the most substantial remaining sources of native RBT capable of re-establishing their historical distribution in Montana downstream of Kootenai Falls.

The status of these Montana RBT populations is presumed to be stable (J. Dunnigan, MFWP, pers. comm. 2004). Pacific Watershed Institute and Resources (PWI 1999) reports that the rainbow trout population in the lower Kootenai River itself (downstream of Kootenai Falls) may be the strongest stock of all the salmonids, but that the genetic integrity of the native RBT has been significantly compromised through stocking of non-native rainbow strains and hybridization with cutthroat trout.

Summary of Factors and Threats Affecting Redband Trout in the Action Area

The Kootenai River population of RBT is the only rainbow trout native to Montana, and is the farthest inland distribution of the sub-species. As such, the population is considered to be at high risk due to hybridization and competition with non-native species, habitat fragmentation, and habitat degradation (American Fisheries Society [AFS] 2008). In particular, there is concern that the Kootenai River basin RBT population is at risk of extinction (KTOI and MFWP 2004). Widespread introductions of non-native trout, primarily coastal rainbow trout and eastern brook trout, have lead to intensive competition, species replacement, and hybridization with these non-native stocks (Muhlfeld 2003, pers. comm.). The introduction of non-native trout above geologic barriers or in adjacent drainages poses a severe threat to the genetic purity and population persistence of isolated populations of RBT.

Habitat fragmentation and degradation problems are the result of land management factors, dam and water diversion facilities, and floodplain development. The land management factors include road construction and maintenance, timber harvest, and livestock grazing, which can alter substrate composition and reduce the frequency and area of pools and have very deleterious

effects to the abundance and distribution of RBT. Forestry practices are a concern because forestry is the dominant land use in the subbasin. However, current forestry practices have improved on non-federal lands and forestry BMPs are being implemented on Montana State Forest lands to maintain water quality and reduce sediment input. The Kootenai River drainage has a history of mining, which likely impacted the population and distribution of RBT.

Libby Dam has caused dramatic changes to the river including an altered hydrograph and lower biological productivity by altering several physical (habitat) and biological changes that together are probable limiting factors for RBT. For example, Koocanusa Reservoir is a nutrient sink, limiting biological productivity downstream of the dam (Woods 1982; Snyder and Minshall 1996). Abundance and diversity of important aquatic invertebrates has declined since construction of Libby Dam (Hauser and Stanford 1997), reducing food abundance for trout. Limited food resources could affect survival of RBT, especially juveniles. The altered hydrograph (e.g., high winter flows, fluctuating daily flows, no flood events) may also have affected RBT through loss of mainstem juvenile habitat and possibly mainstem spawning habitat.

In the mainstem of the Kootenai River in Montana (and the HCP Project area), the most limiting factors were altered hydrograph due to Libby Dam, riparian condition, low temperature, and fine sediment (KTOI and MFWP 2004). At best, the risk rating should probably be "unknown" for at least some populations, and possibly "depressed" or "critical" for some in the drainage.

Due to the spatially fragmented current distribution of RBT in headwater stream areas, removal of all artificial barriers might benefit RBT populations by providing connection among habitats and populations. However, RBT are also restricted to headwater areas due to the widespread introduction of hatchery rainbow trout below fish passage barriers, which has caused major genetic divergence among local RBT populations (Knudsen et al. 2002; Muhlfeld 2003, personal communication). Therefore, existing barriers should be identified and monitored to determine the potential effects of barrier removal or maintenance of RBT stocks.

Where necessary, new barriers may even be warranted to minimize or prevent impacts to RBT populations through competition and/or hybridization with native and non-native salmonids (such as rainbow trout, brook trout, and WCT). However, the effects of such actions on other native fish species that occupy headwater habitats (e.g. bull trout and WCT) must also be considered.

Summary of Programs and Actions Addressing Columbia Redband Trout Issue in Montana

As described for WCT, numerous management programs and other actions are being implemented to eliminate or ameliorate the adverse effects on streams of past, present, and proposed land-management activities in Montana. These include implementation of forestry BMPs; State permit requirements; the SMZ law; TMDL development; Federal standards under INFISH.

In general, RBT conservation has followed a site-specific and opportunity-based approach, rather than a watershed-based approach, with varied results and accomplishments (Benke 2002). The need for a concise status assessment or conservation agreement has been recognized. As well as

the need for protection of existing populations, and to ensure the long-term persistence of RBT within their historic range including increase numbers in some populations and expand others (Benke 2002). In 2009, a multi-state, multi-agency Redband Trout Status Workshop was held. During that workshop, Montana representatives stated preliminary efforts are underway to establish a hatchery population of redband trout in Montana (Grunder 2009).

D. EFFECTS OF THE ACTION

"Effects of the action" refers to the direct and indirect effects of an action on the species or critical habitat, together with the effects of other activities that are interrelated or interdependent with that action that will be added to the environmental baseline. Direct effects are considered immediate effects of the project on the species or its habitat. Indirect effects are those caused by the proposed action and are later in time, but are still reasonably certain to occur. Interrelated actions are those that are part of a larger action and depend upon the larger action for their justification. Interdependent actions are those that have no independent utility apart from the action under consultation.

Factors to be Considered

The evaluations in Part IV of this BO are meant to assess how the baseline habitat conditions would be affected by implementation of the conservation strategies of the DNRC HCP. The actual effects of implementing the DNRC HCP and the actual level of protection for HCP fish species and their habitats cannot be determined precisely, but can be inferred. Just as there are highly variable baseline conditions across watersheds in the action area, so too it is likely that the rate and direction of changing baseline conditions in the action area as a result of the implementation of the DNRC HCP will be variable. The USFWS does not expect that all habitat components would be properly functioning simultaneously in all HCP project area streams during the life of the Permit because of the following: 1) recovery of impaired riparian and channel processes is variable and can require several years or decades depending on the degree of impact; 2) annual variability of changing habitat due to natural and man-caused changes; and 3) the uncertainty of future events such as the effects of climate change. Furthermore, the scattered land ownership pattern limits the ability of any individual land owner to singularly restore watershed processes.

Based on the environmental baseline information presented for all three HCP fish species, the USFWS has determined that baseline conditions for most watersheds in the Final EIS/HCP (2010) Planning Area, HCP Project Area, and AAUs, are probably functioning at some level of risk ranging from good to fair to poor for the HCP fish species. This premise is supported by status reviews, HCP species accounts, petitions for listing fish species, research reports, technical reports, inventory and survey data, and other information cited in this opinion.

The DNRC HCP incorporates five aquatic conservation strategies – 1) riparian timber harvest, 2) sediment delivery reduction, 3) grazing, 4) fish connectivity, and 5) CWEs. Within each conservation strategy, there are several specific commitments that build upon existing DNRC conservation practices and that are intended to maintain or achieve suitable habitat conditions for the HCP fish species. As is commonly done in HCPs with aquatic systems affected by forestry,

the conservation strategies rely on avoidance and minimization measures in addition to mitigation measures that are intended to address impacts when minimization measures do not reduce impacts to an acceptable level, or that is necessary to offset existing impacts.

The riparian timber harvest conservation strategy is expected to provide adequate riparian vegetation that maintains appropriate levels of shade for suitable stream temperature regimes. This strategy is intended to provide suitable levels of in-stream habitat complexity by supplying natural rates of LWD recruitment during the permit period. A major objective of the sediment reduction delivery conservation strategy is the prevention and/or reduction of road-related sediment in order to provide for suitable in-stream sediment levels. Grazing commitments are expected to restore channel morphology and riparian functions in areas where stream-side grazing has degraded riparian areas. The purpose of the fish connectivity conservation strategy is to provide for fish passage at newly constructed stream crossings or existing stream crossings that impair or prevent fish movement. The intent of the CWEs conservation strategy is to address and assess, collectively, the overall watershed conditions by identifying specific habitat elements that may be at risk from a project proposal. These HCP conservation strategies and associated commitments could accomplish the intended habitat conservation directly, indirectly, and/or cumulatively.

Streams differ in their flow, temperature, sedimentation, nutrients, physical structure, and biological components. Fish habitat is the product of many components, including water quality, hydrology / flows, channel structure, sediment supply, access or connectivity throughout the watershed / floodplain, and riparian areas. When properly functioning, these components are closely intertwined to form habitat conditions favorable to healthy populations of fish species. In turn, fish populations have adapted biochemically, physiologically, morphologically, and behaviorally to the natural environmental fluctuations experienced in that stream and /or lake environment. Therefore, conservation should be targeted to maintain habitat elements within the natural range for the particular system (Spence et al. 1996). As indicated in this section, the analysis in Part IV of this BO will focus on the effects to the most important habitat components and riparian functions that are known to support healthy populations of HCP fish species.

Scale of Analysis

The AAUs are comprised of many individual watersheds, small and large. Streams within these watersheds are classified as Class 1, Class 2, or Class 3 according to the Montana SMZ law. Stream miles supporting HCP fish species within the action area and HCP project area for an individual AAU is reported in Appendix E of the Final EIS/HCP (2010) and summarized in Table IV-6 above.

Individual watersheds within AAUs will be affected differentially by DNRC's forest management activities covered under the DNRC HCP because of differences in geology; topography; timber types, existing upland and riparian vegetation conditions, existing roads, grazing management, land ownership patterns, stream flow patterns, floodplain connectivity, biological status of species populations and habitat utilization, and many other factors that could have an affect on watershed environs. For every watershed across the large landscape of the HCP Project Area that may be affected during the 50-year permit term, it is nearly impossible to

predict precisely how an individual action covered under the DNRC HCP (a programmatic plan) could change habitat or population baseline conditions for HCP fish species at a scale of an individual creek (generally referred to as 5th or 6th-field HUCs under USGS's watershed classification system). Furthermore, site-specific habitat and/or local fish population information is more often limited or unavailable at the stream reach scale or individual watershed scale (i.e., creeks, streams, rivers classified at the 5th or 6th field HUCs).

In lieu of analyzing effects of the DNRC HCP at the finer scale of the individual local population, and to provide consistency with the analysis in the Final EIS/HCP (2010) and DNRC HCP, the analysis in Part IV of this BO will focus primarily at the "core area" population scale (described earlier in section A) for bull trout, and similar scale, e.g. subbasins, for WCT and RBT. The bull trout core area population scale closely overlaps with 13 of 14 AAUs described in the Final EIS/HCP (2010). This scale is biologically meaningful and appropriate for bull trout because the AAU (with one exception) closely correlates to bull trout primary core areas, which typically represents a group of local populations that may be partially isolated, but have some degree of gene flow among them (i.e., interbreed) and is the closest approximation of a biologically functioning unit (USFWS 2002). Furthermore, core areas are the building blocks that provide for the conservation of the species, and therefore, the survival and recovery of bull trout relies heavily on the importance of core area populations and the necessary habitat conditions to support them (70 FR 56212 – 56311, September 26, 2005). Note however, the Upper Missouri AAU is the only analysis unit that is not a bull trout core area (i.e., no bull trout occur in this part of the HCP project area) and therefore only this unit will be referred to in Part IV of this BO document as an AAU, or subbasin, in order to avoid confusion.

Habitat Approach to Effects Analysis

Part IV of this BO is intended to determine whether implementation of the DNRC HCP is likely to decrease the size, number, dynamics, or distribution of HCP fish species populations in the action area in ways that would appreciably reduce the likelihood of their survival and recovery in the wild and whether the action might destroy or adversely modify critical habitat, for those species where critical habitat has been designated (e.g., bull trout). Analysis of the effects of the proposed action (issuance of a Permit to DNRC) is habitat-based–that is, the Part IV of this BO will analyze the likely effects of the DNRC HCP on HCP fish species habitat on the covered lands in the HCP Project Area. As suggested above, the most significant effects of the DNRC HCP on HCP covered species are through its influence on riparian processes and characteristics, forest hydrology, connectivity, sediment delivery, and hydrologic and geomorphic responses of stream systems. Effects of the DNRC HCP on HCP covered fish populations are more subtle, and difficult to predict. Therefore, effects of the DNRC HCP on HCP covered fish populations are considered in Part IV of this BO as consequences of habitat effects.

During the development of the DNRC HCP and Draft and Final EIS, DNRC and the USFWS conducted analyses of impacts to HCP fish species and their habitats in compliance with the federal public review process under the National Environmental Policy Act (NEPA) and the state public review process under MEPA. An analysis of impacts to HCP species and habitats is also required by DNRC for their HCP application. The results of the EIS analyses characterized the anticipated changes from the current baseline habitat conditions during the 50-year Permit

period. Some of these future changes to key habitat components were modeled by decade. The habitat-based approach used to describe potential impacts to HCP fish species is consistent and compatible with the type of analyses that would be conducted for the HCP and Part IV of this BO. This was an intended purpose of the EIS analyses in order to reduce redundancy. To a large extent, EIS data, analysis results, and information have been relied upon as a basis for validation of effects as well as for findings and conclusions of anticipated incidental take presented in this Part of the BO (Part IV). Much of this information and data has been directly excerpted from the Final EIS/HCP (2010).

The USFWS and DNRC used the best scientific and commercial data available for the EIS analysis in order to characterize potential changes to aquatic habitat conditions –including channel condition, hydrology, stream temperature, LWD, sediment, and physical barriers to migration–as well as the general condition of the watersheds that support populations of the HCP fish species. An underlying assumption of this analytical approach is that the HCP fish species could experience demographic changes (that is, changes in vital rates, population size, and distribution) commensurate with changes in these habitat-related variables, and that positive changes in the habitat variables will result in positive population trends. Thus habitat variables described above are used as surrogates or indices of HCP fish species population trends for purposes of analysis in Part IV of this BO.

The analysis in Part IV of this BO examines specific habitat characteristics of the DNRC HCP's core areas (bull trout) or subbasins (WCT and RBT) that are essential to supporting populations of the HCP fish species. These habitat characteristics have been derived from a synthesis of published reviews on the status and trends of native fish species in or near the action area, and must be present to ensure that watersheds function properly for native fish populations. They include stream temperature, sediment, LWD, habitat connectivity, and water quality/quantity (USDA et al. 1993, Gregory and Bisson 1997, Murphy 1995, MBTSG 1995a-e, MBTSG 1996a-f). These characteristics have been developed primarily from information on the habitat needs of bull trout, but will be treated as equally relevant to the other native HCP fish species considered in this part of the BO (Part IV). Although the presence of these characteristics does not assure the presence of bull trout or the other HCP fish species, bull trout populations are not likely to survive in a stream, or at best persist at very low levels, if these characteristics are absent or highly degraded. This is generally true for all the HCP fish species.

The following section addresses specific effects of forest, road, and grazing management actions proposed under the DNRC HCP on those individual habitat components most important to the HCP fish species, particularly bull trout. All three HCP fish species require aquatic habitat that is "cold, clean, complex, and connected." However, bull trout tend to have more spatially restrictive biological requirements at the individual and population levels, and may require greater protection of these important habitat components. For example, bull trout are among the most cold water adapted fish and require very cold water for incubation, juvenile rearing, and to initiate spawning. In addition, bull trout juveniles are strongly associated with the interstitial spaces in the substrate, which makes them especially vulnerable to effects of sediment deposition, and therefore requiring lowest fine sediment levels more so that other salmonids. Due to the bull trout's strict habitat requirements, the analysis in Part IV of this BO focuses on the specific habitat requirements for bull trout, with the viewpoint that the response of this

species to the changing habitat conditions would have a similar affect on the WCT and RBT. The analysis also addresses how the DNRC HCP would apply specific conservation measures to avoid or reduce potential adverse impacts to HCP fish species from DNRC's management activities. In addition, the analysis examines the results and likely effects of the HCP's adaptive management program in addressing biological uncertainty in the plan (e.g., changing status of the covered species through time, the effectiveness of the plans' conservation measures, etc.). Included in this analysis are summaries of the proposed habitat commitments and other components of the DNRC HCP. CWEs are described last and address effects on water quality/quantity.

Importance of the Role of Key Aquatic Habitat Components to HCP Fish Species

Stream Temperature

The HCP fish species are cold-water adapted salmonids that, behaviorally and physiologically, have adapted to the very complex temperature situations found in natural stream systems. Stream temperature influences their behavior, growth, metabolism, and habitat utilization. Salmonids like the HCP fish species can seek out localized cold-water sources such as deep stratified pools and areas with upwelling groundwater (Bilby 1984) or they can become inactive (Beschta et al. 1987). Growth and activity of salmonids increase with temperature up to some optimum and then decrease as the optimum is exceeded provided food supply is not limiting. As temperature drops, fish may move long distances to find suitable winter habitat.

Most fish have specific suitable and preferred water temperature ranges, and exhibit distinct responses to increasing or decreasing water temperatures within and outside of these preferred ranges. In general, decreasing water temperatures result in decreased feeding and metabolic rates, and a corresponding decrease in growth. In contrast, increasing temperatures tend to result in an increase in all three of these rates (assuming there is an adequate food supply). However, growth is substantially reduced near either end of the suitable temperature range, either because the metabolic rate is too low at low temperatures or all available energy is used for maintenance at high temperatures. Increasing stream temperatures result in changes in metabolism because higher temperatures require more energy to sustain increased rates and processes (Johnson and Jones 2000). Conversely, as food availability decreases, optimal temperature for a species like bull trout decreases (lower temperatures require less energy to sustain metabolic rates and processes) (McMahon et al. 1999).

The HCP fish species are cold-water fish species that tend to have narrower overall suitable temperature ranges, as well as narrow preferred temperature ranges, than warm- or cool-water species. Thus, they are typically sensitive to relatively small temperature changes. They can exhibit behavioral or habitat utilization changes as a result of increasing or decreasing temperature patterns (Bjornn and Reiser 1991), although in many cases such behavioral changes may have a greater association with overall seasonal changes than just temperature. In particular, freshwater salmonids often change habitats or behavior between summer and winter. While stream temperature is likely an important factor, other influential parameters likely include changes in streamflow, food availability, and day length.

Stream temperature also influences egg incubation rates and the corresponding fry emergence timing of these HCP fish species. Depending on their extent, such changes could affect fry survival rates either positively or negatively. For example, changes in emergence timing might subject fry to environmental conditions (i.e., flow conditions) that increase or decrease survival, or to different competition or predation forces. In more extreme conditions, stream temperature can affect the available fish rearing habitat. Decreased temperatures in the winter can result in deeper and longer ice-over conditions, while warmer summer temperatures can exclude some fish species from using a particular habitat area.

Daily and seasonal stream temperatures are influenced by elevation, shade, water sources, streamflow, stream velocity, surface area, depth, undercut embankments, organic debris, and surface and ground water inflow (Allen 1995). While natural climatic variations result in daily, seasonal, and annual changes in stream temperature, habitat alterations and land use characteristics can increase the magnitude of these natural variations. In response to natural climatic variations, the magnitude of water temperature fluctuations is affected by riparian condition, stream size, and water volume. As a result, stream temperature variations tend to be greatest in small streams during low-flow periods, particularly where riparian shade is limited.

A loss or decrease in riparian vegetation diminishes the amount of shade available to block incoming solar radiation. Reductions in riparian vegetation can result in increased stream temperatures during the summer from increased solar radiation reaching the water surface, but decreased temperatures in the winter due to the reduced insulating capacity of the riparian zone. In winter, riparian canopy cover may help moderate water temperatures by inhibiting energy losses through evaporation, convection, and long-wave radiation (Beschta et al. 1987).

The effectiveness of riparian vegetation to provide adequate shade generally depends on the structure and species composition of the riparian vegetation zone. Brown (1971) noted that on very small streams, adequate shade may be provided by brush species. However, brush species provide increasingly less benefits as stream size increases. Taller vegetation is required to provide adequate shade for larger rivers and streams. Riparian species composition also affects the regulation of stream temperature. While deciduous riparian vegetation might provide adequate shade in the summer, the winter insulating capacity might be reduced as a result of leaf loss in the fall.

Groundwater entering streams (especially small streams) may be an important determinant of stream temperatures (Spence et al. 1996) or may provide localized thermal refugia in larger stream systems. Where groundwater flows originate above the neutral zone (generally, 52 to 59 feet below the surface) groundwater temperatures will vary seasonally, as influenced by air temperature patterns (Spence et al. 1996). Chen et al. (1995) suggested that daytime and nighttime temperatures range more in areas where logging has altered streamside cover. He reported that nighttime temperatures decrease and daytime temperatures increase in these situations, which implies that wider air temperature fluctuations could negatively affect fish survival and health (Thomas et al. 1986; Sullivan 1990) found that air temperature had a stronger influence on stream temperature than shade, and that shade alone may not maintain stream temperatures. Maintenance of groundwater and air temperature may be necessary. Chen et al. (1995) and Sullivan (1990) observed elevated maximum air temperatures at stand margins which

indicated that changes in air temperatures in riparian stands can have an affect on stream temperatures and riparian buffer widths may be inadequate if they do not maintain appropriate air temperatures.

Caldwell et al. (1991) found that small streams are very responsive to localized conditions and are influenced by air temperature and shading characteristics, groundwater flow and water temperature, and elevation. Caldwell (1991) reported water temperatures from small tributaries entering larger streams had minimal influence on downstream water temperature. Stream temperatures equilibrate with downstream conditions and the influence from headwater stream temperature increases generally extends only about 500 feet. However, this study has been criticized in that it was not designed appropriately; assumptions were "demonstrably unfounded"; and that the conclusion that stream temperature equilibration takes place over 500 feet is groundless. Using Caldwell's data, when analyzed appropriately, shows equilibration would take place over a distance of 3,600 feet (American Fisheries Society and the Society for Ecological Restoration 2000).

The amount of influence riparian vegetation may have on stream temperatures is dependant on multiple factors including the size of the stream, water depth, groundwater inputs, riparian vegetative community, length of stream channel shaded, slope, aspect, and region. By altering the thermal regime of streams, reductions in streamside shade may also cause undesirable changes in primary production and fish metabolism, development, and behavior (Beschta et al. 1987). The loss of riparian vegetation and cover can also indirectly influence the thermal environment (local wind patterns, local air temperatures, humidity, conductive and convective heat transfer, outgoing or long-wave radiation), soil temperature, sediment delivery, base flow (and possibly hyporheic exchange), and large wood recruitment (IMST 2004).

It is well established that stream temperature is a critical habitat characteristic for bull trout. Bull trout require a narrow range of cold temperature conditions to reproduce and survive and are regarded as having one of the lowest temperature tolerances among North American salmonids (Selong et al. 2001; Bonneau and Scarnecchia 1996; Goetz 1977). Stream temperature can affect production, limit bull trout distribution and exacerbate habitat fragmentation (Rieman and McIntyre 1993; Fraley and Sheppard 1989). Bull trout are found primarily in colder streams and prefer colder water temperatures than other salmonids (McMahon et al. 1999; McCullough 1999; Rieman and Chandler 1999). Spawning areas are often associated with cold-water springs, groundwater infiltration, and the coldest streams in a given watershed. Goetz (1989) surmised that optimum water temperatures for rearing juvenile bull trout is about 44-46 °F. Juvenile bull trout were found to select the coldest water available in a plunge pool (63 FR 31647) and in the North Fork of the Malheur River, Oregon adult bull trout were found at the mouths of coldwater tributaries only when water temperatures exceeded 70 °F (Buckman et al. 1992). Frissell (1999) inferred the thermal regime, either during summer or winter, is the proximate habitat factor limiting bull trout distribution and abundance. Although adult bull trout do occur in streams that warm to 68-70 °F, these temperatures likely approach the upper limit of desired rearing and holding conditions for these fish. Consequently, environmental stress probably becomes more of a factor as water temperature increases. In a laboratory setting, McMahon et al. (1999) found

optimum bull trout growth occurred between 53.6 °F and 60.8 °F, and that the upper incipient lethal temperature for bull trout was 69.8 °F.

Similar to bull trout, WCT and RBT require cold water temperatures and that may vary according to life cycle stages. The optimum stream temperature for WCT ranges between 45 °F and 62 °F (spawners, fry, juvenile, subadult) (Young 1995). For inland WCT spawning occurs at stream temperatures close to 50 °F and predominantly in small tributaries in the headwaters and upper reaches of river systems (Young 1995). In the St Joe River in Idaho most downstream migrating WCT moved at night after stream temperatures had declined below about 59 °F (Young 1995). Habitats of historic stocks of WCT ranged from cold headwater streams to warmer, mainstem rivers (Shepard et al. 1984; Behnke 1992). Today, remaining stocks of WCT occur primarily in colder, headwater streams (Liknes and Graham 1988). WCT may exist in these streams not because the thermal conditions there are optimal for WCT, but because nonnative salmonid competitors like brook trout cannot exploit these cold, high-gradient waters (Griffith 1988; Fausch 1989).

The potential for riparian vegetation to mediate stream temperatures is greatest for small to intermediate size streams and diminishes as streams increase in size lower in the floodplain (Spence et al. 1996). Generally, small and intermediate streams represent the majority of total aggregate stream length within a watershed (Chamberlain et al. 1991). Given these relationships, maintaining adequate canopy conditions on small and medium sized streams (including intermittent streams) is necessary to avoid altering stream temperature regimes suitable for bull trout, WCT, and RBT.

Sedimentation

Everest et al. (1987) indicated that the effects of deposited fine sediments on salmonid production in a given stream are a complex relationship among many variables that precludes generalization about effects of sediment on salmonid production. Natural hillslope and channel processes that involve surface erosion and mass wasting are the two major forms in which fine sediment is delivered to stream systems on forested landscapes (Swanston 1991, Cedarholm et al. 1981, Everest et al. 1987). When excessive levels of fine or coarse sediments are deposited or suspended in streams survival and production of salmonids can be adversely affected. As deposition of fine sediments in salmonid spawning habitat increases, mortality of embryos, alevins, and fry increases (Chamberlain et al. 1991).

It has been well established that high levels of deposited sediments in spawning gravels (12 to 20 percent, typically) can increase mortality of salmonid eggs and alevins by reducing waterflow through spawning gravel, which can suffocate eggs, and by preventing fry from emerging from the gravel. Levels of fine sediment in streambed gravels have been negatively correlated with salmonid embryo survival (Cedarholm et al. 1981; Tappel and Bjornn 1983) and the quality of juvenile rearing habitat (Bjornn et al. 1977). Weaver and Fraley (1991) observed an inverse relationship between the percentage of fine sediment in substrates and survival to emergence of bull trout embryos. Entombment was the major mortality factor in these tests. Densities of juvenile bull trout were found to be lower in areas of high sediment levels and cobble embeddedness (MBTSG 1998). Because of their close association with the substrate, juvenile

bull trout distribution and rearing capacity are affected by sediment accumulations (Baxter and McPhail 1997). Pools, which are an important habitat feature for cover and security for bull trout and other salmonids, may also be lost due to increased levels of sediment (Megahan 1982).

All salmonid eggs are susceptible to suffocation from the accumulation of fine sediments in spawning gravel; however, Bjornn and Reiser (1991) report that WCT trout eggs were more sensitive than those of rainbow trout, kokanee trout, steelhead trout, or Chinook salmon. They also report that accumulations of 10 percent fine sediment reduced cutthroat trout embryo survival to about 80 percent of gravels without fine sediments (range 65 to 90 percent), while 17 percent fine sediments reduced embryo survival to approximately 55 percent (range 15 to 75 percent). Shepard et al. (1984) report abrupt increases in incubation mortality in streams with 30 percent fine sediments and 100 percent mortality with 50 percent fines or higher.

Increases in suspended sediment can affect salmonids in several ways. Sub-lethal behavioral effects of suspended sediment on salmonids include habitat avoidance and subsequent effects on fish distribution (Cedarholm and Reid 1987; Servizi and Martens 1991), reduced feeding and repressed growth rates (Newcombe and MacDonald 1991), respiratory impairment (Servizi and Martens 1991), reduced tolerance to disease and toxicants (Goldes et al. 1988), and physiological stress (Servizi and Martens 1991). Harvey and Lisle (1998) reported that slight elevations in suspended sediment may reduce feeding efficiency and growth rates of some salmonids and high concentrations of suspended sediment can affect survival, growth, and behavior of stream biota. At high concentrations, fish may cease feeding completely (Sigler et al. 1984) or may avoid high concentrations of suspended sediments altogether (Hicks et al. 1991). Even temporary spikes of suspended sediment may negatively affect salmonid behavior and may be lethal (Hicks et al. 1991). In addition, social behavior may be altered by suspended sediment (Berg and Northcote 1985). Suspended sediment may alter food supply by decreasing abundance and availability of aquatic insects; however, the precise thresholds of fine sediment in suspension or in deposits that result in harmful effects to benthic invertebrates are difficult to characterize (Chapman and McLeod 1987).

Noggle (1978) reported that extremely high concentrations of suspended sediments can cause fish mortality through gill abrasion. Furthermore, he observed that feeding rates of coho salmon decreased when turbidity levels reached certain thresholds. Turbidity is usually a near-linear function of suspended sediment such that as turbidity increases concentration of suspended sediment increases in proportion (Bash et al. 2001). Coho salmon were observed avoiding excessive turbidity levels when less turbid water was easily accessible (Bisson and Bilby 1982). Also, coho salmon were noted to increase their tendency to migrate when reared in turbid water (Sigler and Bjornn 1980). Sigler and Bjornn (1980) observed an inability of smaller coho fry reared in turbid water to compete for food and space with their larger cohorts reared in clear water.

Distance of prey capture and prey capture success were found to decrease significantly when turbidity was increased (Berg and Northcote 1985). Waters (1995) stated that the loss of visual capability leading to reduced feeding is one of the major sub-lethal effects on fish of high suspended-sediment levels. Increases in turbidity was reported to decrease the percentage of prey captured (Bash et al. 2001). At 0 NTUs, 100 percent of the prey items were consumed; at 10

NTUs, fish frequently were unable to capture prey species; at 60 NTUs, only 35 percent of the prey items were captured. At 20 to 60 NTUs, significant delay in the response of fish to prey was observed. Loss of visual capability and the ability to capture prey leads to depressed growth and reproductive capability.

Downstream migration by bull trout provides access to more prey, better protection from avian and terrestrial predators, and alleviates potential intraspecific competition or cannibalism in rearing areas (MBTSG 1998). One of the benefits of migration from tributary rearing areas to larger rivers or estuaries is increased growth potential. However, increased sedimentation may result in premature or early migration of the juveniles and adults, avoidance of habitat, and migration of non-migratory, resident bull trout. Migration exposes fish to many new hazards, including passage of sometimes difficult and unpredictable physical barriers, increased vulnerability to predators, exposure to introduced species, exposure to pathogens, and the challenges of new and unfamiliar habitats (MBTSG 1998). High turbidity may delay migration back to spawning sites by interfering with cues necessary for orientation, although turbidity alone does not seem to affect homing. Delays in spawning migration and associated energy expenditure may reduce spawning success and, therefore, population size (Bash et al. 2001).

Among some populations of WCT, habitat degradation seems to exacerbate problems associated with coarse and fine sediment inputs into streams in the belt geologies where roads are prevalent (Rieman and Apperson 1989). Thurow (1987) found that the number of WCT in surveys of the South Fork Salmon River, Idaho, was negatively correlated with measures of substrate embeddedness due to increased levels of sedimentation. Irving and Bjornn (1984) observed a substantial reduction in incubation or emergence survival with increased fine sediment. Muhlfeld's (1999) research on RBT in northwest Montana showed that cover and depth of pools is critical for conservation of RBT and that land-use practices like road construction could cause sediment delivery to RBT occupied streams resulting in a reduction in pool depth thus decreasing winter survival.

Habitat Complexity/ Large Woody Debris

LWD is one of the most important components of stream habitat for fish populations, of stream hydrology and stream hydraulics, and of stream channel morphology. Stream habitat complexity is often associated with LWD abundance, as wood contributes to the formation of high-quality aquatic rearing habitat (Stouder et al. 1997). Pristine watersheds tend to consist of complex hydraulic conditions (pools, riffles, and side and braided channels) and habitat elements (LWD, undercut banks, variable substrate sizes, and accumulated organic matter). The importance of LWD varies within watersheds, within individual streams, and within individual areas or reaches of streams.

Channel stability, form, and function are also directly related to habitat complexity. Channel forming processes are not only the primary factor in the formation of in-stream habitat units (e.g., pools and riffles), but also influence lateral and vertical channel migration, in-stream sediment mobilization, transport, and deposition, bank stability and erosion, floodplain connectivity, and the riparian habitat of stream systems.

LWD consists of large tree trunks and stems or root wads that fall into stream channels due to natural deterioration (i.e., disease and insect infestation), windthrow, and bank failure. In stream LWD dissipates hydraulic energy during high-flow periods, develops and maintains in stream habitat features (i.e., pools and gravel bars), stabilizes streambeds and stream banks by minimizing scour and erosion, and provides excellent habitat and cover diversity (Stouder et al. 1997). The effective size of LWD varies by stream width, with larger streams requiring larger wood to sufficiently alter hydrologic conditions enough to affect habitat (Meehan 1991; Overton et al. 1997).

Woody debris occurs in the aquatic environment in multiple sizes, as single pieces, or as complex jams within the floodplain, within the channel migration zone (CMZ), and within the immediate stream channel. Literature suggests that there are distinctive spatial patterns of LWD, pools, gravel bars, and forested islands that form in association with particular wood jam types (Abbe and Montgomery 1996). Certain LWD, termed "key members" or key pieces, initiate the formation of stable bars and meander jams that alter the local flow hydraulics and the spatial characteristics of scour and deposition leading to pool and bar formation (Abbe and Montgomery 1996). Individual jams can be very stable helping to provide refugia for forest patch or stand development (Abbe and Montgomery 1996). It is important to note that different sizes of wood respond differently in the stream channel and on the floodplain creating very different types of fish and aquatic habitat.

The size and species or type of wood determines the abilities of the wood to perform the functions above. In general, the larger the size of LWD the greater its stability in the stream channel. Coniferous trees exhibit greater longevity in the stream than deciduous trees (Spence et al. 1996; Bilby and Ward 1989). Some studies in western Washington suggest that the diameter, length, and volume of pieces of wood were greater in mid-order streams than in low order streams. In other words, as the width of the stream increases so does the diameter, length, and volume of LWD (Bilby and Ward, 1989). Generally, LWD is large enough to span the entire channel forming a longitudinal profile that creates the formation of plunge pools and increases pool habitat complexity, reduces stream gradients, and increases stream depth for important for overwinter habitat and cover.

Two primary factors influence the amount of LWD recruitment within a given stream, the size (width) of the stream and the width of the adjacent riparian buffer (Murphy and Koski 1989; Robison and Beschta 1990; McDade et al. 1990; Thomas et al. 1993). Riparian vegetation exerts a greater influence on small streams, where LWD is not easily transported. As a result, individual pieces can greatly influence channel morphology, in-stream cover, food resources, and sediment transport (Knutson and Naef 1997). As stream size increases, the influence of riparian vegetation and individual LWD decreases, while the role of logjams (affected by a river's supply and type of LWD) increases.

Wood enters streams either directly from riparian areas or from hillslopes or upland areas. Both conifer and deciduous tree vegetation located in both the uplands and riparian areas can become LWD. Thomas et al. (1993) observed that effectiveness of upland forest to deliver large wood to the riparian areas and stream channel is naturally expected to decline at distances greater than one tree height from the stand edge (USDA et al. 1993). The introduction of wood from riparian

areas occurs from trees falling as they die, are knocked down, or are undercut by streamflow and stream debris (Spence et al. 1996).

The introduction of wood from hillslopes occurs from windstorms, mass slope failures, and debris and ice torrents (Spence et al. 1996; Keller and Swansen 1979). Wood is also introduced into streams from snow avalanches and ice loading (Keller and Swansen 1979). LWD provides long-term nutrient storage and substrate for aquatic invertebrates (Spence et al. 1996). It moderates flow disturbances and increases retention of water and nutrients and facilitates biological processing (Spence et al. 1996). Hicks et al. (1991) indicated that the abundance of salmonids is often closely linked to the abundance of woody debris, particularly in winter. LWD provides refugia for aquatic organisms during high and low flow events (Spence et al. 1996) and creates a diversity of hydraulic gradients while increasing microhabitat complexity supporting the coexistence of multi-species salmonid communities (Hicks et al. 1991). LWD retains gravels behind logs creating spawning areas for fish that are essential for spawning salmonids (Benda and Sias 1998). Larger debris dams retain fine sediment, acting similar to a filter, reducing the rate of sediment transport downstream, which could degrade spawning habitat (Spence et al. 1996). Pools (lateral, scour, plunge, backwater, pocket) formed in association with wood provide for complex habitat and function as rearing and feeding areas for fish in the summer and as critical low-velocity and thermal refuge in the winter (Benda and Sias 1998; Bisson et al. 1987).

Wood formed pools may also provide an avenue for flow regimes that enhance stream temperatures. Pools force or plunge water down into the substrates to percolate into the hyporheic zone. Once flows enter the hyporheic zone beneath the substrate it may be cooled and may reenter the surface flow as a spring or a seep. This source of cool water seems to be important for spawning bull trout and other salmonids. Pool tail outs, undercuts areas beneath logs, and areas along pool edges where gravels have been deposited because of the pool formation associated with woody debris, are important spawning areas for bull trout. The importance of these pools and woody debris jams for bull trout is high because adfluvial /fluvial bull trout are known to migrate long distances, from larger river systems and lakes to use these types of habitats. These pools and woody debris jams are used for spawning habitat in the upper reaches of mainstem rivers and smaller tributaries in both low and high gradients. In the long-term the loss of LWD in the stream channel reduces the retention of spawning gravels, the frequency of pools, the habitat complexity necessary for cover and productivity and the structure necessary for natural energy dissipation to maintain stream channel function.

Wood is important in creating refugia for fish and other aquatic species. In small streams, wood plays a major role in creating invertebrate habitat by creating a step-pool profile of habitats, enhancing habitat heterogeneity, retaining organic matter, and changing current velocity (Benke and Wallace 2003). Nearly all wood within stream channels has the capacity to influence habitat. Large wood oriented perpendicular to the thalweg is often associated directly with pool formation (Cherry and Beschta 1989; Hauer et al. 1999). Depending on the characteristics of the stream channel and the size and type of wood, LWD can persist and create habitat diversity for a period of months to centuries (Bilby and Likens 1980).

A major role of LWD is the creation and maintenance of deepwater pool habitat for the HCP fish species (Dolloff and Warren 2003). Pools and other habitats associated with LWD are important

to these fish because they provide lower water velocities and greater depths associated with pools during low-flow periods. In general, trout species as well as drift feeding minnows inhabit areas with lower water velocities, while making feeding forays into faster water (Matthews 1998). Pools can harbor more and larger fish than shallower areas because the greater volume of habitat available, particularly during periods of low-flow streamflow.

Large wood and complex habitat create sediment storage sites, which contribute to food production (macroinvertebrates) and the formation of fish spawning areas. Wood also affects in-stream biological functions such as facilitating primary production by providing attachment sites for microbes and algae, sources of nutrients, and storage areas for organic matter. Wood also enhances secondary production in ways such as increasing surface area available to macroinvertebrate grazers and scrapers (Benke et al. 1985).

Habitat complexity provides cover, including security from predators, isolation from competitors, and points of refuge from severe environmental stresses. The shadow provided by wood helps hide fish from predators, as well as aiding in seeing approaching predators (Harvey and Stewart 1991). Complexity is particularly important for aggressive species like salmonids, which do not tolerate other fishes near them.

The HCP fish species, and especially bull trout, are strongly associated with various components of habitat complexity, including cover, large wood, side channels, undercut banks, boulders, pools, and interstitial spaces in coarse substrate (Rieman and McIntyre 1993; Jakober 1995; MBTSG 1998). Bull trout of all age classes are closely associated with cover, especially during the day (Baxter and McPhail 1997, Fraley and Shepard 1989). Bull trout distribution and abundance is positively correlated with pools; complex forms of cover such as large or complex woody debris and undercut banks; and coarse substrates (cobble and boulder) (Rieman and McIntyre 1993, Jakober 1995, MBTSG 1998). WCT and RBT are strongly associated with cold, often nutrient-poor, high-gradient waters having pools and cover (Shepard et al. 1984; Pratt 1984; McIntyre and Rieman 1995, Quigley and Arbelbide 1997, Thurow 1990). Stream shading/riparian buffers, clean spawning gravels, low levels of fine sediments, backwaters, undercut banks, and LWD all contribute to cold water temperatures, formation of pools, provide cover, and/or support different WCT and RBT life stages.

Habitat Connectivity/Fish Passage

Migratory corridors allow individual fish access to unoccupied but suitable habitats, foraging areas, and refugia from disturbances (Saunders et al. 1991). Although habitat connectivity is important for many fish species, it is particularly important to migratory fish species. Species that utilize or require uniquely different habitat characteristics for various life stages are prone to substantial impacts if access to these habitat areas is blocked or restricted. For example, salmonids typically occupy different habitats for spawning, juvenile rearing, and adult rearing. Sometimes these habitat requirements necessitate the movement of fish between a lake environment and a riverine environment. Disruption of migratory corridors can increase stress, reduce growth and survival, and potentially lead to the loss of the migratory life-history types (Rieman and McIntyre 1993). The blockage of fish from any of these habitats could lead to unsuccessful spawning, increased predation, or reduced growth or survival rates.

In addition to these regular life history requirements, accessibility of different habitats can protect fish populations from unusual or catastrophic events. For example, allowing fish to move to larger waterbodies during severe drought or to avoid excessive temperature increases after the destruction of riparian vegetation by fire might encourage survival. This function allows fish to leave their preferred habitat for short periods of time, but return or re-populate the area when appropriate habitat conditions return. Connectivity also facilitates fish species to maintain the genetic integrity to adapt to changing environmental conditions.

Migratory corridors provide the necessary connection between bull trout spawning, juvenile rearing, sub-adult rearing, and adult over-wintering and foraging areas (Rieman and McIntyre 1993). Maintenance of migratory corridors for bull trout is essential to provide connectivity among local populations, and enables the re-establishment of extirpated populations (USFWS 2004). Where migratory bull trout are not present, isolated populations cannot be replenished when a disturbance makes local habitats unsuitable (Rieman and McIntyre 1993). Limited downstream movement was observed for resident bull trout in the Bitterroot River basin in Montana (Nelson et al 2002), suggesting that re-establishment of migratory fish and potential refounding of extirpated bull trout populations may be a slow process, if it occurs at all (USFWS 2004).

In addition to protecting fish populations by allowing the migration or movement between various habitats, protection can also be provided by blocking migration and movement of other fish species (particularly invasive, non-native species). For example, eastern brook trout are known to hybridize, compete with, and even prey upon bull trout. Maintaining a barrier to prevent the movement of brook trout into a stream reach occupied by bull trout populations can be an effective method of protecting bull trout populations from these potential impacts.

Fish movements may be blocked fully for all fish species and age classes, or fish movements may be impeded fully or partially for certain species and/or age classes depending on the type and timing of the obstruction or barrier. Generally, culverts can impede passage in three different ways: water velocity barriers, depth barriers and/or vertical jump barriers (Bell 1991; Bates 1997; Barber and Downs 1996). Different species and sizes of fish have different swimming abilities. Healthy adult fish swim more strongly than juvenile fish and can pass upstream through a culvert with less difficulty. If the culvert is too long, a fish may become exhausted while attempting to swim all the way through. If the velocity of water in the culvert is too great, a fish will not be able to swim fast enough to overcome it (Bell 1991).

In general, it is necessary to provide bull trout access to a large, connected, high quality, freshwater habitat that includes cool temperature, deep pools, large wood, low substrate embeddedness, unimpaired flow regime and channel floodplain interactions. Migratory barriers such as culverted-road crossings can result in isolated populations and habitat fragmentation negatively affecting bull trout in several ways. These may include: 1) reducing geographic distribution, 2) increasing the probability of losing individual local populations, 3) increasing the probability of hybridization with introduced brook trout, and 4) reducing reproduction by eliminating the larger, more fecund migratory life-history form from local populations (USFWS 2004).

In western Montana, fluvial WCT are migrating during peak spring flows, usually during May and June. This migration is influenced by water temperature. Resident cutthroat trout have shorter migrating distances than bull trout and will move in relation to spawning, temperature, and winter habitat. Fluvial bull trout migrations are similar to the fluvial WCT but move primarily on the descending limb of the hydrograph, during the months of June and July. There also appears to be a mid-summer (July/August) run of juvenile bull trout into smaller streams. This secondary migration is believed to be driven by increasing water temperatures within mainstem rivers (Hendrickson 2000).

Based on the migration and spawning timing, it is recommended that passage for WCT and bull trout be accounted for during May, June, July, and August in western Montana (Hendrickson 2000). Resident fish may be moving at other times of the year, but typically if fluvial migration is provided, resident fish can pass through the culverts as well. At times where flow depths are not sufficient, typically resident fish are holding in pools or between rib formations, and are not moving around anyway. There is concern if a stream does not have overhead tree cover and winter icing becomes a problem that cutthroat can not migrate down to larger waters during the winter. However, if culverts have stream substrates through them, or simulated substrates, they will mimic stream conditions and cutthroat trout should be able to move downstream through the culvert (Hendrickson 2000).

Culverts that are installed with a perched outlet or culverts that cause erosion at the outlet due to inadequate sizing often are characterized by increased pipe velocities which cause scour and a perched condition. This in turn can lead to a vertical barrier. On the Lolo National Forest it is recommended to design new culverts without a vertical jump by placing the culvert on the average natural stream gradient. Also recommended is that existing culverts should be assessed to determine if the water velocity within the pipe is more of a limiting factor than the vertical jump itself. Culverts that are designed for adequate flow, and for bedload and debris passage, and installed on a natural stream gradient would be expected to eliminate the vertical jump problem (USFS memo dated January 6, 2000, between the Forest Fish Biologist and Forest Hydrologist, Lolo National Forest).

In western Montana, reductions in flows below irrigation diversions can create seasonal passage barriers for bull trout (MBTSG 1998). In the Bitterroot River sub-basin in Montana, water diversions have virtually eliminated migratory bull trout (Rieman and McIntyre 1993). Diversion dams for irrigation withdrawal of water from forest streams and rivers often impede migration of adult fish or cause juveniles to be diverted into irrigation ditches (Spence et al. 1996). The diversion dam structure which often spans the entire channel can create vertical drops that may be an impassable barrier to fish (MBTSG 1998).

Irrigation water withdrawals can affect both the total volume of water available to fish and the seasonal distribution of flow. Most direct diversions from streams and rivers occur from spring through fall which results in reduced summer flows for fish movements. Lower water levels may concentrate fish, which potentially increases predation and competition for food and space. Reduced water volume and velocities can cause increased water temperatures which may become excessively warm and delay or impede migrations and fish movement into suitable habitat.

Adult bull trout may be blocked from entering into spawning tributary streams during late summer which is a time when reduced stream discharge rates can create thermal barriers to migration. Furthermore, downstream migrating juveniles tend to follow stream margins and commonly get entrained at diversion headgates because they are located along the stream perimeter. Ditches often divert the majority of water from streams and may resemble off-channel habitat which may attract fish into the irrigation ditch (MBTSG 1998).

WCT often move in response to seasonal changes in habitat conditions and habitat requirements and therefore some populations depend on connected habitats to fulfill their life requisites (USFWS 1999b). Fluvial and adfluvial WCT have been shown to migrate more than 62 miles in response to habitat needs (Bjornn and Mallet 1964; Liknes 1984). For example, there can be considerable movement to suitable pools used as overwintering habitats (Brown and Mackay 1995). Among resident WCT in tributaries, less extensive, seasonal movements may be made in response to changing habitat requirements and conditions, particularly water temperatures. WCT may move relatively little in stream reaches that have numerous pools (Peters 1988), whereas movement can be more extensive in stream reaches with few pools (Lewynsky 1986; Peters 1988; McIntyre and Rieman 1995).

Cumulative Watershed Effects

CWE in the context of watershed conditions that impact water quality and quantity are the collective impacts on the watershed resource features that affect the aquatic environment. Such features include: water yield, flow regimes, channel stability, and in-stream and upland sedimentation due to surface erosion and mass wasting. CWE also refers to existing watershed conditions, relative to additional risks associated with land use management activities on specific in-stream habitat elements, including temperature, sedimentation, and habitat complexity.

Water quantity (hydrologic regime) and water quality (physical and chemical constituents) are important components of aquatic habitats (USDA and USDI 2000) that are affected by activities that alter watershed outputs. The USDA and USDI (2000) reported that at a broad scale within the Interior Columbia River Basin (east of the Cascades' crest), water quantity (surface water volume and flow) has been affected by road construction and vegetation changes associated with silvicultural practices, livestock grazing, and agriculture. These activities also can affect water quality by contributing to increased sediment loads, water temperatures, and nutrient and contaminant levels. The USFWS (1998a) reported that within the Columbia River Basin, many subpopulations of the Columbia River DPS of bull trout are threatened by impaired water quality. Changes in water quantity and quality resulting from forest, road, and range management practices can potentially adversely affect fish habitat. Soil and site disturbances from timber harvest activities can cause changes in water quantity and quality and potentially the modification and destruction of aquatic habitats (Quigley and Arbelbide 1997).

Many of the adverse effects on water quantity and quality can result from improper forest, road, and range management practices. These effects can cumulatively alter and degrade aquatic and riparian habitat for resident and migratory native salmonids. These changes can negatively affect fish migration, spawning, incubation, emergence, and rearing success through various factors, such as increased peak flows, channel scour, changes in seasonal base flows, and the presence of contaminants (USDI and USDA 2000, Quigley and Arbelbide 1997).

Analysis of Effects of the Action and Species Response to Proposed Action

This section assesses the specific effects that implementation of the covered activities could have on the important habitat parameters for covered HCP fish species - stream temperature, sedimentation, habitat complexity (i.e., LWD recruitment), connectivity as well as CWEs. The evaluation focuses on those conservation measures that are intended to avoid or minimize specific adverse impacts that are commonly associated with forest and grazing management activities on HCP covered fish species and their habitats. This section presents a general discussion of the effects of the DNRC covered activities on the subject habitat component followed by a discussion of the DNRC minimization and mitigation measures to be implemented under the HCP. A detailed description of the DNRC HCP covered activities is provided in Part I Section C of this BO. Also, the role of adaptive management is examined and how the DNRC HCP commitments in this process would monitor, measure, and evaluate the potential habitat changes that can reasonably be anticipated in the future, and how results of this process may trigger changes to HCP prescriptions if warranted. In essence, the adaptive management process provides an additional degree of assurance about the effectiveness of the HCP measures especially regarding those measures where confidence about meeting the biological objectives would benefit from the added certainty. The anticipated effects of HCP implementation are discussed as well as the effect on the evaluation area for the affected species (i.e., core area/AAU). Finally, for each habitat parameter a summary of the overall effect is provided.

Analysis of Effects on Stream Temperatures

General Effects of Forest, Road, and Grazing Management Activities on Stream Temperature
In general, forest management activities can influence stream temperature by causing changes in riparian vegetation, channel morphology, hydrology, and surface/subsurface interactions (IMST 2004). These changes can result in temperature increases in streams due to the following: 1) reduction in canopy cover, 2) increased coarse and fine sediment delivery to stream channels, which can lead to channel widening and loss of pools, 3) reduction in large wood, which result in reduction of pools, reduced channel capacity, and loss of thermal buffering and coldwater refugia, 4) increased heating of riparian soils, 5) interception of shallow groundwater by road systems, 6) increased air temperature over streams by loss of microclimate buffering, 7) riparian roads, which reduce the interaction of the floodplain with the channel, 8) loss of off-channel wetlands due to reduction in shading, 9) loss of streambank stability due to streamside harvest, leading to increased sediment delivery and channel widening, and 10) increase in basin-wide sediment delivery due to forest-related road systems, leading to pool loss and channel widening (Beschta et al. 1987; Brosofske et al. 1997; Johnson and Jones 2000; IMST 2004).

Forest Management – The importance of streamside cover to fish is well-documented. Trees and shrubs provide shade, one of the most important regulators of temperature in small streams, and shade removal can increase temperatures significantly. Beschta et al. (1987) summarized studies of stream temperature changes associated with canopy removal over small streams and found an increase of daily maximum temperatures in summer that ranged from a few degrees in Alaska streams to more than 50°F in Oregon streams. Temperatures were reduced by 12°F where a nonforested stream meandered through 400 feet of mixed shrub and forest cover (Skovlin 1984). Skovlin (1984) suggested that restoring streamside shade could reduce

temperatures by 6 to 12°F, depending on stream conditions and temperatures. Streams with greater than 75 percent stream shade maintained acceptable stream temperature levels for rainbow trout and chinook salmon, with lowest temperatures found in streams within ungrazed watersheds (Maloney et al. 1999).

Timber harvest has the potential to affect stream temperatures primarily through reducing streamside canopy levels, although canopy closure is only one contributor to stream shading. There are other factors including the latitude of the stream, stream geomorphology, local topography, and stream channel orientation. The potential for riparian vegetation to mediate stream temperatures is greatest for small to intermediate size streams and diminishes as streams increase in size lower in the floodplain (Spence et al. 1996). Generally, small and intermediate streams represent the majority of total aggregate stream length within a watershed (Chamberlain et al. 1991). Given these relationships, maintaining adequate canopy conditions on small and medium sized streams (including intermittent streams) is necessary to avoid altering temperature regimes suitable for native salmonids.

Harvesting timber in riparian zones, particularly the area adjacent to stream margins, can remove shading allowing greater sunlight penetration, surface water warming, and winter ice formation (Beschta et al. 1987; Chamberlain et al. 1991). The temperature increase in a stream is directly proportional to the area exposed to sunlight and inversely proportional to the volume of water in the stream. The effect of canopy removal on stream temperatures is greatest for small streams and diminishes as streams get wider (Sugden et al. 1998). Consequently, small streams respond faster to changes in canopy cover than larger streams (Sugden et al. 1998). Because Rosgen A and B channels have substantially narrower wetted channels than Rosgen C, D, and E channels, the riparian canopy has a greater influence on the stream temperatures than it does on streams and rivers with large wetted widths, where upstream conditions generally controls stream temperatures. During winter, riparian vegetation can moderate stream temperatures and prevent excessive stream cooling. In the absence of riparian vegetation, stream margins may freeze too rapidly or too extensively creating “anchor ice,” a condition in which ice melds to gravel and soil and mechanically uplifts during subsequent thaws. Bank erosion and inputs of sediment may follow this stream condition (Swanston 1991).

Chen et al. (1995) suggested that daytime and nighttime temperatures range more in areas where logging has altered streamside cover. He reported that nighttime temperatures decrease and daytime temperatures increase in these situations, which implies that wider air temperature fluctuations could negatively affect fish survival and health. Chen et al. (1995) and Sullivan et al. (1990) observed elevated maximum air temperatures at stand margins which indicated that changes in air temperatures in riparian stands can have an affect on stream temperatures and riparian buffer widths may be inadequate if they do not maintain appropriate air temperatures.

Headwater streams can be perennial or intermittent, fish-bearing or non-fish-bearing, and connected or not connected by surface flow to downstream systems. Little investigation of the effect of timber harvest adjacent to headwater streams and the resultant temperature effect of this action on temperature regimes in downstream reaches has occurred. It is known that temperature increases in small headwater streams can increase the temperature regimes in downstream reaches, but the magnitude of the effect depends on the relative temperature increase and amount

of exposed streamflow (Beschta et al. 1987). Extensive exposed reaches without buffer strips in headwater streams can be expected cumulatively to have a downstream thermal effect. Beschta et al. (1987) report that exposed small headwater streams draining clearcuts can lead to substantial diurnal temperature fluctuations. They suggest leaving buffer strips as an effective means to moderate temperature changes.

There is good agreement in the literature that riparian buffers are needed to retain shade function and to moderate stream temperature, but there are continuing concerns about what buffer size is adequate and what specific timber harvest activities within those buffers are compatible with fish. Johnson and Ryba (1992) concluded that buffer widths greater than 100 feet provide the same level of shade protection as an old-growth forest. Others have also suggested that buffers greater than 100 feet provide adequate shade to stream systems (Murphy 1995; Beschta et al. 1987). The Resource Assessment Team (1996) observed that effective shade protection to the stream was provided from trees from zero to 77 feet from the bank in the Swan Valley in Montana. The FEMAT report (USDA et al. 1993) suggested that for 100 percent effectiveness in shading a buffer distance of about 0.75 tree height from the stream channel is needed, which is typically greater than 100 feet. As an interim measure until specific watershed analyses are done, the FEMAT approach establishes 300-foot buffers (two site potential tree heights [SPTH]) in which no harvest activities are allowed. This "one-size-fits-all" prescriptive approach for Federal lands has been criticized because it has no functional scientific basis (O'Laughlin and Belt 1995). Appendix C in this part of the BO (Part IV) discusses the establishment and purpose of the FEMAT buffer widths in more detail.

The size of the riparian buffer might also appear to affect stream temperature regulation effectiveness. Dent and Walsh (1997) found that as stream buffer width increased, 7-day maximum and average stream temperatures decreased. Johnson and Ryba (1992) recommend a buffer width from 30 to 100 feet to protect stream temperature in forested areas, and Gomi et al. (2003) found that water temperature in the streams with a 33-foot or a 100-foot buffer did not exhibit statistically significant warming. However, Sugden and Steiner (2003) found that existing Montana SMZ regulations adequately protect stream temperature at 10 western Montana sites, even though the regulations allow for timber harvest to be near the stream as long as all bank edge trees and enough other trees are retained to ensure adequate levels of shade, which is defined as the ability to maintain natural temperature ranges.

The effectiveness of various widths of riparian forest in providing shade to streams is also closely tied to 100-year site index tree heights. Studies have shown that approximately 80 percent of shade effectiveness occurs within 0.5 SPTH, and 90 percent effectiveness occurs within 0.7 SPTH (Oregon Forest Industries Council 1999). A review of the available literature by Castelle and Johnson (2000) concluded that maximum shade produced in forest stands located adjacent to a stream was achieved within 56 to 98 feet of the stream channel. Steinblums et al. (1984) evaluated the effectiveness of 40 different streamside buffer widths in western Oregon and concluded that 90 percent of maximum angular canopy density (a measure of the density of canopy actually capable of shading the stream) could be obtained within a 56-foot buffer.

Regardless of the buffer size, the effectiveness of a buffer may be diminished when the riparian vegetation community is exposed to disturbance, either through natural means or manmade

disturbance. For example, physical alteration of the vegetative structure at the upland/riparian interface may influence the various functions provided by the buffer, either directly or indirectly. Timber harvest on the outer edge of a riparian buffer may expose the buffer area to increased light and wind. The interior microclimate of the riparian forest may be affected by reduction in relative humidity, more variable air temperatures, and increased wind-throw and tree breakage (Murphy 1995). Increased light penetration promotes shrub development which in turn reduces herbaceous cover and tree regeneration resulting in a shrub dominated community (Hibbs 1991). Thus, buffer zones may need to be wider to maintain interior microclimate conditions (USDA et al. 1993) and to ensure the long-term viability of riparian functions (Cederholm 1994). Width of buffer zones, timber harvest within buffer zones, and fixed or variable width buffer zones are the three main issues in designing buffers (Belt et al. 1992).

Groundwater entering streams (especially small streams) may be an important determinant of stream temperatures (Spence et al. 1996) or may provide localized thermal refugia in larger stream systems. Where groundwater flows originate above the neutral zone (generally, 52 to 59 feet below the surface) groundwater temperatures will vary seasonally, as influenced by air temperature patterns (Spence et al. 1996). Timber harvest in upland areas exposes the soil surface to greater amounts of solar radiation than under forested conditions (Carlson and Groot 1997), elevating daytime temperatures of both air and soil (Fleming et al. 1998; Buckley et al. 1998, Morecroft et al. 1998) and increasing diurnal temperature fluctuations (Carlson and Groot 1997). Relationships between shallow source groundwater flows and air and soil temperatures indicate that harvest activities in upland areas may increase stream temperatures via increasing temperature of shallow groundwater inflows. Other pathways for harvest actions to influence stream temperature include changing the volume and timing of peak flows, elevating suspended sediment levels, and altering channel characteristics (Chamberlain et al. 1991; Spence et al. 1996).

Road Management – The construction, use, and maintenance of forest roads typically have limited direct influence on stream temperature, except for road-related activities in the riparian zone. Removal of riparian vegetation associated with roads, such as at stream crossings, may have a small influence on stream temperature in the affected microhabitat of the stream crossing. However, an extensive road system constructed near or adjacent to a stream (such as some legacy roads) is more likely to have a larger affect on stream temperature from mass soil movements and channel changes that can also eliminate or damage riparian vegetation (Furniss et al. 1991). Consequently, nowdays when designing and constructing new forest roads a general principle to minimize effects on streams is to keep disturbances as far as possible from streams, and by providing buffers of undisturbed land between roads and streams (Furniss et al. 1991).

Grazing Management – Livestock grazing can also affect stream temperatures over time because of the loss of riparian vegetation, compaction of riparian soils, and the trend toward wider stream channels in areas used for grazing. The wider stream channels are caused by the destabilized stream banks, and result in a decrease in water depth and increase in the surface area influenced by solar energy and other microclimate conditions.

Livestock grazing can affect nearly all components of aquatic ecosystems. Improper grazing can lead to a reduction in vegetative canopy cover bordering or overhanging a stream. This can

increase summer water temperatures by increasing direct solar radiation, and decrease winter water temperatures accelerating anchor ice formation (MBTSG 1998). Willow cover in an un-grazed area of a livestock exclosure was found to provide 75 percent more shade to the stream than was found in an adjacent grazed area where willows were less abundant (Platts 1991). Browsing of native riparian shrubs, if not limited to moderate utilization, may die off or be replaced with more browse tolerant non-native plant species. Some willow species cannot reproduce under heavy browsing. First-year willow seedlings can be very sensitive to browsing because of their shallow root system and be killed when livestock pull these plants from the ground or trample them (Kovalchik and Elmore 1992). Heavy browsing of riparian trees and shrubs can lead to changes in the composition of the riparian vegetative community (Mosley et al. 1997). Boggs and Weaver (1992) observed that on relatively ungrazed sites that undergo moderate grazing, the riparian understory of a mature cottonwood forest can change from a diverse, dense shrub layer of various mesic shrubs and willows to a nearly impenetrable understory of wood rose (*Rosa woodsii*) and western snowberry (*Symphoriocarpus occidentalis*); and under heavy grazing the shrubs may be eliminated and the stand converted to a herbaceous understory dominated by a single species such as Kentucky bluegrass (*Poa pratensis*). Livestock grazing has also been identified as one of the major factors contributing to declines in upland forest health by helping accelerate the trend of western forests toward denser, smaller trees and to species that are more dominated by fire-sensitive species (Belsky and Blumenthal 1997).

Grazing cattle improperly in riparian zones can lead to decreased vigor of trees, shrubs, forbs and grasses. Livestock are a major cause of this condition because they tend to concentrate in riparian zones for the high-quality forage and water availability. Skovlin (1984) reported that improper grazing in riparian zones can result in: 1) reduction in plant vigor of herbaceous and browse species (trees and shrubs) which, in turn, can lower production and alter composition; and 2) increased trampling; which can waste available forage and compact soils to further reduce productivity. Protracted heavy grazing can cause elimination of shrubs and trees (Maloney et al. 1999). Of further interest is that the dominant vegetation type in the watershed can have a significant influence on stream temperature. For example, lower stream temperatures were found in a western larch/Douglas fir and spruce/fir ecosystem compared to a ponderosa pine and mountain meadow ecosystem; and intermediate stream temperatures were observed in a lodgepole pine forest (Maloney et al. 1999).

<u>DNRC HCP Minimization/Mitigation Effects on Stream Temperature</u>

The HCP conservation strategies addressing stream temperature are based on existing state law and regulations directed at commercial riparian timber harvest and grazing regimes immediately adjacent to streams, lakes, and other water bodies. There are a suite of conservation measures and commitments under the riparian timber harvest and grazing conservation strategies designed to ensure appropriate shade levels adjacent to a stream channel in order to maintain or provide for suitable stream temperatures for HCP fish species. They are intended to minimize or avoid impacts on the riparian functions of the riparian plant community, in particular the area nearest the stream channel where shade is the most influential on stream temperature. In addition, the measures allow DNRC to conduct timber and grazing management actions adequate to meet objectives in their forest management plan, ARMs, and Streamside Management Zone (SMZ) law.

Riparian Timber Harvest Strategy Addressing Forest Management and Road Management – The riparian timber harvest strategy of the DNRC HCP was purposely designed to build upon the requirements of the existing Forest Management ARMs and SMZ law. DNRC's existing forest management practices comply with these requirements and are considered by DNRC to ensure the protection of important riparian functions suitable for HCP fish species. Therefore, DNRC based the HCP riparian timber harvest provisions on these forest practice mandates, but provided additional conservation measures under the DNRC HCP to enhance certainty and timeliness. Furthermore, DNRC determined that timber harvest in riparian areas could be adequately restricted to ensure conservation of riparian functions most important to maintaining or improving fish habitat, while still retaining sufficient flexibility for acceptable levels of timber harvest.

Under the existing requirements and the Forest Management ARMs (36.11.421 through 427); DNRC is required to establish a Riparian Management Zone (RMZ) in addition to a SMZ when forest management activities (including timber harvest) are proposed on sites that are adjacent to fish-bearing streams. The total RMZ width is determined such that the total combined width of the SMZ and RMZ is equal to the average SPTH at stand age 100 years. Tree height at 100 years is determined using site index curves developed by the USFS Rocky Mountain and Intermountain Research Stations (USFS 1980). The site index of a stand is determined by measuring tree height and age directly from suitable index trees located within the SMZ. The RMZ width is never less than the minimum 50 feet required under the SMZ law. As discussed below, the SMZ law classifies streams, establishes minimum buffer zone widths next to streams based on slope steepness, and provides minimum tree retention requirements within the SMZ. In addition, the SMZ law prohibits equipment operation within the SMZ, and Forest Management ARMs can extend this prohibition, or add restrictions, such as a wider RMZ width, based on sites with high erosion risk.

The SMZ law designates Class 1 streams as all streams supporting fish, or that contribute flow for 6 months of the year or more to another stream, lake, or other body of water. Other streams are considered either Class 2 or Class 3 streams. Class 2 streams are those stream segments that contribute surface flow to another stream, lake, or other bodies of water for less than 6 months of the year, or have surface flow for 6 months of the year or more, but do not contribute surface flow to another stream, lake, or other body of water. Class 3 streams are those stream segments that rarely contribute surface flow to other streams or other bodies of water, and normally do not have surface flow for 6 months of the year or more. Class 3 stream segments are typically not connected to other streams.

When slopes are greater than 35 percent, the SMZ width on Class 1 and 2 streams and lakes is extended from 50 feet to 100 feet. The minimum SMZ width for Class 3 streams and other bodies of water is always 50 feet regardless of the SMZ slope. Harvest within a Class 1 SMZ must retain at least 50 percent of trees greater than or equal to 8 inches dbh, or 10 trees greater than or equal to 8 inches dbh for every 100 feet, on both sides of a stream, whichever is greater. Harvest within a Class 2 SMZ must retain at least 50 percent of trees greater than or equal to 8 inches dbh, or 5 trees greater than or equal to 8 inches dbh for every 100 feet, on both sides of a stream, whichever is greater. Harvest within the SMZ of a Class 3 stream and other body of water must retain sub-merchantable trees and shrubs.

The trees retained in a Class 1 or Class 2 SMZ must be representative of the pre-harvest stand in species and size; bank edge trees, as well as trees leaning toward the stream, are to be favored for retention. Where a Class 1 or Class 2 SMZ has been extended to 100 feet, the retained trees are to be concentrated within the first 50 feet directly adjacent to the stream. When salvage logging in the SMZ, the minimum tree retention requirements are met by standing live trees, or by dead or fallen trees where sufficient standing live trees are not available. Timber harvest associated with Class 2 and 3 streams or other body of water will follow existing harvest measures and practices of the SMZ law and practices implemented under Montana Forestry BMPs (DNRC 2004a) and ARMs (36.11.425 and 426).

Under the SMZ law, SMZ boundaries are extended to include wetlands that intercept the normal SMZ boundary. These wetlands are commonly referred to as adjacent wetlands. There is no limit to the distance that the SMZ must be extended to include the entire adjacent wetland. Under the SMZ law, a 50-foot buffer strip is not required around the wetland. The retention tree requirements for adjacent wetlands are the same as required for the SMZ throughout the adjacent wetland, and sub-merchantable trees and shrubs within the wetland must also be retained and protected. Under the DNRC Forest Management ARMs (36.11.421 through 427), a 50-foot wide equipment restriction buffer is added to the adjacent wetland boundary to provide greater levels of protection from site disturbance, erosion, and sediment delivery. Harvest conducted within a wetland management zone (WMZ) is also required to protect and retain shrubs and sub-merchantable trees.

When timber harvests are planned within an RMZ of a Class 1 stream or lake, the length of the RMZ is established based on the 100-year site index tree height. The site index tree height at age 100 years in most DNRC streamside riparian stands generally ranges from approximately 80 to 120 feet. The RMZ width is never less than the minimum 50 feet required under the SMZ law. The actual site index will be measured and established at each site and is largely dependent on the soil and climate of the landscape and other factors affecting the specific productivity of an individual site. The site index of a stand is determined by measuring tree height and age directly from suitable index trees located within the SMZ.

Under the DNRC HCP, timber harvests conducted within an RMZ on a Class 1 stream or lake will establish a 50-foot no-harvest buffer zone immediately adjacent to the affected stream or lake. In the remaining portion of the Class 1 RMZ outside of the no-harvest buffer zone, timber harvest will retain a minimum of 50 percent of the trees greater than or equal to 8 inches dbh and be limited to prescriptions that retain shrubs and sub-merchantable trees. In addition, the majority of timber harvests in the RMZ will retain a higher concentration of trees adjacent to the no-harvest buffer.

The DNRC HCP allows DNRC to conduct a limited amount of timber management in the no-harvest portion of the RMZ in order to emulate natural disturbance regimes due to fire, insect, and disease infestations. These allowances are based on the history and frequency of natural disturbances and the resulting amount of early seral stages of forest riparian plant communities that were evident on the landscape historically in the region (Losensky 1997). The amount of Class 1 RMZ that can be treated will be limited to less than 20 percent of the total Class 1 RMZ acres that occur on forested trust lands within an AAU, including when combined with the

existing non-stocked or seedling/sapling size class acres resulting from past harvest or natural disturbance events. Furthermore, the area treated will retain trees to meet the minimum tree retention requirements of the ARMs adopted under the SMZ law (36.11.305).

The Class 1 RMZ on streams supporting HCP fish species may also include a prescription that extends the length of the RMZ to address the potential for channel migration to occur. A channel migration zone (CMZ) will be determined in those situations where there is potential for a channel to move laterally across the valley floor. The RMZ will be extended beyond the 100 year site index tree height distance to include the CMZ. There are two classifications of CMZs. Type 1 CMZs are connected with streams that typically migrate across valley bottoms rather slowly. Occasionally though, these streams are susceptible to very rapid migration to new or previously abandoned channels during major flood events. Type 1 CMZs are generally associated with Rosgen C, D, DA, and E channel types. Type 2 CMZs correspond to the floodprone area of unstable streams exhibiting sudden erosion and deposition processes. Sudden erosion and deposition processes can occur on a Type 2 CMZs when a stream is forced out of its stream banks and into the floodprone area.

On Type 1 CMZs supporting HCP fish species, the portion of RMZ restricted to 50 percent retention will be extended when necessary to incorporate the entire floodprone area. In the event the width of the floodprone area does not extend beyond the normal RMZ, the standard RMZ harvest restrictions will be applied. The 50-foot no-harvest buffer would not be extended. However, a Type 1 CMZ with an unstable stream channel or stream bank showing evidence of lateral migration will receive the Type 2 CMZ prescription. On Type 2 CMZs supporting HCP fish species no timber harvest will occur within the entire floodprone width. In this case, the no-harvest buffer is a combination of the floodprone width plus an additional 25 feet within the RMZ. Additionally, the delineation of the normal RMZ width (based on 100-year site index tree height) will begin at the edge of the floodprone width, and an additional 25-foot no-harvest buffer will be applied within the RMZ.

Grazing Strategy – The grazing strategy of the DNRC HCP is based primarily on implementing the existing Forest Management ARMs for grazing (Final EIS/HCP 2010), which requires issuing licenses (usually with 10-year terms), setting license conditions, and conducting periodic license inspections. Under this strategy, DNRC will follow the existing grazing inspection and monitoring program as a coarse filter to identify potential problem areas. The new concepts developed under the DNRC HCP strategy for grazing focus on an inspection process and timeline for defining acceptable levels of livestock use and impact, verification and prioritization of problems that will affect HCP fish species, development and implementation of corrective actions to decrease effects to HCP fish species, and follow-up with implementation and effectiveness monitoring.

The conditions required in a grazing license issued by DNRC are expected to provide for suitable stream temperatures by minimizing impacts to streamside riparian vegetation that is accessible to livestock within the grazing allotment. The DNRC HCP grazing strategy is also expected to provide for the function of proper sediment levels; habitat complexity; and channel form, function, and stability. Identification of grazing problems is done through license compliance inspections, thereby ensuring that DNRC grazing management practices minimize loss of

riparian vegetation, minimize physical damage to stream banks, maintain channel stability and channel morphological characteristics, and promote diverse and healthy riparian plant communities.

The DNRC HCP grazing strategy adopts and applies the existing provisions of the Forest Management ARMs for grazing, but also adds specific commitments and clarifies existing practices in order to identify and address grazing problems more quickly. Commitments under the current ARMs are specified below:

1. During renewal inspection, DNRC will evaluate the range conditions, plant species composition, levels of riparian forage and browse utilization, levels of streambank disturbance, presence of noxious weeds, erosion, and condition of improvements on each grazing license.

2. During midterm inspections, DNRC will evaluate the range conditions, levels of riparian forage and browse utilization, levels of streambank disturbance, and overall tract conditions, emphasizing any problems noted on last inspection.

3. DNRC may require stipulations at any time during the license term.

4. DNRC will specify AUMs, type of livestock, and grazing period.

5. DNRC will identify methods to specify AUMs.

6. DNRC will design grazing plans to minimize loss of riparian streambank vegetation and to reduce structural damage to stream banks.

7. DNRC will manage licenses to maintain or restore both herbaceous and woody riparian vegetation to a healthy and vigorous condition, facilitate all age classes of riparian community, leave sufficient plant biomass and residue for adequate filter and energy dissipation during floodplain function, and minimize physical damage to stream banks.

8. DNRC will authorize continuous or season-long grazing only if #6 and #7 are met.

9. DNRC will direct the grazing licensees to place mineral, protein, or other supplements in areas to minimize livestock concentration near riparian areas.

10. DNRC will require holding facilities be located outside of riparian areas.

11. DNRC will evaluate existing riparian use during renewal or midterm inspections and specify acceptable conditions to be met for #6.

12. DNRC will offer technical assistance to mitigate or rehabilitate riparian impacts. If improvements do resolve damages, then DNRC may revise the license. The licensee is primarily responsible for grazing mitigations.

13. The licensee will be responsible for mitigating problems. DNRC may offer technical or financial assistance.

The additional HCP commitments that clarify existing practices and add specific requirements to identify, evaluate, prioritize, and address grazing problems are summarized below:

1. DNRC will continue to review all grazing licenses on a 5-year cycle, with both license renewal and midterm inspections using the Montana DNRC Supplemental Grazing Evaluation Form and Instructions (Final EIS/HCP 2010, Appendix B, Document B-7) as a grazing coarse filter to evaluate range, riparian, and streambank conditions, and presence and extent of noxious weeds.

2. DNRC will use both numerical and narrative criteria in a grazing coarse-filter approach to identify potential problem areas. Numerical criteria to be used in the coarse-filter are:

   a. Riparian forage utilization (50 percent for season-long grazing)

   b. Riparian browse utilization (up to 25 percent shrubs in the heavy or moderate browse class)

   c. Streambank disturbance (10 percent).

   3. DNRC will retain the narrative criteria contained in the existing grazing management ARMs (36.11.444), and DNRC will continue to assess these parameters with methodologies used in the Supplemental Grazing Evaluation Form. Criteria to be evaluated include:

   a. Range condition

   b. Age class distribution of woody shrubs and deciduous trees

   c. Presence and extent of noxious weeds

   d. Condition of improvements

   e. Other problems (such as erosion).

   4. DNRC will include in its grazing evaluations an assessment of the following riparian parameters:

   a. A qualitative assessment of grazing impacts on coniferous tree regeneration and tree seedlings will be added to the inspection process.

   b. The presence and extent of other invasive non-native plant species considered a major threat to riparian or aquatic plant communities and not currently listed as noxious weeds by the State of Montana will also be evaluated.

c. DNRC will develop and maintain a list of these species and provide field evaluators an identification guide for field identification.

5. DNRC will complete noxious weed evaluations during both license renewal and midterm grazing evaluations.

6. DNRC will complete field verification of potential problem sites within 1 year of receiving the results of coarse-filter evaluations. Potential problems will be identified when coarse-filter results indicate levels of livestock use and/or impacts above specified numerical and narrative criteria. DNRC will alert the licensee to any potential problems. The objectives of field verification include the following:

   a. Verify the accuracy of field data collected in the Supplemental Grazing Evaluation Form (Final EIS/HCP 2010, Appendix B, Document B-7).

   b. Determine the applicability of criteria to site-specific conditions.

   c. Determine whether criteria actually represent acceptable levels of livestock use.

   d. Verify and document whether unacceptable levels of impact are occurring within the riparian area.

   e. Determine if terms and conditions of licenses are being followed.

   f. Provide an opportunity to involve the licensee in the field assessment.

   g. Involve a DNRC water resource specialist or fisheries biologist in the field assessment as necessary.

   h. Allow for the collection of any additional information that may be necessary to prioritize problems.

   i. Develop a general approach, specific solution, and/or alternatives to resolve issues.

7. When the verification process determines that no corrective action is necessary, the rationale used to make that determination will be documented by DNRC and discussed at the annual meeting with the USFWS.

8. DNRC will prioritize sites with verified problems in need of corrective action. Priority will be established using the following approach:

   a. Sites with severe problems resulting in highly degraded conditions and problems affecting bull trout core habitat will receive the highest priority. These sites will be addressed before livestock are allowed to use the parcel the next grazing season.

   b. Sites with problems affecting bull trout nodal habitat, WCT priority management areas, RBT habitat, and impaired streams (listed on the most recent 303(d) list and

scheduled for TMDL development) that support HCP fish species will receive the second-highest priority. DNRC will also attempt to address these sites before livestock turnout the following year. However, if higher-priority sites (as described in commitment 9(a) are being addressed, then DNRC will, at a minimum, address these second-priority sites within 1 year of verification.

c. Sites with problems affecting remaining bull trout and WCT habitat will have lower priority. Lower-priority sites will be addressed within 1 year of verification.

9. DNRC will develop and document site-specific corrective actions for addressing verified grazing problems using the following mechanisms, as appropriate. Complex issues or severe impacts not readily addressed by commitments 10(a) and 10(b) will require the development of grazing management plans.

   a. DNRC will make the licensee responsible for mitigation, rehabilitation, and/or the development of a grazing management plan. Technical assistance may be provided by DNRC, NRCS, or another appropriate entity.

   b. Cancellation of a license by DNRC will be reserved for the most extreme situations when no other solutions are feasible, the licensee is uncooperative, or all other feasible alternatives have failed.

   c. A grazing management plan will be developed in coordination with the applicable county weed district in situations where invasive non-native plant species not currently listed as noxious weeds by the state are found and determined to be a major threat to riparian or aquatic plant communities.

10. DNRC will develop and document site-specific corrective actions for addressing verified grazing problems and will complete implementation evaluations on sites where corrective actions are implemented. These evaluations will occur within 1 year of development and implementation of corrective actions. Implementation evaluations will be completed with the following objectives; 1) verify implementation of improvements, changes in grazing license, other changes in grazing management, or compliance with existing terms of the license; and 2) determine the effectiveness of improvements, newly implemented practices, and/or a new grazing strategy.

11. If improvements or changes to grazing management are determined to be ineffective in correcting problems, DNRC will do the following:

   a. Adjust the license to facilitate progress toward meeting the corrective action objectives.

   b. Continue annual effectiveness monitoring until improvements are verified to be effective.

12. DNRC will develop and complete formal training on the implementation of this HCP conservation grazing strategy for all DNRC field staff involved in the administration of grazing licenses.

13. DNRC will provide grazing licensees with informal training opportunities and education outreach materials, such as pamphlets and brochures, designed to provide information regarding the HCP, riparian conservation objectives, and grazing management conservation commitments contained in the HCP.

14. At the annual HCP review meetings with the USFWS, DNRC will provide a summary of inspection results and licensee responsiveness describing the status of coarse-filter grazing evaluations, problem verifications completed, and corrective actions implemented.

15. DNRC will provide the USFWS with more detailed information in a comprehensive monitoring report during the 5-year reviews. This report will include results of coarse-filter evaluations and documentation on the implementation and effectiveness of corrective actions.

In summary, each year DNRC will compile the data contained in each Supplemental Grazing Evaluation Form (Final EIS/HCP 2010, Appendix B, Document B-7) completed for all grazing licenses affecting streams supporting bull trout, WCT, and RBT. Results from these evaluations will be used to assess the conditions of HCP-affected riparian areas and as a coarse filter to identify potential problem sites. This approach will allow DNRC to quickly identify and then eliminate or minimize unacceptable grazing effects on HCP fish species or their habitat. The process is specifically designed for application to grazing activities and incorporates numeric and narrative criteria in a grazing coarse-filter approach that will describe general acceptable levels of livestock use and identify potential problem areas. Support for these criteria can be found in the scientific literature (Ehrhart and Hansen 1997, 1998), and they are very similar to the criteria used in the *Plum Creek Timber Company Native Fish HCP* (Plum Creek 2000); the Montana State Office of the USDA NRCS (USDA NRCS 2003); and the *Beaverhead Forest Plan Riparian Amendment* (USFS 1997); and the defunct University of Montana Riparian and Wetland Research Unit (Thompson et al. 1998). Furthermore, the coarse-filter process directly addresses existing riparian conditions and assesses project risk to specific habitat elements, such as streambank stability and riparian vegetation.

DNRC Stream Temperature Monitoring and Adaptive Management – Under the DNRC HCP, DNRC will conduct monitoring of two stream temperature related parameters in relation to determining the effectiveness of the riparian timber harvest strategy measures for providing and maintaining adequate levels of in-stream shade sufficient to maintain suitable stream temperatures on Class 1 streams. Monitoring of in-stream shade levels, defined as total solar energy affecting the surface of the stream in the stream reach adjacent to the timber harvest unit, will be conducted in conjunction with monitoring in-stream water temperatures on sites representative of Class1 RMZ harvests.

DNRC will measure both pre- and post-harvest levels of in-stream shade by the best available, scientifically valid, commonly accepted method. Existing methods that meet these criteria include the Solar Pathfinder and angular canopy densitometer. DNRC will conduct shade monitoring activities on at least five sites in Class 1 RMZs with timber harvest involving the removal of more than 25 percent of trees greater than or equal to 8 inches dbh as measured from the outer edge of the no-harvest buffer to the outer edge of the RMZ (based on SPTH).

DNRC will prioritize monitoring activities to those sites located on Class 1 streams supporting HCP fish species. DNRC will also prioritize the type of harvest units by focusing on those that have the greatest potential to produce a measured effect on the level of in-stream shade, such as units with the highest amount of forest canopy removal or with narrower RMZs.

The monitoring efforts of in-stream shade will occur during the first 10 years of implementation of the HCP. Monitoring projects will include riparian harvest located on sites with slopes greater than 35 percent and less than 35 percent. The distribution of monitoring sites between the two slope classes will be representative of the Class 1 RMZs harvested. If five or more monitoring sites are not available due to a lack of riparian harvest, DNRC will monitor all available sites.

DNRC will determine whether the 50-foot no harvest buffer and minimum tree retention requirements are effective at maintaining suitable stream temperatures regimes for HCP fish species. DNRC will have a minimum of two ongoing stream temperature monitoring projects operating at any one time. All harvest units undergoing temperature monitoring will also undergo stream shade monitoring as described above. Monitored sites will include riparian harvest located on sites with slopes greater than 35 percent and on sites with slopes less than 35 percent. The distribution of monitoring sites between the two slope classes will be represent harvest Class 1 RMZs harvested.

The approach to be used for temperature monitoring is explained in detail in the DNRC HCP, Chapter 4. If the monitoring efforts show that DNRC is meeting its goals, it is anticipated that there will be no significant adverse effects on stream temperatures under the DNRC HCP standard harvest prescription. Modified temperature monitoring methods for non-temperature-sensitive reaches and temperature-sensitive reaches are also described in the DNRC HCP.

In general, for the majority of Class 1 riparian harvest sites (referred to as non-temperature-sensitive sites), DNRC will use a stream temperature exceedance matrix to determine criteria for maximum increases in stream temperature, attributable to timber harvest (i.e., difference between upstream and downstream monitoring sites). In most cases, a change in stream temperature of less than 1.8° F will not adversely affect HCP fish species, particularly where upstream maximum temperatures are within the acceptable temperature range for bull trout (less than 59° F).

To ensure protection of native fish species from increased stream temperatures, DNRC will classify specific areas as temperature-sensitive reaches and provide additional protections during riparian harvest. This will be achieved by committing to no statistically significant ($p>0.05$) increase in stream temperature attributable to DNRC timber harvest activities in temperature-sensitive reaches. DNRC also recognizes that there are conditions where any significant in-

stream temperature increase may not be acceptable. In reaches where in-stream temperatures are already elevated due to human-caused disturbance or activities, even a small increase in stream temperature may have an adverse effect on fish. For example, bull trout may not tolerate a change from 66° to 68° F because these temperatures are at or near their temperature tolerance range. At these high baseline temperatures, even a small increase may cause physiological and behavioral effects, disrupt rearing activities, and/or cause a barrier to migration. Therefore, DNRC has committed to identifying reaches affected by elevated stream temperatures. DNRC indicated that the most current EPA-approved 303(d) list is the most appropriate source of information to define temperature-sensitive reaches.

If monitoring results of at least five riparian harvest temperature monitoring sites (5 sites are anticipated to be monitored during the 10-year period) are not available, then DNRC will continue this level of monitoring effort for an additional 5-year period.

For most Class 1 streams that support HCP fish species, through this monitoring and evaluation program, DNRC will ensure that riparian harvest prescriptions maintain stream temperature regimes and that any changes are less than a 1.0°F increase from baseline conditions. In most cases, a change in stream temperature of less than 1.0°F would not adversely affect HCP fish species, particularly where upstream maximum temperatures are within the acceptable peak seasonal temperature range for the HCP fish species (less than 59°F). In addition, the 1.0°F temperature change threshold is generally appropriate given the accuracy of stream temperature monitoring equipment, the natural variability inherent within any given stream reach, and the ability to statistically differentiate significant differences in stream temperatures with a limited sample size.

If DNRC's monitoring results from the first 10-year monitoring period indicate that riparian timber harvest implemented under the riparian timber harvest strategy is maintaining suitable in-stream temperature regimes, DNRC could reduce the monitoring efforts to include a minimum of one ongoing in-stream cover and stream temperature monitoring project at any one time through year 25 of HCP implementation. However, if the continued monitoring results indicate the strategy is not meeting the in-stream cover and stream temperature objectives, adaptive management procedures, including enhanced monitoring, will be implemented. Should adaptive management be needed, the data collected from effectiveness monitoring activities will be reviewed to develop an alternate approach to addressing shade and stream temperature. If the quantity and quality of available data are adequate, potential alternative approaches include: 1) developing a predictive relationship between in-stream temperatures and shade levels and then using this relationship as a screening-level tool on riparian timber harvest (which will allow comparison of pre-harvest and predicted post-harvest stream temperatures), and/or, 2) establishing a minimum post-harvest shade level based on the monitoring data, and/or, 3) establishing and implementing alternative RMZ harvest prescriptions that will meet minimum post-harvest shade levels needed to meet stream temperature requirements (e.g., larger no-harvest buffer or RMZ tree retention requirements). The approach or approaches selected will be determined through discussions with the USFWS.

In addition to the stream temperature monitoring program described above, DNRC will also monitor its grazing strategy as described below. As mentioned above, the DNRC HCP

commitments comprising the grazing strategy were designed to help ensure that important riparian functions are maintained to minimize effects on stream temperature on grazing licenses.

Under the DNRC HCP, DNRC will verify that corrective actions at grazing sites where corrective actions have been implemented to ensure measures are implemented appropriately and to conduct effectiveness monitoring. Monitoring design, methods and protocols will be selected from established procedures that have been demonstrated to be practicable, cost-effective, and suited for addressing the site-specific conditions and monitoring objectives. These evaluations will occur within 1 year of corrective actions and the following parameters will be evaluated.

1. Verify implementation of corrective actions, changes in grazing license, other changes in grazing management or compliance with existing terms of the license.

2. Determine the effectiveness of corrective actions, newly implemented practices, and/or a new grazing strategy based on thresholds established for the corrective action, practices or strategy at the time of prescription.

DNRC will update the USFWS on the status of grazing coarse-filter evaluations, number of problem sites verified, and the number of corrective actions implemented. More detailed information will be provided during the 5-year review, including results of evaluations, methods implemented to correct problem sites, and the effectiveness of those actions. If improvements or changes in grazing management are determined to be ineffective in correcting problems, DNRC will (1) adjust the permittee license to facilitate progress toward meeting the corrective action objectives, and (2) continue annual effectiveness monitoring until improvements are verified to be effective.

Analysis of Effects of HCP Measures on Stream Temperature

This section describes the effects of HCP implementation on stream temperatures for DNRC's riparian timber harvest and grazing strategies.

Riparian Timber Harvest Strategy – This evaluation of the effects of the DNRC HCP on stream temperature relies mainly on the analysis conducted by DNRC and presented in the Final EIS/HCP (2010). The advantage of this analysis approach is that it is relatively simple and can determine whether harvest prescriptions can maintain adequate levels of shade. This analysis employed a commonly used model to project potential changes of in-stream shade levels in representative riparian stand types that occur in the HCP project area. Actual specific stand characteristic and various site data of these stand types were used to model shade conditions. The model predicts shade production over time (by decade) for each stand type by simulating changes of these stand characteristics in relation to three Rosgen (1994) stream channel types representative of stream channels within the HCP project area. Each simulation was run for a period of 100 years.

Simulation of stream shading processes was modeled using the RAIS model (Welty et al. 2002). Note that shade from hardwood, brush, and adjacent commercial forest were not considered, nor was site topography (including slope). Simulations did vary by stream channel type, primarily via the differing channel widths associated with the channel type, and the stream areas to be

shaded by the riparian stand. The modeled stream widths considered were based on DNRC watershed inventory data and stratified by Rosgen channel type classifications (Rosgen 1994). Average stream widths were 7.2 feet for Rosgen Type A streams, 16.8 feet for Rosgen Type B streams, and 51.5 feet for the same combined Rosgen channel types of D, F, and G.

Shade targets used in the simulations are based on the existing pre-harvest (no-harvest or unmanaged) shade levels for each stand type. When compared to pertinent shade and temperature data in the literature, the comparable pre-harvest shade levels are known to be adequate to meet suitable stream temperature for salmonids. Although the relationship between shade and temperature is not well-defined and is influenced by multiple local factors (elevation, topography, etc.), Washington State Timber, Fish, and Wildlife (1990) program data indicates that in medium-elevation stands (1,000 to 2,300 feet) a 15 percent reduction in shade, on average, will result in a 1.8 to 2.7^{o}F increase in maximum stream temperature. In addition, the minimum post-harvest stream shading level of 45 percent (2,300-foot elevation stands) to 70 percent (1,000-foot elevation stands) is generally adequate to ensure that stream reaches meet water quality parameters for salmonids.

In most of the scenarios modeled, the shade levels resulting from the implementation of the DNRC HCP increase slightly over time (Final EIS/HCP 2010, Figures 4.8-14 through 4.8-16). The only exception was the Swede Creek stand type for the A and B stream channel types, which showed a slight decrease in shade over time, but the shading levels remained well above the shade target levels. Notwithstanding the Swede Creek situation, for all model scenarios over the entire modeling period, the DNRC HCP provided equal or greater in-stream shade than existing conditions. In addition, all of the scenarios evaluated for the DNRC HCP indicate shade levels at least 10 percent greater than the established target levels.

Based on the shade analysis, the stream temperatures are not expected to measurably increase from direct solar input, or indirectly from the moderate changes in microclimate or soil temperature expected to occur from the selective harvest regimes used by DNRC. The analyses of the DNRC HCP typically indicate increasing shade levels throughout the modeled period. These results apply to all Class 1 streams including those streams supporting fish species and tributary non-fish bearing perennial reaches. Class 1 streams are extremely important in providing stream shading, which in turn directly or indirectly affects water temperatures in downstream reaches where fish, including HCP fish species are present. For all other streams, including Class 2 and 3 streams which are both non-fish bearing, management commitments under the existing SMZ and RMZ harvest regulations would apply to these riparian areas. As a result, the additional protection of the HCP commitments would be provided to stream reaches currently or potentially supporting the fish species and also to those contributing to non-fish bearing streams, which support important temperature regulation functions. Also, current levels of protection would continue to occur for the other streams through the implementation of existing regulations.

The RMZ riparian timber harvest allowances to harvest within the no-harvest buffer could result in some overstory removal adjacent to the stream channel, and therefore, some level of decreased shading. Nonetheless, the limitations are not likely to cause a significant decrease in shade levels because the amount of the RMZ acres treated is small and is still subject to the SMZ law

which prohibits clearcutting in the RMZ, establishes a minimum tree retention requirement, and protects trees associated with streambanks from harvest. Consequently, the limitations of these allowances are not anticipated to have a significant negative impact on stream shade because the impact on the no-harvest buffer would be minimal and no measurable or detectable changes to stream temperature would be expected. Furthermore, DNRC will be required to monitor stream temperatures to verify the effectiveness of maintaining adequate shade levels and associated suitable stream temperature regimes (see Adaptive Management section below).

Grazing Strategy - As indicated above, livestock grazing can affect stream temperatures over time because of the loss of riparian vegetation, compaction of riparian soils, and the trend toward wider stream channels in areas used for grazing. The wider stream channels are caused by the destabilized stream banks and result in a decrease in water depth and increase in the surface area influenced by solar energy and other microclimate conditions. As described above, in addition to the Forest Management ARMs, the HCP provisions will require DNRC to implement several activities to address these potential impacts (see previous section DNRC HCP Minimization/Mitigation Effects on Stream Temperature).

Detailed grazing inspections are conducted by DNRC on each licensed parcel during the field season prior to license renewal. During these inspections, DNRC determines stocking rates for the licensed parcel, identifies potential problems related to the overall conditions of the tract, checks conditions of any existing improvements, and identifies the need for any additional improvements. Stocking rates are based on the grazing capacity of the licensed parcel. Grazing capacity is the maximum number of animals that can graze each year on a given area of land, for a specific number of days, without inducing a downward trend in forage production, forage quality, or soil conditions. Grazing capacity determinations are based on existing range conditions, which are estimated through visual assessment of existing plant species composition compared to potential plant species composition (climax range condition). The methods used for these determinations are based on guidelines developed by the NRCS (USDA NRCS 1977).

DNRC expects that approximately 30 grazing license inspections or midterm evaluations affecting HCP fish species will be completed each year. Of these, approximately 14 sites per year will require verification of potential problems based on coarse-filter results. It is anticipated that three to eight of the sites undergoing verification will require follow-up action to implement corrective actions (DNRC 2011). Under the DNRC HCP, DNRC will prioritize which sites will be addressed first based on the present species' legal status and the severity of the problem and will address sites with listed HCP species (i.e., bull trout) before turnout the next grazing season. The remaining situations will be addressed within 1 year of verification.

Within the DNRC HCP project area, a total of 391 parcels with grazing licenses encompass 164,931 acres that are proposed to be covered by the Permit. Approximately 163 of the 391 parcels contain a segment of stream known to support at least one of the three HCP fish species. These 163 parcels contain approximately 82 miles of stream supporting bull trout, 121 miles of stream supporting WCT, and 4 miles of stream supporting RBT (Final EIS/HCP 2010). Nearly 25 percent of the total stream miles of the HCP project area on DNRC's grazing parcels contain HCP fish species habitat (Table IV-11). Nearly all of these stream miles contain WCT habitat

(99 percent) and about 66 percent have bull trout habitat. RBT habitat occurs in only 3 percent of the stream miles on these HCP project area grazing parcels.

The number of grazing parcels in the HCP project area varies substantially by bull trout core area. As a result, the potential effects to HCP fish species would tend to vary in a similar manner (Final EIS/HCP 2010). For example, about 30 percent of the total grazing license parcels in the HCP project area occur in the Middle Clark Fork core area, as do 34 percent of the parcels containing any HCP fish species. In addition, the Blackfoot River core area contains about 22 percent of the grazing license parcels and 25 percent of the parcels with any HCP fish species. The other 12 units contain less than about 13 percent of the parcels with HCP fish species. Therefore, grazed parcels that potentially may cause negative effects to HCP fish species habitat, and that may require commensurate corrective actions, are likely to occur in the Middle Clark Fork, Bitterroot, and Blackfoot core areas because these units contain the majority of grazing licensed parcels with HCP fish species habitat (>63 percent). In terms of stream miles, these three core areas contain nearly 75 percent of the total stream miles that contain HCP fish species habitat (Table IV-11).

Table IV-11. Stream miles and fish distribution within HCP project area grazing license parcels.

Bull Trout Core Area[1]	Stream Miles on Grazing License Parcels Within the HCP Project Area				
	Total Stream Miles	**Bull Trout Habitat**	**WCT Habitat**	**RBT Habitat**	**Total HCP Fish Species Habitat**
Bitterroot	85.7	15.5	19.5	0.0	**19.5**
Blackfoot	102.1	14.6	25.5	0.0	**25.5**
Flathead Lake	9.9	0.0	1.4	0.0	**1.4**
Lower Clark Fork	4.1	0.0	0.0	0.0	**0.0**
Lower Kootenai	0.5	0.5	0.5	0.5	**0.5**
Middle Clark Fork	145.2	30.5	45.1	0.0	**45.1**
Middle Kootenai	25.2	2.5	4.9	3.4	**4.9**
North Fork Flathead	7.0	5.2	5.2	0.0	**5.2**
Rock Creek	8.4	0.8	1.1	0.0	**1.9**
Stillwater	6.4	3.0	2.5	0.0	**3.0**
Swan	2.5	1.5	2.0	0.0	**2.0**
Upper Clark Fork	46.2	5.0	7.9	0.0	**7.9**
Upper Kootenai	13.0	2.5	5.0	0.0	**5.0**
Upper Missouri[1]	45.9	0.0	0.0	0.0	**0.0**
TOTAL	**502.1**	**81.6**	**120.8**	**3.9**	**122.1**

[1] Note that the Upper Missouri unit is not a bull trout core area,.

As mentioned above, improperly managed livestock grazing can degrade bull trout habitat by removing riparian vegetation, which destabilizes streambanks, widens stream channels, promotes incised channels, lowers water tables, reduces pool frequency, increases soil erosion, and alters water quality (Howell and Buchanan 1992, Mullan et al. 1992, Overton et al. 1993). These

effects can reduce overhead cover, increase summer stream temperatures, and increase sediment in spawning and rearing habitats and minimize effects to water quality. A fully mature riparian area results in increased shading and lowered stream temperatures.

Under the DNRC HCP grazing strategy, protection of streamside vegetation through existing DNRC grazing management practices and the additional HCP measures are likely to maintain and/or improve riparian habitats adjacent to streams having HCP fish species habitat. In turn, a healthy riparian vegetation community should result in maintaining or improving levels of streamside shading that would support suitable stream temperature regimes for HCP fish species for those stream segments that DNRC has jurisdiction.

The DNRC HCP strategy is designed to identify potential problems and determine relative risk; indices of healthy and functioning riparian communities, streambank stability, and acceptable levels of impact as determined on a site-specific basis. It does this by addressing potential problems through field verification and corrective action. During the process, site-specific information is collected to more clearly define the problem and develop solutions best suited to the circumstances involved. Licensees and other DNRC resource specialists may be brought into the process to help craft solutions that are both reasonable and practicable while still meeting conservation objectives.

Summary of the Analysis on Stream Temperature

When considering the baseline conditions for bull trout, stream temperature is most problematic in the Middle Clark Fork, Bitterroot, and Blackfoot bull trout core areas. As mentioned above, grazed parcels that potentially may cause negative effects to HCP fish species habitat, and that may require commensurate corrective actions, are likely to occur in the Middle Clark Fork, Bitterroot, and Blackfoot core areas.

A major concern exists with the mainstem Clark Fork River of the Middle Clark Fork core area in midsummer when warming of stream temperatures become only marginally suitable for bull trout. When this happens bull trout congregate in a limited number of thermal refugia where they become vulnerable to angling overexploitation. The HCP will have little affect on the mainstem because proposed HCP projects lands along the mainstem will be few in number; and furthermore, the HCP riparian conservation measures would protect key thermal refugia areas for bull trout.

Dewatering, both natural and artificial, that occurs in the Bitterroot River system in combination with the anticipated effects of climate change and post-fire increases of stream temperature, represent a main threat to bull trout in the Bitterroot River core area. Much of the mainstem Bitterroot River as well as the lower reaches of many tributaries is unsuitable for bull trout (warm and dewatered) in midsummer. Mahlum et al. (2008) study results on the effects of fire on stream temperature in the Bitterroot River basin documented a significant overall increase in late summer water temperature (August-September) over the past 12 years in all streams which they attributed to changes in climate. Increases of maximum summer water temperatures suggested bull trout habitat may be further contracting, and they found no significant recovery of colder stream temperatures in burned areas five years after wildfires. They concluded the fires

have had localized, long-term impacts on water temperatures in the Bitterroot River system (Mahlum et al. 2008).

Nearly 20 stream miles that support HCP fish species occur in the Bitterroot core area. The Gird Creek Riparian Stand data (Final EIS/HCP 2010, Figure 4.8-14 through 16) that was used in the EIS shade modeling analyses is a riparian stand type located in the Bitterroot River drainage on the Hamilton Unit. It represents a major riparian stand type (spruce/red-osier dogwood habitat type; current plant community are stands of Engelmann spruce with lesser amounts of Douglas-fir) found on flat alluvial benches and terraces bordering streams at low to mid elevations in the west central portion of the HCP project area. The SPTH of dominant and co-dominant tree species at 100 years for this stand type is 119 feet, which represents the size of the buffer width that DNRC would employ under the HCP riparian harvest prescription. Based on the shade analysis of this stand type, shade levels would be maintained or would be increased thus avoiding negatively affecting maximum summer or minimum winter stream temperatures. Therefore, stream temperatures in this core area are not expected to measurably increase from direct solar input, or indirectly from the moderate changes in microclimate. Most likely the DNRC HCP conservation measures would improve existing stream temperatures in this core area and maintain suitable stream temperatures where they currently exist. The modeled shade analyses support this premise.

The sensitive watersheds analysis in the Final EIS/HCP 2010 (Final EIS/HCP 2010, Chapter 4, Table 4.8-13) identified parcels in watersheds with stand-replacement fire, and other criteria, as watersheds likely to have CWE concerns. The Bitterroot core area contains 13.5 percent of the area (14,757 acres) in sensitive parcels mainly due to recent large fires. The DNRC HCP CWE strategy would expressly address these concerns in terms of stream temperature in order to ensure that the recovery of affected riparian stands attain appropriate shade levels to provide for suitable stream temperatures for HCP fish species. It would accomplish this by identifying the burned areas as a high risk category and sensitive to incrementally adding to existing degraded conditions that could further exacerbate stream temperatures. DNRC would employ protective measures to ensure that future actions, such as proposed timber sales, would not further exacerbate the current degraded conditions resulting from the wildfire.

In the Blackfoot core area, stream temperature problems have largely been related to the recent years of drought, as well as related fires, and the slow recovery of bull trout populations. The recent bull trout population downturn is believed related more to decreased instream flow and related warmer water temperatures resulting from the drought pattern. The entire region of the Blackfoot River core area experienced drought conditions in 2001 through 2003, resulting in reduced streamflow and potentially affecting bull trout numbers, which have been slow to respond. These conditions would be considered to fall within the range of historic natural variability. The Snow-Talon Fire of 2003 burned extremely hot in the Copper Creek drainage and high stream temperatures have occurred in portions of the drainage above the confluence of Copper Creek.

Despite the trouble spots related to stream temperature that remain in the Blackfoot core area the current status of bull trout in this core area is one of the strongest among fluvial populations in the Clark Fork River Basin. However, there are indicators that the increasing trend may not be as

strong or consistent as previously suggested. Overall, the habitat trend is at least stable, and probably improving. Further, the DNRC HCP would maintain or improve stream temperatures through ensuring that streamside shade levels are adequate in relation to riparian harvest and that grazed parcels maintain healthy riparian vegetation plant communities.

Conclusion on Effects on Stream Temperature

Based on outputs and assumptions used to determine the annual sustainable yield under the DNRC HCP, DNRC anticipates conducting RMZ harvest on approximately 32 to 64 acres adjacent to Class 1 streams on an annual basis out of the approximately 7,000 acres of total annual harvest within the HCP project area. The total amount of riparian harvest that could occur over the 50-year Permit period would range between 1,600 to 3,200 acres. In other words, of the total amount of timber harvest projected in the HCP project area over the Permit period, riparian harvest comprises less than 1 percent of the total (ranges between .5 - .9 percent).

A riparian timber harvest conducted under the DNRC HCP is expected to retain about 80 percent of the tree basal area in the RMZs of Class 1 streams in the combined area of the 50-foot no-harvest buffer and the remainder of the RMZ out to a distance of one SPTH (generally between 80 and 120 feet) (Final EIS/HCP 2010). As explained below, the amount of the post-harvest tree basal area would maintain or improve shade levels over the Permit period for the majority of stand types and stream channels in the HCP project area.

Loss of riparian overstory canopy and the associated shading provided to the stream through timber harvesting can result in elevated summer stream temperatures due to the increase in incident solar radiation that reaches the water surface (Chamberlain et al. 1991). However, under the HCP the likelihood of adverse effects to HCP fish species from an increase in stream temperatures is negligible because DNRC's timber harvests, road systems, and grazing management in RMZs would have little to no effect on stream temperature regimes. The main reason is because the size and design of RMZs would buffer existing stream temperature effects by maintaining adequate shade levels. In the unlikely event of a change in stream temperature, the increase is not expected to be greater than 1^0 F. This protection is due in large part to the following: 1) the HCP commitment to retain a 50-foot no-harvest buffer immediately next to the stream supporting HCP fish species; 2) the retention of 50 percent of merchantable trees (i.e., basal area of trees retained) and all submerchantable trees and shrubs in the remainder of Class 1 RMZs; and 3) the adequacy of Montana's current SMZ regulations to maintain stream temperature regimes (Sugden and Steiner 2003) such as the width of the RMZ buffer (based on the 100-year site index tree height) and tree retention requirements within the harvestable portions of the RMZ. Additional discussion on riparian function under the DNRC HCP is provided in Appendix D.

The shade analysis in the Final EIS/HCP (2010) shows that for most of the HCP scenarios modeled, shade levels per decade through the Permit term tend to increase slightly over time (see Final EIS/HCP 2010, Figures 4.8-14 through 4.8-16). All of the scenarios evaluated for the HCP indicate shade levels at least 10 percent greater than the established target levels. Only in certain allowances for salvage harvest of disease- or insect-infested trees could there be harvest from within the 50-foot no-harvest buffer on Class 1 streams, and salvage harvest of fire-killed trees to exceed the normal 50 percent retention requirement in that portion of a Class1 RMZ outside the

50-foot no-harvest buffer. The HCP also allows for the management of a portion of the total Class 1 RMZ acreage using harvest prescriptions designed to meet the minimum retention tree requirement of the SMZ Law. However, these allowances are limited in extent and scope and are not expected to have a substantial effect on stream shade and stream temperatures within the HCP project area.

The DNRC HCP is expected to provide a more comprehensive and coordinated approach to minimizing grazing effects on HCP fish habitat and species beyond DNRC's current grazing program. DNRC would use the existing grazing inspection and monitoring program to collect data as a coarse filter in order to identify potential problem areas. Accordingly, a process and timeline for verifying and prioritizing the problems would be developed and a plan to implement corrective actions with follow-up implementation and effectiveness monitoring. The DNRC HCP also establishes specific numerical guidelines for riparian zone utilization and streambank disturbance levels. On stream segments that DNRC has jurisdiction, the grazing strategy commitments are expected to minimize potential loss of riparian vegetation and physical damage to stream banks, maintain channel stability and channel morphological characteristics, and promote diverse and healthy riparian plant communities. It is expected that degraded habitat due to grazing impacts will improve under the DNRC HCP and that existing stream temperatures suitable for HCP fish species will continue during the Permit period.

The Bitterroot, Blackfoot, and Middle Clark Fork core areas include the most stream miles of HCP fish species habitat that are affected by grazing. If there are impacts from grazing (i.e., problem areas requiring corrective actions) negatively affecting HCP fish species habitat there is a higher probability for them to occur within these core areas sometime during the 50-year Permit period. However, in other core areas there are certain stream segments in grazing parcels that are highly sensitive because the HCP fish species is limited in distribution (and abundance) to those segments – such is the case with RBT. Therefore, those stream segments exposed to grazing impacts in the Middle Kootenai core area where redbands occur may be especially important in terms of protecting the health of the riparian plant community - particularly if the stream segments are crucial spawning and rearing areas for redbands.

In conclusion, it is likely that covered activities under the DNRC HCP will not result in a measurable negative effect on maximum summer or minimum winter stream temperatures. The modeling results indicate that the HCP riparian buffer widths would be effective at maintaining the key riparian function of shading and stream temperature at a level that provides for the conservation of HCP fish species. Furthermore, DNRC has committed to ensuring there would be no more than an increase of 1^0 F in stream temperature from existing levels and has developed a monitoring program to measure any changes in stream temperature as a way to verify model outputs (Final EIS/HCP 2010, Chapter 4, Monitoring and Adaptive Management).

Analysis of Effects on Sedimentation

General Effects of Forest, Road, and Grazing Management Activities on Sedimentation
The general effects of forest, road, and grazing management activities on sedimentation are discussed below.

Forest Management – Forest management activities that substantially disturb the soil, such as yarding, burning, or road and skid trail construction, can alter both surface and subsurface pathways that transport water to streams (Thomas et al., 1993, Murphy 1995, Keppeler and Brown 1998). Logging can also alter the internal soil structure. As tree roots die, soil "macropores" collapse or are filled in with sediment. These subsurface pathways are important for water transmission. When subsurface flow pathways are destroyed over a sizable area of steep slope, the flow can be routed to the surface and increase gully erosion and sediment delivery (Keppeler and Brown 1998).

Forest management activities (other than timber harvest) can have effects on soil erosion and soil productivity that are much greater than natural conditions, and these can lead to increases in erosion and runoff (Elliot et al. 1999). Such activities include tree planting, site preparation, prescribed burning, timber harvest, stand maintenance, forest nurseries, and seed orchards, as well as associated activities, including logging road construction and maintenance and gravel quarrying for roads.

The cutting and felling of trees by itself does not cause significant erosion, but the effect of removing large amounts of vegetation can lead to greater erosion rates so that the total erosion from timber harvest may approach that from roads (Elliot et al. 1999). Not all hillside surface erosion reaches stream channels, but conduits such as roads, ditches, and skid trails increase this probability, particularly if buffer strips are not left between treated areas and stream channels (Chamberlin et al. 1991). The potential for surface erosion is directly related to the amount of bare compacted soil exposed to rain and runoff, and timber harvesting tends to compact the soil (Chamberlin et al. 1991). Skidding logs to landing sites compacts and scarifies the soil. Skid trails are responsible for most of the erosion on timber harvest units because of the removal or disturbance of the surface humic layer (Elliot et al. 1999) and the reduced infiltration rates as a result of compaction of the forest soil (Everest et al. 1987).

The role of the protective surface residue layer on the forest floor is critical in controlling erosion (Elliot et al. 1999). Loss or disturbance of this litter and duff layer through mechanical means can significantly increase erosion. Further, the decomposing root system reduces infiltration capacity resulting in increased runoff with the potential for increased sediment delivery to stream channels. In addition, compaction has been associated with reduced soil productivity; decreases in microbial populations; and reduced root growth, height and timber volume (Elliot et al. 1999).

Site preparation consists of clearing slash and competing vegetation and exposing adequate mineral soil for subsequent tree planting or natural regeneration. This is accomplished using one or more techniques, such as tractors or excavators, tree planting hoes, and broadcast burns (described below). The extent of site preparation has been reduced over the last few years in the forest industry because of specific environmental concerns, particularly the practices of broadcast burning and scarification of large areas.

Forest practices during site preparation, harvest, yarding, and other activities that utilize heavy equipment increase soil compaction which may increase splash erosion and channelized runoff (Spencer et al. 1996). Soil compaction caused by heavy equipment and yarding can decrease infiltration capabilities, increasing surface runoff. The effect of compaction is especially

important because of the long-term consequence (on the scale of decades and centuries) of the hydrologic characteristics of soils and the site productivity of second growth forests (Everest et al. 1987). Compaction can occur with a single pass of logging equipment across a site. Tractor logging creates relatively large areas of bare and compacted ground that interrupts subsurface channel networks formed by decomposed root systems. This results in reduced access and capacity of these subsurface channels causing soil slumps and increased surface erosion during forest management activities.

Road Management – It is generally recognized that one of the greatest potential effects of forest management activities on aquatic habitat is accelerated erosion and subsequent sediment delivery to streams (Waters 1995). Forest roads are considered the main cause of accelerated surface erosion in forests across the western U.S. (Harr and Nichols 1993) and contribute more sediment to streams than any other land use activity (Gibbons and Salo 1973; Quigley and Arbelbide 1997). Roads are recognized as a long-term, chronic source of sediment affecting streams (Belt et al. 1992; Swanston 1991; Furniss et al. 1991; MBTSG 1998).

Historically, roads have adversely affected salmonid habitat by increasing in-stream sediment loads, altering the morphology of stream channels, destabilizing streambanks, modifying drainage networks, creating barriers to movement, and increasing the potential for chemical pollution of the aquatic ecosystem (Furniss et al. 1991). Roads can cause serious degradation of salmonid habitats in streams if poorly planned, designed, located, constructed, and maintained (Furniss et al. 1991; Quigley and Arbelbide 1997; MBTSG 1998). Roads alter the natural sediment and hydrologic patterns by altering hillslope drainage patterns, which affect sediment transport and deposition, and by altering the timing and magnitude of peak flows and stream discharge (Furniss et al. 1991; Megahan 1982).

Forest road construction, road use, and maintenance activities are a primary source of fine sediment delivery to streams. In addition, tree-felling, log hauling and skidding, construction of landings, slash disposal, site preparation, and equipment staging and operations are all potential sources of fine sediment and are activities that diminish the ability of forest soils to resist surface erosion. Nearly all road-related activities can often lead to increases in the levels of soil disturbance, soil compaction, vegetation removal, and the subsequent levels of upland erosion. In general, the potential for impacts increases when these activities are conducted in proximity to streams, and reduces with increased buffer widths. Even with adequate buffer size, however, these activities can still have a substantial effect on sediment delivery to streams due to road stream crossings. Not only can sediment delivery increase directly from road surface runoff, but such road configurations provide a more direct route for sediment generated by other forest management activities to reach and enter the streams.

Stormwater runoff from forest roads can be a direct source of fine sediments, and the increased runoff rates can contribute to increased erosion of upland soils. Miller et al. (1985) observed that when runoff was discharged directly to stream channels 50 percent of the deposited sediment and 100 percent of the suspended sediment reached the stream, in contrast to only 1 percent of road sediment reaching the stream channel when runoff was directed to the forest floor. Increased runoff results in increased stream flows and an increased potential for streambank erosion and further sedimentation levels. Accelerated surface erosion and increased levels of sedimentation

may decrease following the initial disturbance, but can remain above natural levels for many years (Swanston 1991). In general, logged slopes contribute sediment to streams based on the amount of exposed soils to rainfall and runoff. The rate of sediment delivery to stream channels is determined by slope steepness and distance to the stream channel (Quigley and Arbelbide 1997).

Construction of road networks can greatly accelerate and lead to long-lasting erosion rates within a watershed (MBTSG 1998; Beschta 1978; Reid and Dunne 1984; Swanston and Swanson 1976). Elements that lead to these effects include poor road location and surface drainage, undersized culverts, generation of sidecast materials, and inadequate road maintenance practices (Quigley and Arbelbide 1997). Road re-construction activities can also increase sediment delivery to streams if done without consideration of site-specific erosional processes and without implementation of appropriate BMPs and sediment abatement measures. Road surface erosion is particularly affected by traffic, which increases sediment yields substantially (Reid and Dunne 1984). Other important factors affecting road surface erosion include condition of the road surface, timing of when roads are used in relation to rainfall, road prism moisture content, location of the road relative to watercourses, methods used to construct the road, and steepness of the terrain on which the road is located.

Processes initiated or affected by roads include landslides, road surface erosion, secondary surface erosion (landslide scars exposed to rain splash), gullying, debris torrents, debris flows, slumps, and earthflows (Swanston 1991). Forest roads can substantially increase the frequency of mass soil movements in steep watersheds by several to hundreds of times depending on site variables (Everest et al. 1987; Furniss et al. 1991). Jenson and Finn (1966) observed that sedimentation is directly proportional to road mileage in granitic areas. Swanston and Swanson (1976) estimated that debris torrents in managed forests in Oregon occurred 41 and 4.5 times greater than rates in unmanaged forests as a result of forest roads and clearcuts. Similarly, Morrison (1975) found rates of debris torrents to be 13 and 8.8 times greater in forests with roads and clearcuts than in forests without them. Furniss et al. (1991) reported that sediment produced from roads greatly exceeds sediment produced from forests and clearcuts. In many locations, poorly-designed roads have been shown to have a larger effect on sedimentation than hillslope landslides or surface erosion (Kelsey 1980; Best et al. 1995; Wu and Swanston 1980; Swanson et al. 1987; Ziemer et al. 1996). Furniss et al. (1991) reported that road location is the most important factor in construction of roads because it affects more site variables like slope steepness, soil stability, bedrock structure, and presence of subsurface water and will determine the extent of surface failure.

Roads and related ditch networks are often connected to streams via surface flowpaths, providing a direct conduit for the sediment. Ground disturbance from road blading, particularly where the road is immediately adjacent to streams, and at intermittent and perennial stream crossings, can result in elevated sediment levels. The amount of sediment delivered continuously to streams may temporarily increase as bare soil is exposed as a result of blading and when ditch-roughness features (which store and route sediment) are removed. Ditch maintenance is another source of sediment which can increase erosion within the ditch. Sediment yield from road segments with freshly graded ditches is five to seven times greater than the yield from segments with vegetated ditches (Elliot and Tysdal 1999).

New roads within some portions of the HCP project would likely change the natural hillslope drainage network and could accelerate erosion processes. These changes could alter or exacerbate the physical processes in nearby streams, leading to changes in streamflow regimes, sediment transport and storage, channel bed and bank configurations, substrate composition, and stability of slopes adjacent to the streams (MBTSG 1998; Furniss et al. 1991). These changes could potentially have significant effects for HCP fish species in the action area, particularly in watersheds where fish may already be stressed due to degraded habitat conditions.

High road densities can contribute to increased peak flows, but to varying degrees, and depending on local conditions. Scientific literature indicates variable responses of peak flows related to road density (peak flows exceeding a two-year recurrence interval) in the Pacific Northwest. While Jones and Grant (1996) identified increases in small peak flows (less than 2-year runoff events), this was not identified for larger peak flows (Thomas and Megahan 1998). In the Rockies, King and Tennyson (1984) studied road construction effects on peak flows in six watersheds and did not find any significant effect on flood flows.

Considering sediment impacts only, some research suggests that sediment production from forest roads is highly variable from road segment to road segment and that most road segments produce little sediment (Luce and Black 1999). McGreer et al. (1998) suggested that sources of sediment delivery from certain road segments in the Thompson River watershed in western Montana can be identified and therefore treated individually. For example, they found that nine individual locations delivered 76 percent of the total sediment volume in Boiling Springs Creek. On Goat Creek in the Swan Valley, five stream crossings contributed 70 percent of the total sediment delivered by roads to the watershed. In both the Goat Creek and Piper Creek watersheds, the majority of sediment was determined to come from a minority of stream crossings. Overall for both watersheds, less than 5 percent of road mileage was considered to actually deliver sediment to streams (Watson et al. 1997). This implies that managing sediment production of the few highest risk segments would be most efficient in preventing or reducing risk of sediment delivery to streams.

Roads can have very different effects on water resources depending on location and construction. All else being equal, higher total road densities in a watershed increase the risk for aquatic system functioning and associated fish resources than lower total road densities. At minimum, it appears that road density can be a general indicator of potential watershed problems because road density is correlated with many types of watershed alterations, and it is useful when more specific indicators are not available. However, it is unknown and unproven that road densities *per se* cause fish populations to decline when roads exceed some specific density. Certain portions of road systems create the majority of negative effects associated with roads— for example, those segments built on erodible soils, on steep or unstable slopes, and in close proximity to streams.

When a culvert is plugged by debris or is overtopped by high flows, streams associated with these structures can be diverted, can contribute to road failure, and can cause sedimentation (Murphy 1995). Although proper design and location of these structures can minimize the risk of structural failure, any crossing structure is almost certain to fail if it is not maintained or removed when a road is abandoned (USDA et al. 1993; Murphy 1995). Nevertheless, even proper culvert

design and location is not secure against failure. For culverts designed for a 25-year flood, there is an 80 percent probability of failure over a 50-year period; for culverts designed for a 100-year flood, there is a 40 percent probability of failure over a 50-year period (USDA et al. 1993). The effects of such a failure on salmonid habitat will depend on when it occurs, what the stream failure is associated with, antecedent weather conditions, and the number of salmonids using the affected stream system.

In summary, it is apparent that a direct effect of timber harvest and road construction is an increase in sediment delivery to streams. Indirect effects of timber harvest and road building activities on streams include increased stream flow and an associated increase in water temperature. Erosion potential and accelerated sediment delivery is increased by reduction in vegetation, compaction of soils and disruption of natural surface and subsurface drainage patterns. Generally, logged slopes contribute sediment to streams based on the amount of bare compacted soils that are exposed to rainfall and runoff. Slope steepness and proximity to channels determine the rate of sediment delivery. Road reconstruction activities include activities such as blading, culvert replacing, ditch cleaning, and road stabilization. Temporary road construction and obliteration also affects sedimentation rates and surface water and streamflow regimes (Lee et al. 1997b).

Grazing Management – Overgrazing by livestock and its effects on salmonids has been identified as a major problem on western rangelands for decades (Platts 1991). Beschuta et al. (1991) concluded that livestock grazing represents the land–use most damaging to riparian vegetation. Further, elimination of grazing from the riparian zone may be needed to restore streamside vegetation, and fencing is the most effective means of improving riverine habitat in order to restore or maintain salmonid production (Beschuta et al. 1991). Behnke and Zarn (1976) reported the influence of livestock grazing on headwater habitat could be devastating to native threatened and endangered species, and indicated that destabilization of streambanks by trampling with consequent siltation of streambeds as the major factor. However, less is known about grazing impacts in riparian forest environments which may be more resilient than rangeland riparian zones. Also, there is evidence that livestock grazing practices can be employed that will protect stream fisheries (Platts 1982, Rinne 1999).

The impacts of livestock grazing on sediment delivery to streams are greatest when these activities occur in proximity to streams, but can also vary by the intensity, duration, and timing of such activities. The direct access of livestock to streams often results in the greatest sedimentation impacts. This access results in the disturbance of streamside vegetation and soils, and the collapse and tapering of stream banks. This causes increased erosion potential from the area and a direct and site-specific pathway for sediment delivery. The entrance of livestock into stream channels can also result in wider and shallower stream channels, with reduced water velocities and increased sedimentation.

Livestock grazing can affect streambank stability by trampling and removal of streamside vegetation (Waters 1995). Large sections of unstable streambanks indicate an absence of appropriate vegetation in the right amount and type. Vegetation provides soil-binding root mats that protect streambanks by reducing water velocity along the stream edge and providing a means of trapping sediments and nutrients (Platts 1991). However, high stocking rates are a

particular problem and can lead to increased sediment production and deterioration of channel stability. Trampling and hoof slide causes sloughing of streambanks and accelerates bank erosion (MBTSG 1998; Platts 1991). In severe cases, streambanks may collapse causing soil to enter directly into the stream. The longer cattle have access to a stream reach, the more likely streambank deterioration will occur (Mosley et al. 1997). Fall grazing systems studies in southwestern Montana indicate that 21 days of grazing maintained riparian areas in good condition compared to 37 days of grazing, which did not (Myers 1989). Dufour (1993) found that a 30 percent utilization standard for degraded riparian areas appeared to be adequate for riparian recovery and bank stability, but reported the best protective measure for streambanks was exclusion, particularly in sensitive areas of salmonid spawning and rearing habitats.

Direct impacts may result from trampling by livestock on bull trout redds (and other HCP fish species). By using clay targets to simulate bull trout redds, Gregory and Gamett (2009) assessed the probability that cattle would step on bull trout redds. They observed that 15–83 percent of the simulated redds were affected by trampling. When the control period was standardized to the same time period as the treatment, cattle were found to be responsible for affecting 12–78 percent of simulated redds and breaking 6–49 percent of the clay targets. Impacts were higher in pastures where cattle stocking intensity was higher, but impacts were also determined by site conditions adjacent to the simulated redds.

The potential exists where livestock have access to spawning streams and where eggs have already been buried in redds, that trampling by livestock could destroy or disrupt eggs buried in gravel. The mechanical action of trampling can destroy eggs immediately or dislodge and expose eggs as a result of disturbance of the substrate. Indirect effects may result from spawning adult bull trout (or other HCP fish species) being harassed off redds, unintentionally. Livestock movement in or along a spawning reach may interrupt spawning behavior or cause bull trout to be displaced from redds. The more often this happens, the less likely there will be successful spawning. The degree of impact from livestock trampling and harassment would probably depend on the frequency and duration of the disturbing action, but is more likely in or near riparian areas where cattle and other livestock have open access during the spawning season of HCP fish species. On the other hand, interruption of spawning behavior, if temporary and infrequent, may not impede redd construction and spawning behavior. The actual effect is indeterminate at this time.

<u>DNRC HCP Minimization/Mitigation Effects on Sedimentation</u>

DNRC's sediment delivery reduction conservation strategy is intended to reduce potential sediment delivery to streams with HCP fish species and to help ensure that DNRC forest management activities do not contribute to a level of in-stream sedimentation that would adversely affect HCP fish species. The strategy was developed from existing DNRC practices, but adds new commitments. The overall HCP strategy consists of five separate but closely related components that address the potential for sediment delivery from different types of forest management activities as described below. Under this strategy, DNRC would continue to use existing practices, measures, and programs to achieve the stated conservation objectives, and will supplement this effort with conservation commitments that clarify existing DNRC operational procedures. DNRC also commits to specific timelines for addressing existing sediment problems related to DNRC roads.

Based on the biological goal and specific management objectives of the strategy, DNRC will adhere to specific conservation commitments designed to:

1. Minimize the number of roads to those necessary to meet near- and long-term forest management needs.

2. Reduce potential sediment delivery from existing road sources to streams supporting HCP fish species.

3. Construct, reconstruct, maintain, reclaim, and use roads with practices and measures that reduce the risk of sediment delivery to streams supporting HCP fish species.

4. Conduct timber harvest and associated operations (site preparation, slash treatment, reforestation) with practices and measures that reduce the risk of sediment delivery to streams supporting HCP fish species.

5. Conduct gravel excavation, processing, hauling, and use for DNRC forest management projects with practices and measures that reduce the risk of sediment delivery to streams supporting HCP fish species.

DNRC's forest management program includes measures to reduce erosion and to evaluate sediment delivery. This approach incorporates various operational requirements contained in the SMZ Law and ARMs and all applicable Montana Forestry BMPs (DNRC 2004a). The Montana Forestry BMPs are designed to meet state water quality standards and are recognized by the State of Montana as the primary mechanism to achieve water quality standards (Department of Health and Environmental Sciences [MDHES] 1991 and MDEQ 2006) and compliance with the Clean Water Act (CWA). DNRC participates in state-wide forestry BMP audits which use on-site inspections and evaluations to assess both BMP implementation and effectiveness at preventing erosion and/or sediment delivery to streams or ephemeral drainage features. These audits are conducted every 2 years under the direction of the Montana Environmental Quality Council (MEQC), and results are presented in a written report to the MEQC and Montana Legislature.

DNRC has routinely conducted monitoring and implemented changes to correct sediment related issues. DNRC conducts internal BMP audits on ongoing and recently completed DNRC timber sales. DNRC also conducts other site-specific monitoring projects designed to quantitatively determine the effectiveness of BMPs and other mitigation measures in reducing erosion and non-point source pollution. Currently, there are several ongoing monitoring projects that are evaluating the effectiveness of BMPs commonly used at stream and ephemeral draw road crossings.

DNRC is also monitoring the effects of DNRC timber harvest on forest soils for approximately three different timber sales per year. The objectives of these soils monitoring projects include determining whether BMPs and recommended soil conservation practices were applied, and if so, how effective they were. To date, soils monitoring studies have been completed on 94 timber sale projects since 1988 (DNRC 2011).

Most recently, DNRC has conducted three monitoring projects focusing on the duration and magnitude of turbidity events resulting from culvert removal, stream simulation culvert installations, and armored ford installations. The design of this monitoring technique incorporates hi-tech instrumentation, rapid installation, and site adaptability that will allow DNRC to conduct in-situ turbidity monitoring on a variety of land management projects throughout the State. The data collected from these monitoring efforts will be adaptively incorporated into future project implementation with goals of reducing environmental effects as well as maintaining environment effects assessment credibility (DNRC 2011). DNRC also completed two other soils monitoring projects following the 2000 wildfire and salvage operations in the Sula State Forest (DNRC 2002a) and the 2001 wildfire and salvage harvest in the Coal Creek State Forest (DNRC 2003b). All of these monitoring efforts are summarized in the DNRC State Forest Land Management Plan: Implementation Monitoring Report (Fiscal Years 2001 to 2005) (DNRC 2005a). As a result of these monitoring projects, DNRC has changed some practices to improve soil resource protection.

DNRC's existing regulatory requirements, policies, and operational forest practices to reduce the risk of erosion and sediment delivery to streams are described in detail in the Final EIS/HCP (Final EIS/HCP 2010, Chapter 2, pages 2-85 to 2-95). These requirements form the basis of the sediment reduction delivery strategy. The additional HCP commitments are outlined below.

HCP Commitments for Minimizing Roads – The HCP commitments for minimizing roads used for DNRC forest management activities incorporate and clarify the existing DNRC sediment delivery reduction practices for planning transportation systems with the minimum number of road miles (ARM 36.11.421). The HCP commitments include the following existing DNRC practices*:*

1. DNRC will only build roads that are necessary for current and future management objectives.

2. DNRC will identify necessary roads by conducting transportation planning as part of landscape-level or project-level evaluations.

3. DNRC transportation planning will consider:

    a. Existing and probable future access needs within the road planning project area

    b. The relationship of existing access routes and road systems on adjacent parcels

    c. Logging system capabilities

    d. Access needs of planned and future forest improvement activities

    e. Access needed for fire protection

    f. Public access

    g. Planning road systems cooperatively with adjacent landowners whenever practicable

h. Protection of wildlife and aquatic habitat.

4. DNRC will evaluate and consider the use of alternative yarding systems that minimize road needs if such systems are practicable and economically feasible and their use will meet immediate and foreseen future management objectives.

5. DNRC will only use existing roads located in a SMZ only if potential impacts to water quality and aquatic habitat can be adequately mitigated. DNRC will consider relocating roads outside of the SMZ when these impacts cannot be adequately mitigated.

6. DNRC will restrict or reclaim roads that are non-essential to near-term future management needs, or where unrestricted access would cause excessive resource damage. The term "near-term future" generally refers to a period of 15 or 20 years. Decisions on road restrictions or reclamation will be based on consideration of several factors, including, but not limited to, planned activities, desired future stand conditions, silvicultural objectives, infrastructure needs, cost, fire protection access needs, and available human and financial resources.

HCP Commitments for Reducing Sediment from Existing Roads – The commitments for reducing sediment from all existing DNRC roads incorporate and clarify the existing ARMs, BMPs, and policies covering DNRC forest management programs as described in the existing practices. All existing DNRC roads include permanent, temporary, open, closed, abandoned, and reclaimed surfaces as well as stream crossing structures. The additional HCP commitments include a timeline for completing road inventories in watersheds supporting HCP fish species, a prioritization scheme for implementing corrective actions, and a timeline for identifying and implementing corrective actions, as described below.

1. DNRC will complete inventories of all existing roads and stream crossing structures used for forest management activities and abandoned roads that are within the HCP project area and located within watersheds (sixth-order HUCs) supporting HCP fish species. Roads inventoried will be limited to those for which DNRC has legal access and sole ownership, or cost-share or reciprocal road agreements.

2. DNRC will complete inventories using current methods and procedures. These methods and procedures may be revised over time to include additional information, implement new technology, or improve efficiency. However, the essential elements of the existing DNRC inventory would be maintained. Any revision of the methods and procedures would continue to provide all information required for the identification of existing and potential sediment sources and the development of corrective measures.

3. DNRC will complete road inventories on all watersheds supporting bull trout (including core and nodal habitat) during the first 10 years that the Permit is in effect.

4. All DNRC road inventories for watersheds supporting WCT or RBT will be completed within the first 20 years that the Permit is in effect.

5. Based on the completed road inventories, DNRC will classify all inventoried road segments/sites as being either:

    a. Low risk of sediment delivery (meets BMPs or has very low risk of sediment delivery)

    b. Moderate risk of sediment delivery (does not meet BMPs, has moderate risk of sediment delivery, or meets BMPs but is poorly located)

    c. High risk of sediment delivery (does not meet BMPs, is poorly located, is currently delivering sediment, or has high risk of future sediment delivery).

6. DNRC will prioritize corrective actions based on the following factors:

    a. Watersheds supporting bull trout

    b. Watersheds supporting WCT or RBT

    c. Watersheds supporting other sensitive beneficial uses (e.g., domestic/municipal uses)

    d. Watersheds in which TMDLs are in place

    e. 303(d) listed watersheds in need of TMDL development.

7. DNRC will prioritize implementation of corrective actions within a watershed by: High-risk sites, Moderate-risk sites, then Low-risk sites whenever feasible.

8. DNRC project-level, site-specific corrective actions will be developed and implemented on sites identified as having a high or moderate risk of sediment delivery. These corrective actions would only occur on roads and stream crossing structures where DNRC has legal access and has sole ownership. These sites will be improved to a level necessary to reduce risk of sediment delivery to streams supporting fish species and to meet or exceed the habitat requirements for HCP fish species. To bring problem road segments up to minimum BMP standards, DNRC would develop and implement site-specific road improvements and road upgrades, road abandonment or road reclamation, culvert replacement and/or removal and other mitigation measures as necessary.

9. On roads with shared ownership where DNRC does not have sole ownership, DNRC would continue to work with other cooperators to address road segments identified as having moderate or high risk of sediment delivery as described under existing practices.

10. DNRC will complete corrective actions on all identified sites with high risk of sediment delivery located within bull trout watersheds that are in the HCP project area within the first 15 years that the HCP and Permit are in effect. DNRC will use annual updates and the 5-year monitoring report to document progress of corrective actions.

11. Corrective actions will be implemented at all identified high-risk sites in watersheds supporting WCT or RBT within the first 25 years that the HCP and Permit are in effect. Annual updates and the 5-year monitoring report will be used to document progress on these corrective actions.

12. DNRC will continue to implement the road sediment source inventories and corrective actions in watersheds supporting HCP fish species throughout the duration of the Permit term.

13. DNRC will incorporate the goals, targets, and prescriptions contained within approved TMDLs applicable to covered activities where DNRC has actively participated in the development of the TMDL, and the TMDL planning area is located within a watershed containing HCP project area parcels supporting HCP fish species. In these cases, the requirements of the TMDL may be applied in conjunction with the commitments contained in one or more of the aquatic conservation strategies. DNRC will actively participate in TMDL development when 25 percent or more of the TMDL planning area consists of HCP project area parcels in watersheds supporting HCP fish species.

    HCP Commitments for Reducing Sediment Delivery from New Road Construction, Reconstruction, Maintenance, and Use

The commitments for reducing potential sediment delivery from all new DNRC road construction, reconstruction, maintenance, and use rely primarily on DNRC's continuing commitment to implement existing SMZ Laws, ARMs, and policies covering DNRC forest management programs, as described above for the existing practices. These policies apply to both new temporary and new permanent roads. These commitments also include several additions to the existing DNRC practices. The additions included in these commitments are described below:

1. A DNRC water resource specialist will review road management activities associated with forest management projects located within watersheds (sixth-order HUCs) supporting HCP fish species. The water resource specialist will make recommendations that will be integrated into the development of road standards, contract specifications, site-specific BMPs, and other mitigation measures. The purpose and role of the specialist reviews are detailed in commitment 5 below. Specific road management activities that will be reviewed by the water resource specialist include:

    a. Road construction and reconstruction projects meeting one or more of the following criteria:

        i. Greater than 0.5 mile in length,

        ii. Located within the RMZ of a Class 1 stream supporting an HCP fish species,

        iii. Includes the installation of a Class 1 stream crossing, or

iv. Located on sites with high erosion risk

b. Road maintenance projects and use of roads for hauling timber harvest greater than 100 mbf involving one or more of the following circumstances:

i. Located within the RMZ of a Class 1 stream supporting an HCP fish species,

ii. Includes a Class 1 stream crossing, or

iii. Located on sites with high erosion risk

2. Regarding new road locations or reconstruction of existing roads DNRC will avoid high-hazard sites prone to mass failure. Proposed road locations will be screened by DNRC during the CWE coarse-filter analysis for locations associated with slope instability and prone to mass failure. A DNRC water resource specialist will review all proposed road locations in the field when a CWE coarse-filter analysis indicates that the proposed road is located on sites with high risk of slope instability in watersheds supporting HCP fish species.

3. When new road construction or reconstruction cannot be avoided on potentially unstable slopes, DNRC will design and implement site-specific mitigation measures to reduce the risk of mass failure.

4. Roads deemed unnecessary for future use and that are reclaimed will be left by DNRC in a stable condition not requiring maintenance.

5. DNRC will design and implement site-specific BMPs and other mitigation measures to reduce the risk of sediment delivery to streams affecting HCP fish species to the maximum extent practicable. A DNRC water resource specialist will make recommendations that will be integrated into the development of road standards, contract specifications, site-specific BMPs, and other mitigation measures. Annually, the USFWS will be provided the HCP implementation checklist where the decision rationale for determining measures necessary to adequately reduce the risk of sediment delivery may not be practicable or feasible due to site, funding, or other limitations, will be documented.

6. DNRC contracts that address forest management activities conducted in watersheds supporting HCP fish species and including road construction, reconstruction, maintenance, and use will include applicable road design specifications and operating requirements. These specifications will include road construction and maintenance standards, resource protection requirements, BMP requirements, special operating and design requirements, and site-specific BMP and mitigation measure specifications.

7. DNRC will incorporate the goals, targets, and prescriptions contained within approved TMDLs applicable to covered activities where DNRC has actively participated in the development of the TMDL, and the TMDL planning area is located within a watershed

containing HCP project area parcels that support HCP fish species. In these cases, the requirements of the TMDL may be applied in conjunction with the commitments contained in one or more of the aquatic conservation strategies. DNRC will actively participate in TMDL development when 25 percent or more of the TMDL planning area consists of HCP project area parcels in watersheds supporting HCP fish species.

8. DNRC will administer road construction projects to ensure that contract specifications, BMPs, and other resource protection requirements are met on a weekly basis when road construction and maintenance activities are actively occurring.

9. On sites where DNRC practices have resulted in unacceptable levels of impact to soil or water resources, appropriate mitigation and/or rehabilitation measures will be implemented by DNRC as soon as possible. Examples of unacceptable levels of impact are major departures in BMPs resulting in actual sediment delivery to streams or a high risk of sediment delivery to streams.

HCP Commitments for Reducing Sediment Delivery from DNRC Timber Harvest Activities – The commitments for reducing potential sediment delivery from DNRC timber harvest activities (harvest, yarding, site preparation, and slash treatment) focus on reducing the levels of soil disturbance and subsequent levels of erosion and providing buffers zones for effective filtration of sediment. The commitments are primarily based on existing practices, but also include several new measures. The commitments include:

1. A DNRC water resource specialist will review all proposed timber harvests greater than 100 mbf located within a watershed supporting an HCP fish species. The water resource specialist will conduct a field review and make recommendations that would be integrated into the development of contract specifications, site-specific BMPs, and other mitigation measures. The purpose and role of the specialist reviews are detailed in commitment 4 below.

2. Timber harvests proposed on high-hazard sites prone to mass failure will be screened during the CWE coarse-filter analysis as outlined in the HCP CWE conservation strategy. A DNRC water resource specialist will conduct a field review of all proposed harvest locations when CWE coarse-filter analysis indicates the timber harvests are located on sites with high risk of slope instability and are prone to mass failure.

3. When timber harvests are conducted on unstable slopes, DNRC will modify harvest prescriptions and/or design and implement mitigation measures to avoid increasing the risk of mass failure.

4. DNRC will design and implement timber sale contract specifications, special timber harvest operation requirements, site-specific BMPs, and other mitigation measures to reduce the risk of sediment delivery to streams affecting HCP fish species to the maximum extent practicable. A DNRC water resource specialist will make recommendations that will be integrated into the development of contract specifications, special operating requirements, site-specific BMPs, and other mitigation measures. In

cases where measures necessary to adequately reduce the risk of sediment delivery may not be practicable or feasible due to site, funding, or other limitations, decision rationale will be documented in the HCP implementation checklist and provided to the USFWS in the annual update.

5. Contracts addressing DNRC timber harvest and associated forest management activities will include applicable standard operating requirements and restrictions; special operating requirements and restrictions; BMPs; and site-specific mitigation measures designed to avoid, minimize, or mitigate the risk of sediment delivery to streams affecting HCP fish species.

6. DNRC will administer timber sale projects to ensure that contract specifications, BMPs, and other resource protection requirements are met.

7. DNRC will incorporate the goals, targets, and prescriptions contained within approved TMDLs applicable to covered activities where DNRC has actively participated in the development of the TMDL, and the TMDL planning area is located within a watershed containing HCP project area parcels that support HCP fish species. In these cases, the requirements of the TMDL may be applied in conjunction with the commitments contained in one or more of the aquatic conservation strategies. DNRC will actively participate in TMDL development when 25 percent or more of the TMDL planning area consists of HCP project area parcels in watersheds supporting HCP fish species.

8. DNRC will complete contract inspections during routine contract administration. DNRC will document the levels of compliance with contract specifications and requirements.

9. On sites where DNRC practices have resulted in unacceptable levels of impact to soil or water resources, appropriate mitigation and/or rehabilitation measures will be implemented as soon as possible.

HCP Commitments for Reducing Sediment Delivery from Gravel Excavation, Processing, and Use

The following HCP commitments are for reducing potential sediment delivery from gravel excavation, processing, hauling, and use.

1. DNRC will design and implement site-specific BMPs and other mitigation measures to reduce the risk of sediment delivery to streams affecting HCP fish species from all gravel pits. A DNRC water resource specialist will make recommendations that will be integrated into the development of contract specifications, permits, and Plans of Operation.

2. DNRC gravel pits will comply with biennial agreements established with county weed boards. Noxious weeds will be managed utilizing an integrated weed management approach. Such practices include, but are not limited to: 1) The use of weed-free equipment; 2) re-vegetation of disturbed areas with site-adapted species, including native

species as available; and 3) biological control measures included in timber sale contracts and Plans of Operations. Non-vegetated areas associated with large gravel pits may not exceed 40 acres.

3. DNRC gravel pits will not be developed within SMZs. Some site-specific minor levels of borrowing and stockpiling of material may occur in a SMZ where required to construct, reconstruct, improve, or maintain roads or road stream crossings. If borrows occur in SMZs, measures to minimize risk of sediment delivery will be developed by a DNRC water resource specialist and integrated into the development of contract specifications or permits.

4. DNRC will not develop gravel pits within RMZs. Some site-specific minor levels of borrowing and stockpiling of material may occur in a RMZ where required to construct, reconstruct, improve, or maintain roads or road stream crossings. If borrows occur in RMZs, measures to minimize risk of sediment delivery will be developed by a DNRC water resource specialist and will be integrated into the development of contract specifications or permits.

5. The Stillwater Block and the Swan Unit, may each be allowed to have one medium non-reclaimed gravel pit within the portion of an RMZ that extends beyond the SMZ.

HCP Commitments for Reducing Effects of Grazing on Aquatic Species – The minimization and mitigation measures of DNRC's grazing strategy are outlined in detail above in DNRC HCP Minimization/Mitigation Effects on Stream Temperature.

Monitoring and Adaptive Management for Sedimentation – The DNRC HCP sediment delivery reduction conservation strategy includes both implementation monitoring and effectiveness monitoring whereby DNRC will monitor compliance with sediment reduction targets by using case studies completed in discrete watershed study areas (fifth- or sixth-order HUC).

The following subsections describe DNRC's HCP monitoring and adaptive management commitments for the sediment delivery reduction conservation strategy.

DNRC's implementation monitoring component addresses the resource objectives of minimizing roads and reducing sediment delivery from roads and timber harvest, and includes the following components:

1. DNRC will track and report the amount of road that is newly constructed, reconstructed, relocated, abandoned, and reclaimed within the HCP project area. This will also include providing the amount of reduction in road mileage for high-risk sites, if any. DNRC will provide the USFWS with updates for these activities in the 5-year monitoring reports.

2. Qualitative assessments, including internal BMP audits and contract administration inspections, will be conducted by DNRC on all forest management projects that involve levels of road construction and reconstruction greater than 0.5 mile in length, are located within the RMZ of a stream supporting a HCP fish species, include the installation of

stream crossing on a Class 1 stream, or are located on sites with high erosion risk as defined by the state ARMs. BMP audits and timber sale inspections will also be completed by DNRC on all timber sales and timber permits greater than 100 mbf. Up to 12 BMP audits, at least one on each DNRC administrative unit with an active timber sale program in the HCP project area will be conducted annually. These assessments will be used by DNRC to evaluate the implementation and effectiveness of all applicable BMPs. BMP audits include assessments of the adequacy of drainage and buffers, the risk of sediment delivery to streams, and any occurrence of erosion.

3. Documentation of contract inspections will be completed by DNRC management foresters during routine contract administration. These will be compiled and evaluated every 5 years to determine the levels of compliance with contract specifications and requirements.

4. At the annual HCP review meeting, DNRC will update the USFWS on the status of projects related to the design and implementation of mitigation measures to reduce the risk of mass wasting in areas where new road construction or reconstruction cannot be avoided on potentially unstable slopes. DNRC will provide the USFWS documentation annually of adequate road and harvest design and mitigation measures in these areas.

5. DNRC will provide the USFWS with updates on all road inventory and sediment monitoring and implementation activities and issues at the annual update and 5-year monitoring meetings in accordance with the requirements in the Final EIS/HCP (2010), Appendix A, Chapter 4.

Similar to DNRC's ongoing implementation monitoring program, effectiveness monitoring for the sediment delivery reduction conservation strategy addresses whether BMPs and other mitigation measures are adequately reducing sediment delivery from new road construction, reconstruction, maintenance, use, and correctives action implemented on problem segments of existing roads, and from timber harvest, site preparation, and slash treatments. Specific effectiveness monitoring components include the following measures:

1. DNRC will conduct qualitative assessments, including DNRC internal BMP audits and contract administration inspections, on all forest management activities that involve the levels of road construction and reconstruction and timber harvest identified in the implementation monitoring activities. These assessments will be used to evaluate the effectiveness of all applicable BMPs.

2. DNRC will implement a minimum of two ongoing quantitative sediment monitoring projects at any one time (for example, during a field season) to determine the effectiveness of BMPs and other mitigation measures. DNRC will prioritize higher-risk sites, including stream crossings, roads and timber harvest on unstable slopes, and roads adjacent to streams. Individual monitoring projects will be designed to investigate the effects of a DNRC forest management project on specific water and soil parameters and evaluate the effectiveness of BMPs and other commonly used site-specific mitigation measures. Monitoring design, methods, and protocols will be selected from established

procedures that have been demonstrated to be practicable, cost-effective, and suited for addressing the project-specific monitoring objectives (MacDonald et al. 1991; Rashin et al. 1993; Dissmeyer 1994; Rashin et al. 1994; McCullough and Espinoza 1996; Reeves et al. 2004). Examples of quantitative monitoring types and methods that may be implemented include in-channel sediment sampling (e.g., grab samples, substrate scoring, core samples, suspended solids); sediment traps; soil condition surveys; and streambank erosion rate sampling. Higher-risk sites will be given priority by DNRC for this type of monitoring.

3. DNRC will use case studies to evaluate the effectiveness of corrective actions implemented on problem segments of existing roads in reducing sediment production. In these studies DNRC will model sediment production for problems road segments both prior to and following implementation of corrective actions. Model outputs will be used to quantify sediment and determine whether percent sediment reduction targets are being met. DNRC will use results from the quantitative sediment monitoring (described above) as well as results of other applicable studies to validate model assumptions and adjust model coefficients used. These studies will be completed in discrete watershed study areas (5th or 6th code HUC). Case studies would likely be completed in areas of concentrated ownership where DNRC is most active and where there is greater potential for sediment production to be reduced due to corrective actions.

4. Following the completion of numerous case studies and after having completed a majority of the road inventories across the project area, DNRC will extrapolate across the broader project area to estimate progress and ensure the achievement in meeting the sediment reduction targets across the entire HCP project area.

5. DNRC will provide the USFWS with updates on all sediment and BMP effectiveness monitoring at the annual update and 5-year monitoring meetings in accordance with the requirements in the Final HCP (Final EIS/HCP 2010, Appendix A, Chapter 4).

6. DNRC would be required to revise or create new BMPs and report the changes to the USFWS if the adaptive management process is triggered for the following situations: 1) if through the BMP audits or other qualitative assessments, DNRC determined that BMP effectiveness fell below 90 percent; 2) if through the quantitative assessments, the project-specific thresholds are exceeded for one project in two subsequent years, and 3) if the results of case studies show that corrective actions are not effective in reducing sediment production from existing problem road sources by at least 50 percent (or 10 percent per decade).

The adaptive management process would ensure that the HCP sediment delivery reduction conservation strategy will be effective at reducing the anticipated levels of sediment that is expected to be delivered to streams occupied by HCP fish species during the Permit term. The amount of both implementation monitoring and effectiveness monitoring that will be conducted by DNRC will be adequate to determine with sufficient precision sediment delivery because the focus of the monitoring program (e.g., case studies, internal audits) will concentrate on the high risk sites and use standard methods of assessment, including quantitative evaluations. In

addition, under the HCP, DNRC will ensure the tracking and reporting on HCP sediment delivery commitments by requiring each administrative unit to use an HCP implementation checklist for each forest management activity when planning a project within the HCP project area.

The monitoring and adaptive management program for the grazing strategy is described in detail above in Monitoring and Adaptive Management for Stream Temperature.

Analysis of Effects of HCP Measures on Sedimentation

It is generally recognized that one of the greatest potential effects of forest management activities on aquatic habitat is accelerated erosion and subsequent sediment delivery to streams caused by forest road construction, road use, and maintenance activities (Waters 1995). The construction, maintenance, and use of forest roads can be a substantial source of sediment loading to streams. As a result, this is a primary issue for roadways built close to surface waters (within 300 feet), and particularly those that support sensitive fish species. The proximity of a road and stream limits the intervening distance to effectively infiltrate the runoff and deposit transported sediment. Historically, forest road- related activities have been a primary source of fine sediment delivery to western Montana streams. Currently, existing forest roads are a major source of sediment within the action area, including the HCP project area (Final EIS/HCP 2010, Chapter 4, Section 4.8.4.2, subsection Road Surface Sediment Production).

Other forest management activities that can contribute to the sediment delivery to Montana streams include timber harvesting, yarding, site preparation, and slash treatment. These activities often increase the levels of soil disturbance, soil compaction, vegetation removal, and the subsequent levels of upland erosion. DNRC has indicated their existing harvest methods and procedures to minimize soil disturbance in conjunction with existing riparian buffers and timber harvest BMPs, sediment delivery to streams from these activities is relatively small especially compared to the construction and operation of forest roads (Final EIS/HCP 2010, Chapter 4, Section 4.8.4.2, subsection Timber Harvest Site Preparation and Slash Treatment).

As mentioned above, road density can be a factor in contributing to sediment increases in streams, particularly those road segments in close proximity (< 300 feet) to the stream channel and at stream crossings. DNRC estimates that during the Permit term, construction of about 1,100 miles of new roads on DNRC HCP project lands is anticipated. Furthermore, this increase could impact HCP fish species habitats in the affected reaches where road segments are constructed in proximity (< 300 feet) to streams or at stream crossings. These impacts would be localized to the watersheds and local populations where the roads are built. However, the exact magnitude of sediment impacts resulting from new road construction under the HCP is difficult to discern and quantify because not all of the locations of new roads are known at this time, nor their design and development. A thorough discussion about the relationship between road density and the potential effects on sedimentation from implementation of the HCP is provided in Appendix E.

Analysis of HCP Measures on Sedimentation – Road Inventory of the HCP Project Area: Existing roads are a major source of sediment within the action area, which includes the HCP area (Final EIS/HCP 2010, Section 4.8.4.2, subsection Road Surface Sediment Production).

There are approximately 4,570 miles of existing road located on DNRC forested trust lands within the action area, with approximately 2,646 miles of road in watersheds supporting HCP fish species within the HCP project area (Final EIS/HCP 2010, Chapter 4, Table 4.8-7). Sediment from roads has the potential to affect HCP fish species, particularly those segments of road located within 300 feet of a stream. Of those existing roads located on forested trust lands within the HCP project area, approximately 700 miles (26 percent) are located within 300 feet of a stream and about 240 miles of this total are within 300 feet of known HCP occupied fish streams (Final EIS/HCP 2010, Chapter 4, Table 4.8-7). Table 4.8-7 in the Final EIS/HCP (Final EIS/HCP 2010, Chapter 4, page 4-192) shows that of the 240 miles within 300 feet a HCP fish species stream, 177 miles are within 300 feet of a stream occupied by bull trout, 235 miles within 300 feet occupied by WCT, and nearly 12 miles are within 300 feet occupied by RBT. Note that there is overlap in that all of the road miles within 300 feet of a HCP-occupied stream are simultaneously occupied by bull trout and WCT. All of the 177 road miles that are within 300 feet of a stream occupied by bull trout are also the same stream miles occupied by WCT. Consequently, there is an additional 58 road miles within 300 feet of a WCT stream.

DNRC has inventoried approximately 430 miles of existing roads to identify major and minor road problems and general maintenance needs. This represents about 16 percent of the roads within the HCP project area and provides a statistically significant sample of road problems that commonly occur on trust lands (DNRC 2008a). Although a total of 12.5 miles of road (3 percent of all inventoried roads) were identified by DNRC as problem segments (segments with a moderate or high risk of increased sediment delivery), the sediment modeling for this assessment assumed a more conservative estimate (6 percent), to compensate for the relatively small proportion of roads inventoried.

Based on the distribution of the inventoried road problems, sediment production from forest roads focused on surface runoff close to streams and road-stream crossings. Because the DNRC road inventory specifically targeted potential problem areas, the proportion of inventoried roads within 300 feet of streams was substantially greater than the estimate for the entire HCP project area (27 percent) (Final EIS/HCP 2010, Chapter 4). In particular, 46 percent of the inventoried problems were related to culvert crossings, of which the primary problems included alignment/grade (24 percent), capacity/plugged (28 percent), and energy control/armoring (20 percent). About another 46 percent of all inventoried problems were associated with inadequate road surface drainage, including drain dips (14.6 percent) and corrugated metal pipes (CMPs) (19.5 percent). Within these two categories, the most common problem was inadequate capacity for relief CMPs due to plugged inlets, improper sizing, or ineffective drain dips (DNRC 2006b).

Analysis of Sediment Production from Roads and Stream Crossings – The Water Erosion Prediction Project (WEPP) model, a public domain model developed by Federal agencies, was determined to be the best tool to quantitatively evaluate surface runoff and BMP applications and the effect on sediment delivery for these identified problems (Final EIS/HCP 2010, Chapter 4). The WEPP soil erosion model is a process-based model to predict runoff, soil erosion, and sediment delivery and has been widely used to model some typical forest conditions. The WEPP model estimated sediment production and delivery from commonly observed problem road segments (see DNRC 2008b for details on the modeling). The modeling was applied to the specific conditions within the road network on DNRC forest trust lands, allowing a comparison

of the relative rates of sediment production in each bull trout core area (i.e., AAU in the HCP project area (Table IV-12).

Table IV-12. Comparison of the estimated sediment production (with and without appropriate BMPs) based on expected road miles at the end of the Permit term by bull trout core area (ie., AAU).

Bull Trout Core Area	Total Sediment Potential (Tons/Year)	Predicted Sediment Production with BMPs (Tons/Year)	Percent Sediment Reduction with BMPs (percent)
Bitterroot	98	37	62
Blackfoot	155	43	72
Flathead Lake	34	10	70
Lower Clark Fork	7	2	77
Lower Kootenai	18	4	78
Middle Clark Fork[2]	217	59	73
Middle Kootenai	91	19	79
North Fork Flathead	80	18	78
Rock Creek	8	3	68
Stillwater[2]	370	84	77
Swan[2]	288	63	78
Upper Clark Fork[2]	348	121	65
Upper Kootenai	35	8	77
Upper Missouri[3]	176	65	63
Total	1925	536	72.6 (Avg.)

Note: Estimates are summarized for each aquatic analysis unit, as well as the percent reductions resulting from BMP implementation (DNRC 2008h).

[1]The estimate of future road miles in the sediment analysis includes temporary roads.

[2]Aquatic analysis units in high precipitation regions.

[3] The Upper Missouri unit is not a bull trout core area, but included here for analytical and comparative purposes.

The amount of new road constructed in each core area over the 50-year Permit term was estimated using the proportion of HCP project area lying within each core area. In addition to the new roads, other existing roads would be reclaimed by DNRC during the 50-year period. Thus, it was determined that the actual or net increase in roads for each core area could be estimated by subtracting the amount of reclaimed road from the amount of new road construction, and adding this to the existing roads to estimate the total roads (Table IV-13).

Common road parameters of grade, road width, and road segment length were calculated by DNRC from available data and used as standard road geometries in all scenarios. Understanding that steeper road segments typically generate more sediment than moderate- or low-grade roads and that a wide range of road grades exist on HCP project area lands, three road grades (5, 10 percent, and 15 percent) were used in the modeling, each representing distinct road grade ranges (0 to 7.5 percent, 7.6 to 12.5 percent, and 12.6 to 17.5 percent). These three ranges account for about 89 percent of all road segments within the HCP project area (DNRC 2008a).

The modeling conducted used two soil types based on predominant classifications identified through road inventories, which indicate about 65 percent coarse material (gravelly loam to very gravelly silt-loam), and 22 percent fine material (silt loam) (NSSC 1995). The standard modeled road segment had a flat cross section without any inboard ditch or drainage features. These model runs establish background conditions that other BMP application scenarios could be compared against. The results of the model were weighted, based on the site-specific conditions (road grade, soil types, etc.) within each of the individual AAUs within the action area. The weighting was assigned based on a combination of road inventory data and local knowledge and/or best professional judgment of the road conditions on DNRC forest trust lands.

The analysis modeled various BMP application scenarios to represent existing and future road conditions. The model decreased the linear extent of contributing road surface area by incorporating road surface drainage features such as cross drains or drive-through drain dips. The model scenarios provided a basis to qualitatively describe DNRC's sediment reduction plans over the time scale of HCP implementation. The modeling also evaluated various sediment buffer widths (5 to 300 feet) to evaluate sediment filtration effectiveness, the influence of road relocations, and the effectiveness of constructed buffers such as slash filter windrows.

In general, the upgrades and BMP applications on existing problem road segments were found to have a large effect on reducing sediment production from road surfaces by an average of slightly greater than 70 percent, if all problem road segments were upgraded (Table IV-12). This value is consistent with field experiments and other published values in the literature (USFHA 1979; Burroughs and King 1989; Rashin et al. 2006; Sugden 2007).

The observed highest sediment production values occur in bull trout core areas with the highest precipitation (Stillwater, Swan and Upper Clark Fork). Sediment production rates ranged from 1.62 to 7.32 pounds per linear foot of road (DNRC 2008a). Applying these sediment production rates to the estimated problem road segments within each core area, results in a range of 7 to 370 tons per year of sediment production with an average of 148 tons per year over all core areas (Table IV-12). DNRC's HCP commitments addresses sediment production at these problem road segments by applying timely corrective actions (BMPs and other HCP sediment abatement measures) during the Permit term. By the end of the 50-year Permit term, DNRC anticipates reduction in sediment production from the problem road segments ranging from 62 to 79 percent depending on the core area.

Based on these modeling results, DNRC has developed a target rate of 50 percent sediment reduction from existing road sources over the term of the Permit. DNRC expects it will be able to reduce total existing sediment production by approximately 10 percent per decade in those areas prioritized for corrective actions. DNRC will monitor compliance with sediment reduction targets by using case studies completed in discrete watershed study areas (fifth- or sixth-order HUC). Case studies would likely be completed in areas of concentrated ownership where DNRC is most active and there is greater potential for sediment production to be reduced due to corrective actions. The information collected in the case studies and site-specific quantitative monitoring projects will be extrapolated and used initially across the entire core area. Following the completion of numerous case studies and after having completed a majority of the road inventories across the HCP project area, DNRC will extrapolate across the broader project area

to estimate progress and ensure achievement in meeting the sediment reduction targets across the entire HCP project area.

The DNRC road inventory indicates there is also substantial potential for direct sediment delivery at stream crossings, particularly due to culvert failures. Culverts fail primarily due to rainfall events that produce stream flows exceeding the hydraulic capacity of the culvert especially if the hydraulic capacity of the culvert is compromised by lack of maintenance or is blocked by debris. This leads to circumstances where the integrity of the road prism is jeopardized by excessive erosional forces. A culvert failure would result in substantial erosion effects on the road prism and the immediate surrounding area. The probability of such failures is greater for problem stream crossings as compared to appropriately constructed crossings.

Of the 2,258 estimated stream crossings in the HCP project area, about 24 percent (550) occur on perennial streams, and 20 percent (458) occur on streams that support at least one HCP fish species (Final EIS/HCP 2010, Chapter 4, Table 4.8-8). DNRC inventoried 384 road crossings and identified 38 percent (132) problem sites. Site-specific data from the problem sites were then used to calculate the probability of culvert failures in these locations over the 50-year Permit term (DNRC 2007a). The large sample size and wide spatial distribution of the problem sites allows application of the results across DNRC ownership. This evaluation also estimated the volume of sediments that would be delivered to the streams at each crossing should a catastrophic failure occur. The analysis used a simple runoff model to estimate the probability and recurrence interval of storm events large enough to exceed the hydrologic capacity of the existing culvert at each site. Interpretation of the results indicates an average failure probability (over the Permit term) of 45 percent for high-risk stream crossings, with an average at-risk sediment volume of about 70 cubic yards (DNRC 2007a). However, these estimates are considered conservative because they are based on the probability of exceeding the carrying capacity of the culvert under recurrent storm events, which does not necessarily correlate directly to a catastrophic failure.

The net increase in road miles within 300 feet of a stream under the DNRC HCP across all bull trout core areas (including the Upper Missouri AAU) is 122 miles (Table IV-13). Most of the increase occurs in the Middle Clark Fork (36.3 miles); Upper Clark Fork (22.7 miles), and the Upper Missouri (24.8 miles). These three units account for 69 percent of the net increase, or about 83.8 more road miles close to streams. Similarly, most of the net increase in stream crossings (260 crossings) is anticipated in these same three units (Table IV-13). Note that not all of the 122 miles of new road would occur within 300 feet of an HCP occupied stream. About 73.9 miles of new forest road are anticipated to be constructed within 300 feet of an occupied HCP fish stream during the Permit term. The net increase of 73.9 miles of road when added to the existing total results in 280.5 miles of road within 300 feet of an occupied HCP fish stream in the HCP project area during the Permit term (see Table IV-14). The greatest net increase is in the Middle Clark Fork (10.4 miles), Stillwater (7.1 miles), Blackfoot (4.9 miles), and the Swan (4.8 miles)(Table IV-14).

Table IV-13. Existing and anticipated net increase in road miles and road densities (per square mile) overall, within 300 feet of streams, and number of stream crossings in the HCP project area over the 50-year Permit term.

	Bitterroot	Blackfoot	Flathead Lake	Lower Clark Fork	Lower Kootenai	Middle Clark Fork	Middle Kootenai	North Fork Flathead	Rock Creek	Stillwater	Swan	Upper Clark Fork	Upper Kootenai	Upper Missouri[1]	Total
Existing Miles of Road and the Net Increase under the HCP															
Existing	210.1	386.1	81.4	11.4	12	447.5	183.9	69.1	13.2	382.6	258.9	195.4	95.1	298.8	2,645.5
HCP	23.4	103.0	17.9	10.2	8.2	185.6	54.9	15.1	11.1	33.8	78.1	104.5	17.8	149.6	813.2
Existing Road Density (per sq mile) and the Net Increase Under the HCP															
Existing	4.85	4.37	4.96	1.75	2.18	3.24	4.10	2.39	1.83	2.80	3.71	2.65	5.47	1.66	3.09
HCP	0.54	1.17	1.09	1.57	1.49	1.34	1.22	0.52	1.54	0.25	1.12	1.42	1.02	0.83	0.95
Existing Miles of Road within 300 Feet of Streams and the Net Increase Under the HCP															
Existing	76.9	100.5	19.1	1.7	2.0	136.3	47.6	13.1	3.4	90.7	54.7	54.3	25.1	75.0	700.4
HCP	1.9	9.3	1.3	2.0	1.0	36.3	8.1	1.3	2.6	1.2	8.6	22.7	0.8	24.8	122.0
Existing Road Density (per sq mile)within 300 Feet of Streams and the Net Increase															
Existing	1.78	1.14	1.16	0.26	0.36	0.99	1.06	0.45	0.47	0.66	0.78	0.74	1.44	0.42	0.82
HCP	0.04	0.10	0.08	0.30	0.19	0.26	0.18	0.04	0.37	0.01	0.12	0.31	0.05	0.14	0.14
Existing Stream Crossings and the Net Increase Under the HCP															
Existing	204	323	78	7	5	423	180	60	11	303	169	177	99	219	2,258
HCP	8	39	6	5	2	113	28	5	7	11	42	69	4	78	417

Source: DNRC (2008a).

[1] Note the Upper Missouri unit is not a bull trout core area, but included for analytical and comparative purposes.

Table IV-14 shows the stream miles affected (existing and net increase within 300 feet of a forest road) by bull trout core area for each HCP fish species stream during the Permit term. The total net increase of stream miles within 300 feet of a forest road across all bull trout core areas is 30.8, 41.0, and 13.8 stream miles for bull trout, WCT, and RBT respectively. Adding the net increase to the existing stream miles, the total stream miles occupied by bull trout, WCT, and RBT that are within 300 feet of an existing or anticipated new forest road is 207.2, 276.1, and 13.8 stream miles respectively (Table IV-14). These values are derived from data presented in Table 4.8-7 in the Final EIS/HCP (Final EIS/HCP 2010, Chapter 4, page 4-192). Note that almost all of the stream miles occupied by bull trout and by WCT overlap such that every bull tout stream is occupied by WCT as well.

Table IV-14. Extent of HCP fish species habitat affected by stream miles within 300 feet of a forest road (existing and new) within the HCP project area Bull Trout core areas through the Permit term.

Bull Trout Core Area[1]	Existing Stream Miles within 300 feet of a Road within the HCP Project Area	BullTrout Stream Miles[2] within 300 Feet of a Road	WCT Stream Miles within 300 Feet of a Road[2]	RBT Stream miles within 300 Feet of a Road[2]	Stream Miles of HCP Fish Species within 300 Feet of a Road[2]
Bitterroot	76.9	21.1	25.7	0.0	25.7
Blackfoot	100.5	15.7	33.4	0.0	33.4
Flathead Lake	19.1	0.1	4.6	0.0	4.6
Lower Clark Fork	1.7	0.4	0.4	0.0	0.4
Lower Kootenai	20	0.7	0.7	0.7	0.7
Middle Clark Fork	136.3	52.8	69.9	0.0	69.9
Middle Kootenai	47.6	12.7	16.7	13.1	16.7
North Fork Flathead	13.1	7.9	9.9	0.0	9.9
Rock Creek	3.4	0.1	0.4	0.0	0.4
Stillwater	90.7	51.5	47.9	0.0	52.3
Swan	54.7	28.7	32.5	0.0	32.5
Upper Clark Fork	54.3	11.6	20.7	0.0	20.7
Upper Kootenai	25.1	3.9	5.5	0.0	5.5
Upper Missouri[1]	75.0	0.0	7.8	0.0	7.8
Total	700.1	207.2	276.1	13.8	280.5

Source: DNRC (2008a)

[1] The Upper Missouri River unit is not a bull trout core area or an area where RBT is present. Only WCT is present in this unit within the HCP project area.

[2] Stream miles include existing stream miles within 300 feet of a road plus the additional stream miles that are anticipated to occur (new) within 300 feet of a road by the end of the Permit term

Sediment delivery from roads adjacent to streams is reduced through the physical structure provided by riparian vegetation, which slows water and mechanically filters and stores fine sediment (Beschta 1989; Bilby 1984; Sullivan et al. 1987; Everett et al. 1994). Riparian forests can filter up to 90 percent of the sediment from the uplands, and there is a demonstrated direct relationship between buffer width and buffer effectiveness (USDA et al. 1993). Buffer widths tend to be problematic for legacy roads, which were typically constructed adjacent to streams with numerous stream crossings. DNRC's current road construction practices regulate road location and design to minimize such impacts to streams and this practice would continue under DNRC's HCP. For roads with inadequate available buffer area, DNRC would likely mitigate effects through road relocation or simulating buffers by constructing slash filter windrows. This practice is particularly effective near stream crossings where the road runoff cannot drain to adequate filtration prior to reaching the stream crossing. Research studies indicate that correctly applied slash filter windrows can provide significant (75 to 85 percent) sediment filtration effectiveness (Burroughs and King 1989).

DNRC timber sale contracts active between 2001 and 2003 accounted for improvement of 121 miles of existing roads and accounted for improvement of maintenance activities on approximately 172 miles of existing road. DNRC evaluated approximately 1,564 miles of existing road from fiscal year 2006 through fiscal year 2010. Maintenance measures and improvements to approximately 521 miles of existing roads were included in the 120 timber sales contracts sold from fiscal year 2006 to fiscal year 2010 (DNRC 2011). DNRC has appropriated approximately $20,000 annually to both the NWLO and SWLO for contract services to help complete road inventories and assessments. A portion of DNRC's forest improvement funds collected under each timber sale is set aside for road maintenance needs. These funds are allocated annually to each DNRC administrative land office for implementation. The land office selects and prioritizes individual road maintenance projects to be implemented with these funds.

BMPs have shown repeatedly to minimize sediment transport and delivery from roads (Burroughs and King 1989; Cook and King 1983; DNRC 2006a; Rothwell 1983; Seyedbagheri 1996). Since the inception of the state-wide BMP audits in 1990, DNRC has consistently ranked among the highest of all ownership groups (DNRC, U.S. Forest Service/Bureau of Land Management, private industrial, and non-industrial private), in both BMP application and effectiveness (DNRC 2006d, 2008d, 2010). The results of the DNRC internal BMP audits are comparable with the results of the state-wide audits (DNRC 2000a, 2005b). State-wide audits are completed biannually by interdisciplinary teams consisting of representatives from various forest landowner groups throughout Montana. Four to five DNRC harvest sites are typically completed in each BMP audit cycle. BMP audits provide an important feedback mechanism to DNRC on the implementation and effectiveness of BMPs. Approximately 90 internal and 25 state-wide BMP audits have been completed on DNRC timber sales since 1998. Although there is no clear specific mandate for DNRC to conduct BMP audits, each subsequent Final BMP Audit report has made the recommendation that the BMP audit process be continued, and to date the audits continue.

Analysis of Grazing Impacts – The number of grazing parcels in the HCP project area varies substantially by bull trout core area. As a result, the potential effects to HCP fish species would tend to vary in a similar manner (Final EIS/HCP 2010). For example, about 30 percent of the total grazing license parcels in the HCP project area occur in the Middle Clark Fork core area, as do 34 percent of the parcels containing any HCP fish species. In addition, the Blackfoot River core area contains about 22 percent of the grazing license parcels and 25 percent of the parcels with any HCP fish species. The other 12 units contain less than about 13 percent of the parcels with HCP fish species. Therefore, grazed parcels that potentially cause negative effects to HCP fish species habitat, and that may require commensurate corrective actions, are likely to occur in the Middle Clark Fork, Bitterroot, and Blackfoot core areas because these units contain the majority of grazing licensed parcels with HCP fish species habitat (>63 percent). In terms of stream miles, these three core areas contain nearly 75 percent of the total stream miles that contain HCP fish species habitat (see Table IV-11). Hence, the anticipated HCP improvements in grazing management would likely provide the greatest benefits to the HCP fish species in the Middle Clark Fork, Bitterroot, and Blackfoot core areas.

Summary of Effects on Sedimentation

This section provides a summary of the effects of roads on sedimentation under the HCP specifically for roads and stream crossings.

Effects on Sedimentation from Roads – Most of the increase of road miles within 300 feet of streams occurs in the Upper Clark Fork and Middle Clark Fork bull trout core areas, and Upper Missouri AAU (note that the Upper Missouri unit is not a bull trout core area). These three units account for 69 percent of the net increase, or about 83.8 more road miles close to streams. Similarly, most of the net increase in stream crossings (260 crossings) is anticipated in these same three units. Furthermore, predicted sediment production with BMPs based on expected (future) road miles during the term of the Permit is among the highest levels for these 3 units (Final EIS/HCP 2010, Table 4.8-19), with the Upper Clark Fork core area almost 70 percent greater (121 tons/year) than the next highest total, the Stillwater core area (84 tons/year). The Upper Clark Fork core area occurs in a high precipitation zone and is predicted to have a net increase of 22.7 miles of road within 300 feet of a stream. The net increase in road segments within 300 feet of streams for the Stillwater core area is 1.2 miles and for the Swan 8.6 miles, both of which are high precipitation zones where risk of some unpredictable amount of sediment delivery is likely to occur at some point over the term of the Permit. There is also a risk of an unpredictable amount of sediment delivery to occur during the Permit term for the Middle Clark Fork core area and Upper Missouri AAU; however, these units do not occur in high precipitation zones and so the risk is tempered somewhat. The sediment increases for all these segments within 300 feet of a stream is expected to be largely offset by BMPs and other sediment abatement measures that may be required based on site-specific conditions.

About 59.5 miles of existing road in the Middle Clark Fork core area is within 300 feet of a WCT stream and by the end of the Permit term there will be an increase of 36.3 miles of new road within 300 feet of any stream (values derived from Final EIS/HCP 2010, Chapter 4, Table 4.8-7 and Table 4.8-20). It is unknown how many miles of new road would occur within 300 feet of an HCP fish species stream; however, one can surmise from the expected increase in stream crossings on HCP fish species streams anticipated in this core area (113) that it could be more than a moderate increase. Therefore, the risk of an unpredictable amount of sediment delivery to occur during the Permit term for the Middle Clark Fork core area is elevated. Even though this core area does not occur in a high precipitation zone, a single storm event or above normal spring runoff has the potential to delivery above background sediment levels to a HCP fish species stream especially from those road segments located within 300 feet of a stream or at culvert stream crossings. In turn, adverse impacts to HCP fish species due to the sediment increases could potentially occur by degrading spawning and rearing habitat or impair normal feeding, breeding, and sheltering behavior.

When considering the baseline habitat conditions for the Middle Clark Fork core area, the trend is uncertain. Forest habitat conditions have trended upward, with an improved baseline (B. Riggers, USFS, pers. comm.) and particular emphasis on road BMPs and improvement of fish passage in tributary systems. However, at the same time, private residential development and private logging have increased, much of which is concentrated at the lower reaches of key tributaries at sites where bull trout are known to congregate and may be increasingly vulnerable. In balance, it would be difficult to determine whether or not the overall habitat trend is

improving as well as the population trend for bull trout, or other HCP fish species. Prospects for continued habitat conservation activities are good; however, population response as a result of these activities is not certain, given the nonnative species habitat and connectivity concerns. It is also uncertain how the DNRC HCP would affect baseline habitat conditions, but there is risk that adverse effects could temporarily occur on occasion due to sediment input at these localized sites where new stream crossings and new roads constructed within 300 feet of a HCP fish species stream.

The existing baseline conditions for bull trout in the Upper Clark Fork core area is at-risk because much of the existing watershed functions poorly for most bull trout habitat and bull trout population attributes. The same is likely true for WCT in this core area. The legacy effects of past smelting operations in Anaconda and irrigation withdrawals, in conjunction with the dominance of exotic species have resulted in watershed conditions that limit bull trout populations in terms of abundance and distribution. Combined effects of over a century of farm and ranch-related land management uses, including irrigation dewatering, grazing, and water quality impairment (temperature, sediment and runoff), have created impacts to bull trout populations in the core area. The existing legacy of forest roads and forest practices are also an ongoing concern. The DNRC HCP project could add another incremental negative affect to the baseline because of the elevated risk of sediment delivery from additional new roads and new stream crossings during the term of the Permit, especially in this high precipitation zone. There is about 24.4 miles of existing road within 300 feet of a bull trout stream and 27.7 miles within 300 feet of a WCT stream (Final EIS/HCP 2010, Chapter 4, Table 4.8-7). DNRC expects to build another 23 miles of new road within 300 feet of a stream and 69 more culverts Final EIS/HCP 2010, Chapter 4, Table 4.8-20).

The impact to bull trout or WCT is difficult to precisely ascertain, but it seems likely that at some point during the term of the Permit an isolated storm event in the Upper Clark Fork core area could cause a road-related failure that allows some sediment to enter a HCP fish species stream which could adversely impact either spawning habitat or rearing habitat or both. The Changed Circumstances program under the DNRC HCP is intended to catch these problems and fix them quickly.

The historical decline of the WCT is continuing in the Upper Missouri River AAU. The MDEQ (1998) lists 37 streams in the Missouri River drainage as being water-quality impaired as the result of forestry practices, agricultural practices, water withdrawals, roads, and mining. This decline of WCT coincided with the stocking of non-native rainbow trout, brook trout and brown trout. By the 1950's, these non-native salmonids had colonized most of the cold-water fish habitat in the Missouri drainage and WCT were confined to a few headwater populations. Most of these streams no longer contain native WCT because of competition with brook trout and hybridization with rainbow trout. Many of these streams are impaired by more than one activity. Many WCT populations in this AAU may be lost in the next 100 years if intervention does not occur to address the major threats (Shepard et al. 1997).

Even though 75 miles of road exist within 300 feet of a stream, only 6.7 miles occur within 300 feet of a WCT stream (Final EIS/HCP 2010, Chapter 4, Table 4.8-7). However, DNRC expects to build an additional 24.8 miles of road within 300 feet of a stream and construct 78 more

stream crossings during the Permit term. Given the precarious status of baseline conditions for WCT habitat and populations, the addition of sediment from new roads to any WCT-occupied streams would likely further exacerbate these degraded conditions. The actual affect on WCT and its habitat is impossible to predict from implementation of the DNRC HCP. It is likely that at some juncture over the 50-year Permit period some amount of sediment input could happen and degrade WCT spawning and rearing habitat at least temporarily. Again, the DNRC HCP has safeguards to quickly identify road-sediment related problems and fix them in a timely manner.

Effects on Sedimentation from Stream Crossings (culverts) – The effect of sediment mobilized by construction activities associated with installation of new culverts or with culvert removal and replacement projects is expected to adversely affect HCP species occurring in those streams. The risk of sediment adversely affecting HCP fish species is likely to occur during and following the construction phase. Sedimentation and turbidity will occur from heavy equipment operation on access roads and excavation/fill areas by exposing, destabilizing, and/or compacting streambanks, streambeds, and riparian soils. Additional sedimentation may occur from excavating the roadfill (above the wetted perimeter), backfilling, clearing and restoring the riparian area, maintenance, and repairing streambeds following high-flow events, as needed. Following construction, periodic spikes in sediment input are expected during the first winter season in response to precipitation events that may mobilize unstable sediments from upland locations. Sedimentation may also occur throughout the site recovery period until fill slopes stabilize.

Studies have shown that about 60 percent of the sediment yield resulting from instream activities such as culvert removal is suspended sediment, which ranges up to sand-sized particles (Waters 1995). Increases in suspended sediment have been shown to affect salmonid behavior in several ways. Fish may avoid high concentrations of suspended sediments altogether (Hicks et al. 1991). Even small elevations in suspended sediment may reduce feeding efficiency and growth rates of some salmonids. At lower concentrations of suspended sediment fish may decrease feeding and at higher concentrations may cease feeding completely (Sigler et al. 1984).

Based on observations made at two culvert replacement projects in Washington (Bakke et al. 2002), the USFWS estimated bull trout could be exposed to up to 2,000 mg/l of suspended sediment for up to 3 hours. This sediment dose may be at a level where serious physiological effects of disease, reduced growth, and hindered immunological response are probably avoided (Newcombe and Jensen 1996). However, short-term reductions in oxygen uptake are likely, until bull trout relocate to more suitable water. Therefore, bull trout may be significantly disrupted from their normal behavior patterns during periodic sediment pulses that could last up to 3 hours during any one pulse, with the highest concentration reached during the reinstatement of streamflow in the reconstructed channel. Excavation, backfilling, and upland restoration activities are likely to produce some sediment, but the USFWS surmised that action agency efforts to maintain silt fencing and other erosion control measures should ensure minimization of suspended sediment concentration to avoid adverse affects (USFWS 2004b). Based on Washington State water quality turbidity standards that were exceeded 600 ft downstream from an instream work site, the USFWS concluded that in extreme cases the high turbidity levels could significantly alter the breeding, feeding and sheltering behavior of bull trout as far downstream as 600 ft. (USFWS 2004b).

In addition, social behavior patterns of salmonids may be altered by suspended sediment (Berg and Northcote 1985). High concentrations of suspended sediment can also affect survival, growth, and behavior of stream biota that serve as forage for salmonids (Harvey and Lisle 1998). Suspended sediment may alter food supply by decreasing abundance and availability of aquatic insects. However, the precise thresholds of fine sediment in suspension or in deposits that result in harmful effects to benthic invertebrates are difficult to characterize (Chapman and McLeod 1987).

A new culvert installation or the replacement of a culvert is generally a short-term activity (less than one day) and typically results in a short-term pulse of sediment that is mobilized from equipment having to work instream. However, some larger culvert projects can take longer because of the site characteristics such as stream size, stream gradient, and slope steepness, which may require significant amounts of fill or other construction features that take longer to install.

Depending upon the concentration and duration of exposure, sediment could seriously degrade existing spawning habitat conditions to a point where bull trout reproductive success is reduced (Shepard et al. 1984). The same is likely true for WCT and RBT as well, although the tolerance level for both of these species may be higher and the impact may be less severe because exposure time to higher sediment levels may be lower due to the shorter egg incubation period. It is recognized that bull trout are more sensitive to changes in their environment than WCT and RBT because of the differences in the bull trout life history strategy (Rieman and McIntyre 1993).

The introduced sediment from most culvert projects would be localized and relatively small in comparison to background levels, but it could be additive to the background levels. Also, due to the construction timing, these small quantities of sediment would be generated at a time of low background sediment yield in the system. In other words, the timing of the sediment input from construction-related activities would generally occur when backgrounds levels of sediment in the stream system are generally absent or in low quantities (i.e., lack of precipitation during this time). Whereas sediment generated during fall and winter rains or runoff would occur when background levels of sediment are generally higher.

Rashin et al. (1999) studied the effectiveness of BMPs to control erosion and sediment delivery to streams associated with the installation of culverts and new roadways in western Washington during the first and second year. The culvert fill height appeared to have a strong influence on magnitude of erosion and sediment delivery. The evaluation of erosion severity during the second year resulted in a strong correlation with the culvert-fill height and severity of erosion. Observations on the inflow end of culverts resulted in 88 percent of the culvert fills around 19-20 feet in height had moderate (25-50 percent of the fill area is actively eroding) or severe (greater than 50 percent of the fill area is actively eroding) erosion. Moderate and severe erosion was observed less frequently (39 percent) as fill height decreased. The culverts included in the Rashin et al. (1999) study did not have stream-simulation designs, so the results may not be fully applicable to activities under the HCP. The USFWS expects BMP effectiveness in minimizing sediment delivery and slope stability to be much higher with stream simulation designs under the

HCP because crossing structures currently are not built within the bank-full width and since 1999 there have been advances in BMPs and more experience with regard to their effectiveness.

In the post-fire landscape in the Big Creek drainage located in the North Fork Flathead bull trout core area, culverts that were considered to be at "steep" sites with deep fill, the USFS concluded that culvert replacement could produce 1.2 – 5.3 tons of sediment depending on the width of the culvert and if conditions are dry or wet (USDA 2002). This amount of sediment produced during culvert replacement included the implementation of all BMP's to minimize sediment delivery to streams. The USFS reported that if a culvert at a "steep" site with deep fill fails, the potential erosion from the fill directly over the culvert was estimated at 202.4 tons. This did not include erosion that may occur along stream banks or along road surfaces if a culvert fails, only the road fill (USDA 2002).

Monitoring by the Flathead and Lolo National Forests (USDA 1999) indicated that during the application of BMP's, 1 to 2 tons of sediment is typically produced at each crossing, and most of the sediment that is created is deposited within the first 150 feet downstream of the culvert. Although BMP's (silt fences, clean water diversions, etc) were considered effective in greatly minimizing sediment input during the replacement or removal process, the USFS concluded that it was impossible to stop all sediment input from occurring. Furthermore, they surmised that sediment produced by the culvert replacements were likely to cause some scattered, temporary (several weeks to months) reductions in bull trout spawning and rearing habitat near culverts that occur in or near spawning and rearing areas. Additionally, these habitat reductions would displace some juvenile bull trout in habitats near the culverts for several weeks to months.

Culvert generated sediment can create artificially high sediment levels during bull trout egg incubation and is truly not flushed until the spring freshets; however, substrates used for rearing would be cleansed by those spring freshets thus reducing sediment levels and minimizing impacts to juvenile bull trout from that year class. Certainly, age 1+ and older juveniles could be subject to elevated levels of sediment during fall and winter prior to spring rains and flushing of fines. This dynamic would likely occur until the site becomes revegetated. Confounding this relationship, however, is the sediment capacity of the stream at any given discharge. If sediment exceeds transport capacity, deposition can occur at any discharge, while transport may continue at very low discharge levels if capacity is not exceeded. In the core areas within high precipitation zones, transport capacity of sediment is generally not a problem; however, on occasion a single stream may have sediment transport issues because of the cumulative effects of past fires or poor road construction, or other natural events or man-made activities (DNRC 2005a).

The USFWS expects DNRC to maintain all the erosion control features of a culvert project in a functional condition in order to satisfy the objectives of the sediment reduction delivery strategy of minimizing sediment delivery to HCP fish species streams.

The USFWS also expects new culvert structures will result in fewer maintenance needs and better performance during high precipitation events, resulting in near-normal sediment and bedload movement and debris conveyance. With implementation of BMPs the likely resulting sediment impacts should be relatively minor to HCP fish species and their habitats. Although,

the potentially small increase in sediment delivery could result in take of bull trout eggs, fry, and juveniles the risk of incidental take occurring is likely low. Similarly, road segments associated with stream crossings or located within 300 feet of an HCP fish species stream may potentially increase sediment yield slightly which could potentially result in an increased risk of take to bull trout eggs, fry, and juveniles. Furthermore, in the core areas within higher precipitation zones and with more new roads to be constructed (and associated new stream crossings), there may be a cumulative increase in sediment yield from affected watersheds (most likely by less than 1 percent) soon after the road construction in the affected watershed. However, as the new road system becomes stabilized hydrologically (re-vegetated, drainage features properly working), sediment yield should become constant, albeit slightly above background level.

Substrate embeddedness is an indicator of the overall habitat condition and is a measure that is particularly useful in assessing the quality of bull trout rearing areas (USFWS 1998b). Rearing habitat within a reach of a given stream is considered to be functioning appropriately when the reach embeddedness is less than 20 percent; functioning at risk when reach embeddedness is 20 to 30 percent; and when over 30 percent, the rearing habitat is considered to be functioning at unacceptable risk (USFWS 1998b). Juvenile bull trout densities are highly influenced by substrate composition (Shepard et al. 1984, Reiman and McIntyre 1993, MBTRT 1998). During the summer, juvenile bull trout hold positions close to the stream bottom and often seek cover within the substrate itself. All bull trout, regardless of their life history/reproductive strategy, are associated with complex forms of cover including LWD, undercut banks, boulders, and pools. Therefore, channel and hydrologic stability are important to bull trout (Reiman and McIntyre 1993). When streambed substrate contains more than 30 percent fine materials, juvenile bull trout densities drop off sharply due to a reduction in interstitial spaces (Shepard et al. 1984). Any loss of interstitial space or streambed complexity through the deposition of sediment would result in a loss of summer and winter habitats (MBTRT 1998). The reduction of rearing habitat will ultimately reduce the potential number of recruited juveniles and therefore reduce population numbers (Shepard et al. 1984).

Culvert projects within 600 feet (upstream) of bull trout rearing habitat may result in a short-term increase in embeddedness, reducing rearing habitat quality and effectiveness. Sediment impacted rearing habitat may function at a lower level until the next freshet removes the fine sediment downstream (USFWS 2004b). Considering the extent of these impacts, juvenile bull trout are expected to be displaced and thus experience a temporary but significant disruption in their normal behavior. These effects are not anticipated to lead to lethal impacts on juvenile bull trout.

The Swan and Stillwater core areas are estimated to have a net increase of 8.6 and 1.2 miles respectively, of new roads constructed within 300 feet of a stream during the Permit period (Final EIS/HCP 2010, Chapter 4, Table 4.8-20). About 42 new stream crossings are expected to occur in the Swan core area and 11 in the Stillwater. Already existing are 45.2 miles in the Stillwater core area and 27.7 miles in the Swan of road within 300 feet of a HCP fish species stream (Final EIS/HCP 2010, Chapter 4, Table 4.8-7). Because these core areas are high precipitation zones, the risk of sediment delivery to a HCP fish species stream is elevated. Habitat conditions in both core areas are somewhat stable with the main concern being non-native species and the negative affects to native fish (i.e., HCP fish species). Nevertheless, the possibility that during the Permit period higher than normal sediment input could occur at stream

crossings that wash out or road segments that fail due to flooding. The actual degree of adverse impact to the HCP species or harm to spawning and rearing habitat for bull trout and WCT would be difficult to precisely determine.

There are 11.2 miles of road within 300 feet of RBT streams in the Middle Kootenai core area. Over the Permit term, DNRC would construct 8.1 more miles of road within 300 feet of streams and add 28 more stream crossings. The actual affect on RBT and its habitat is impossible to predict from implementation of the DNRC HCP. It is likely road and stream crossing construction, and road maintenance and use will contribute sediment delivery to RBT streams potentially contributing to existing fine sediment concerns in that at some juncture over the 50-year Permit period some amount of sediment input could happen and degrade WCT and RBT spawning and rearing habitat at least temporarily. Again, the DNRC HCP has safeguards to quickly identify road-sediment related problems and fix them in a timely manner. In the mainstem of the Kootenai River in Montana (and the HCP Project area), the most limiting factors were altered hydrograph due to Libby Dam, riparian condition, low temperature, and fine sediment (KTOI and MFWP 2004). At best, the risk rating should probably be "unknown" for at least some populations, and possibly "depressed" or "critical" for some in the drainage.

Although the DNRC HCP is expected to improve overall habitat conditions within the HCP project area, sediment delivery into a HCP fish stream could happen with new road segments constructed within 300 feet of streams and/or at new stream crossings. In turn, this sediment input may be enough to negatively affect spawning and rearing areas where baseline conditions for bull trout are already at-risk. Not only is this difficult to predict where and when it could occur, but also the duration. Most circumstances related to sediment delivery from new roads are temporary and the effects relatively small, but not all events fall into this category. Therefore, the DNRC HCP monitoring program and associated corrective action commitments address road-sediment related problems by priority and timeframes that require correcting problems quickly.

Conclusion of Effects on Sedimentation

DNRC has determined that sediment produced at road-stream crossings and sediment from road segments located within 300 feet of the stream could potentially be delivered to a Class 1 stream (Final EIS/HCP 2010, Appendix A, Chapter 7). Furthermore, sediment entering a Class 1 stream could have adverse impacts that may potentially incidentally take HCP fish species or harm their habitats. The USFWS agrees with this determination even though the HCP commitments would significantly reduce the potential for sediment generated by forest management activities to be delivered into a Class 1 stream. Consequently, at some juncture during the Permit term the USFWS has determined that a forest management action related to roads may cause enough sediment to enter a HCP fish stream to cause adverse impacts that rise to the level of take of a HCP fish species and/or harm their habitats. The USFWS also acknowledges that not all road work within 300 feet of a stream has the potential to contribute sediment to the stream or that every contribution of sediment from this type of work would cause an adverse impact that would rise to the level of harming a HCP species or its habitat.

It is unlikely that the potential to deliver sediment into a HCP fish stream can be completely eliminated, especially in some core areas as discussed above. The risk is elevated in some

circumstances because of the following: 1) the amount of existing and new roads expected to be built within 300 feet of a stream, including Class 1 streams; 2) the associated number of existing and expected new stream crossings; 3) high precipitation levels that can occur annually in certain areas of the HCP project area; and 4) the occasional unpredictable storm event that can cause flash flooding. The potential in the Upper Clark Fork core area for road or culvert failure to deliver sediment to a HCP fish stream is greater because of the amount of predicted sediment generated (121 tons/yr with BMPs) and the net increase of road miles in proximity to a stream from new road construction and stream crossings. Additionally, this core area occurs in a high precipitation zone. The Upper Clark Fork core area is anticipated to have 69 more stream crossings in addition to the 177 existing stream crossings as well as 105 more miles of new road during the Permit term. The net increase of new road miles within 300 feet of a HCP fish stream is almost 23 miles. Therefore, the risk is much higher that fine sediment in particular would enter the stream channel and be deposited in spawning gravels thus reducing survival of eggs and developing fry of HCP fish species. Additionally, important habitat factors for rearing fish, such as interstitial spaces in the substrate and deep pools (embedded substrate) may be reduced or lost, thus diminishing food availability and cover.

The Middle Clark Fork core area may be high risk as well at some juncture during the Permit term because of the high levels of sediment that could be generated as a result of the anticipated higher level of road densities and stream crossings. However, even though the Middle Clark Fork core area is expected to have 113 more stream crossings in addition to the 423 existing ones, and 36 more new road miles in addition to the 136 existing miles of road within 300 feet of a stream, the estimated sediment production (59 tons/yr with BMPs) is relatively moderate, presumably because of the soil types and lower erosion risk. Nevertheless, there is still a reasonable possibility that enough of this sediment produced could enter a HCP fish stream and cause harm to HCP fish species and their habitats.

More moderate levels of sediment production, but still with some level of risk for sediment delivery are the Stillwater and Swan core areas, and the Upper Missouri AAU. The Stillwater core area is anticipated to produce 84 tons of sediment per year with BMPs; however, only 11 stream crossings and 1.2 miles of new road within 300 feet of a HCP fish stream are expected to be built during the Permit term, so the potential for sediment delivery to a HCP fish stream is limited. On the other hand, the Swan core area will have slightly less sediment production (63 tons/yr with BMPs), but anticipated to have 42 more stream crossings and almost 23 miles of new road within 300 feet of a HCP fish stream. In this case, the potential for sediment delivery in the Swan core area is difficult to ascertain because of the lower amount of sediment produced and therefore lower amount available for delivery; however, the potential risk for delivery is relatively high. Both the Stillwater and Swan core areas occur in high precipitation zones where surface erosion risk from roads is likely higher. The Upper Missouri AAU will have nearly 25 miles of new road within 300 feet of a stream and 78 new stream crossings, and therefore, pose some risk, albeit lower due to occurring in a lower precipitation zone.

Increased levels of sediment delivery could occur during and immediately following new road construction activities and installation of new stream crossing structures. Also, these same impacts could occur during the implementation of corrective actions, including the installation of BMP upgrades to existing roads, replacement or removal of existing stream crossing structures,

rehabilitation of existing stream crossing sites, and reclamation of existing or previously abandoned roads. For most of these activities the amount of sediment delivery is expected to be relatively minor and short duration because of the requirement to incorporate BMPs before, during, and after implementation of these activities. Nonetheless, in the higher precipitation zones the risk of sediment entering a HCP fish stream in the presence of these road-related actions increases especially on steeper slopes with soils of higher erodibility and in close proximity to the stream.

DNRC will limit the potential for risk of "incidental take" by reducing sediment delivery by 50 percent from problem road segments over the 50-year Permit term. This will be accomplished through a combination of: 1) avoiding or minimizing impacts from activities going forward, and 2) performing corrective actions to reduce potential sediment from past management legacies.

The WEPP model was used in the EIS analysis of this HCP to quantitatively evaluate surface runoff and BMP applications and the effect on sediment delivery from roads. The modeling was applied to specific conditions within the road network on trust lands. The WEPP model estimated sediment production and delivery from both new roads and problem segments on existing roads. The WEPP modeling results indicate the highest sediment production values would occur in core areas with the highest precipitation (Stillwater, Swan, and Middle Clark Fork).

The HCP sediment production rate for the estimated problem road segments within each core area (including Upper Missouri AAU) ranges from 7 to 370 tons per year, with an average of 137 tons per year over all units (see Table IV-12 above). Under the HCP, the sediment produced at problem road segments will be minimized by applying corrective actions (BMPs and other HCP sediment abatement measures) during the Permit term. By the end of the 50-year Permit term, the anticipated reduction in sediment production from the problem road segments ranges from 62 to 79 percent depending on the core area. Based on these modeling results, DNRC has developed a target rate of 50 percent sediment reduction from existing road sources over the term of the Permit. DNRC expects it will be able to reduce total existing sediment production by approximately 10 percent per decade in those areas prioritized for corrective actions.

DNRC will monitor compliance with sediment reduction targets by using case studies completed in discrete watershed study areas (fifth- or sixth-order HUC) where DNRC has concentrated ownership and is more active. The information collected in the case studies and site-specific quantitative monitoring projects will be extrapolated and used initially across the entire core area (including the Upper Missouri AAU). Following the completion of several of these case studies and after having completed a majority of the road inventories across the HCP project area, DNRC will extrapolate across the broader project area to estimate progress and ensure achievement in meeting the sediment reduction targets across the entire HCP project area.

In conclusion, the USFWS anticipates that adverse effects to HCP fish species and their habitats due to sediment produced from new road construction and associated stream crossings and delivered to a HCP fish stream is likely at some point during the term of the Permit. The site-specific location and timing of these sediment effects is nearly impossible to predict. However, the most likely scenario of an event happening that causes incidental take, is in those core areas

that occur in the highest precipitation zones, with the highest sediment production, and the greatest amount of stream crossings and road segments within 300 feet of a HCP fish streams – specifically the Stillwater, Swan, Upper and Middle Clark Fork core areas. Nevertheless, it is possible that these same effects could occur in other core areas because all the core areas (including the Upper Missouri AAU) will have some increase in stream crossings and road segments within 300 feet of HCP fish streams. When DNRC forest management activities within these core areas are at high levels during the Permit term, especially when significant road construction is occurring in proximity to a HCP fish stream, the probability of sediment delivery will increase and therefore the prospect of incidental take also rise.

As previously mentioned, livestock grazing can degrade aquatic habitat by removing riparian vegetation, increasing stream temperature, destabilizing streambanks, widening stream channels, reducing pool frequency, increasing soil erosion, altering water quality, and includes increasing sediment delivery to spawning and rearing habitats (MBTSG 1998; Elmore and Beschta 1987). Potentially, negative effects to HCP fish species habitat that may require commensurate corrective actions are likely to occur in the Middle Clark Fork, Bitterroot, and Blackfoot core areas because these units contain the majority of grazing licensed parcels with HCP fish species habitat (>63 percent) and contain nearly 75 percent of the total stream miles that contain HCP fish species habitat. The actual levels of sediment input to an HCP fish species stream from grazing impacts is nearly impossible to predict at the programmatic scale in Part IV of this BO; however, the DNRC grazing strategy in practice should determine at the site specific scale whether instream sediment levels are suitable on grazing parcels. It should accomplish this by more clearly defining a grazing problem and developing solutions best suited to the circumstances involved. Where severe sediment problems exist on priority sites, corrective actions would be addressed before turnout of the next grazing season, and non-prioritized situations would be addressed within 1 year of verification.

Sediment effects can occur from unexpected, but predictable (within the Permit term), catastrophic natural events that cause sudden, major amounts of sediment to enter a HCP fish species stream and that may be exacerbated by man-made activities such as timber harvest or road construction. Such events as floods, large fires, and massive landslides can result in inundation of stream segments with excessive amounts of sediment bedload that could cause significant adverse effects to HCP fish populations in the affected reaches. However, it is virtually impossible to predict when or where these events would occur or how much sediment would be delivered to a HCP fish species stream. The DNRC HCP incorporates a "Changed Circumstances" process that would be triggered when a natural disturbance of a certain large magnitude occurs. This process is specifically designed to promptly assess site conditions and to prepare a contingency plan that presumably would implement sediment abatement measures quickly to prevent further increases in soil erosion and sedimentation in streams.

Analysis of Effects on Habitat Complexity/LWD

General Effects of Forest, Road, and Grazing Management Activities on Habitat Complexity/LWD
The primary concerns associated with forest management effects on habitat complexity or LWD recruitment arise from timber harvest adjacent to streams and grazing licenses on forested parcels supporting HCP aquatic species streams.

Forest Management – The manipulations of vegetation and soils that could potentially become LWD or could produce future LWD on the floodplain, or in the stream channel have historically been affected by forest practices. Timber harvest activities (including salvage, and thinning) in proximity to streams can have a substantial effect on habitat complexity, particularly if LWD recruitment is affected. Because LWD plays a critical role in the formation and maintenance of in-stream habitat features, any reduction in LWD would likely reduce habitat complexity over time. Other forest management activities that affect stream flow or sediment loading rates have the potential to affect habitat complexity. Increased sediment loading can result in filling pool habitat, increasing substrate embeddedness, and reducing substrate diversity. In addition, forest management activities can also alter the water and sediment yields within a watershed, subsequently affecting channel stability, form, and function.

Forest practices directly influence vegetation within a watershed by the removal of trees during harvest, thinning, salvage; through manipulations of understory and ground vegetation to promote growth and vigor of desired species by burning or mechanical or chemical treatments (Spence et al. 1996). Forest vegetation is indirectly affected by changes in site conditions following harvest such as changes in microclimate, soil moisture and stability, ground cover, and susceptibility to erosion (Spence et al. 1996; Beschta et al. 1995). Soil compaction by ground-based equipment can reduce infiltration of water, thereby inhibiting seedling or established vegetation growth (Spence et al. 1996). Tree roots can die after logging and subsurface spaces can become compacted or filled with sediment, which also reduces infiltration of water and aeration in the soils thereby leading to changes in vegetation and species composition (Spence et al. 1996). The magnitude of vegetation change and the succession of vegetation following logging depend on the type and degree of disturbance (Spence et al. 1996).

Upland practices can effect surface erosion, mass wasting, hydrologic processes and nutrient dynamics, all of which contribute to altering levels of LWD on the floodplain and in the stream channel. These effects are greatest in the years immediately following logging because the degree of devegetation and soil disturbance is highest then (Spence et al. 1996). Different types of harvest schedules can affect the watershed processes by controlling the frequency of disturbance to the watershed area and the amounts of LWD delivered to the floodplain and stream channels. Hauer et al. (2007) indicated that logging practices in streams in the Crown of the Continent ecosystem has contributed to nutrient loading leading to increased algal growth, thus negatively affecting water quality for cold-water adapted native fish such as bull trout.

In general, current harvest methodology is tending to move away from the even-aged timber practice of large, extensive acreages of clearcutting in the uplands, and generally not an accepted practice in or near riparian areas. Clearcutting in upland areas is still considered where it is appropriate to obtain certain desired future conditions. However, smaller patches of scattered clearcuts versus large, continuous clearcuts are more likely to be considered under today's harvest methods. Clearcutting of extensive acreages, particularly in smaller watersheds, is potentially more disruptive of natural watershed processes because all vegetation is removed and soils are highly disturbed. This can have more effects on levels of current and future LWD through delivery mechanisms such as mass wasting, erosion of streambank vegetation, soil compaction, changes of vegetation species, etc. Selective harvest methods which leave larger older trees standing for structural retention or a set of wind tolerant trees for a rotation or more

can maintain LWD levels by minimizing disturbances to soils such as compaction and minimizing effects to hydrologic processes such as mass wasting (Spence et al. 1996). In some cases drawbacks of selective harvest for the landowner include increased harvest cost, increased road densities, and growth of a less desirable tree species (Spence et al. 1996).

The practice of using buffers along streams is widely used to reduce impacts from logging and other forest activities on aquatic habitat complexity including LWD. Buffers will insure to some degree that LWD levels remain on the floodplain and in the stream channels. The widths of the buffers vary and depend on the aquatic processes that are to be maintained. In the past buffers have been designated using valley width and sideslope gradients, from the wetted channel edges, from the average high flow channel, from the bankfull channel, and more recently from the edges of the channel migration zone (CMZ). Stream channel or riparian buffers may vary because of the topography including slope, geology, precipitation levels and forms, and vegetative species.

USDA et al. (1993), or FEMAT, identifies variable size buffers and establishes buffers based on stream types and that can be adjusted with watershed analysis and the demonstration of meeting aquatic conservation strategy objectives. FEMAT also describes that the effects of riparian vegetation on streams decrease with increasing distance from the stream banks and that the effectiveness of floodplain forests and forests along constrained channels to deliver large wood is low at distance greater than approximately one tree height away from the channel (see Appendix D). Generally, there are equipment limitations, harvest and yarding limitations, site preparation limitations, and road building limitations within these buffers.

The potential recruitment of LWD to stream channels from adjacent forest stands is generally limited to an area located within a width equal to or less than the 100-year site index tree height as measured from the edge of the stream channel. This conclusion is well documented in the literature and is commonly used to delineate the width of SMZs or RMZs. In a study of streams in southeast Alaska, Murphy and Koski (1989) found that almost all (99 percent) identified sources of woody debris in streams were within 100 feet of the stream bank. Nearly half of the woody debris came from trees located on the lower bank (less than 3 feet away) and 95 percent was from trees within 66 feet of the stream. McGreer (1994) reported a study by Andrus and Froehlich in the Oregon Coast Range in 1992 in which 70 to 90 percent of all LWD recruitment was found to occur within 100 feet of streams. McDade et al. (1990) reported that 85 to 90 percent of LWD recruitment comes from within 100 feet of stream channels in western Oregon. Robison and Beschta (1990) concluded that the probability of recruitment was primarily a function of tree distance from the stream and that part of the tree height that would provide woody debris of a minimum diameter to a stream.

Where riparian areas have been already altered by human activity, the long-term prospects for recovery of large conifers may be limited without active manipulation of riparian vegetation (Spence et al. 1996). Hicks et al. (1991) describes case studies by Bisson and Sedell (1984), Bryant (1980), Toews and Moore (1982), Dolloff (1986), and Elliott (1986), where the removal of woody debris had immediate effects on salmonid populations because of declines in channel stability, reduction in pools and pool quality, enlarged riffles, and the overall reduction in the quality of fish habitat and fish communities. Many streams in second growth forests have

become progressively debris-impoverished following logging to the edge of the channel and young riparian stands do not produce sufficient debris of the proper size and quality to replace materials lost (Hicks et al. 1991). Such things as pruning, thinning, burning, and planting may be necessary for improved conditions in riparian areas to increase current and future LWD for floodplain and stream channel complexity. Long-term and future LWD can be enhanced with riparian buffers adjacent to year round channels as well as, headwater and intermittent channels, and are used to minimize mass failures and maintain a steady flow of LWD, as described by Spence et al. (1996).

Grazing Management – Grazing activities within the riparian zone can substantially affect stream habitat complexity by increasing the level of fine sediment entering the stream, reducing pool size and frequency, destabilizing stream banks, and removing fish cover habitat. Grazing typically results in wider and shallower stream channels than would naturally occur, and can change meander patterns (Platts 1991). LWD is affected by continued compaction of soils in riparian areas, trampling of riparian vegetation, grazing of coniferous and deciduous trees, and streambank or channel erosion.

Grazing has created changes in species composition Spence et al. (1996). Particularly important are riparian areas because livestock tend to migrate or congregate in these areas. Spence et al. (1996) described the replacement of riparian area vegetation such as willow, aspen, sedge, rush, and native grasses by annual grasses or sagebrush as due to historic and continued grazing. Spence et al. (1996) indicate that recovery of grasses, willows, and other woody species can occur within a few years when grazing pressure is reduced or eliminated but that restoration of fully functioning riparian areas including older forests will take considerable time. Grazing pastures have also been maintained by removing woody shrubs and trees with tractors, using chemical treatments, and suppressing natural fire.

The trampling and compaction of soils associated with livestock grazing can lead to stream down-cutting and the invasion of water intolerant species. The water intolerant species of vegetation do not have the same root strengths to keep streambanks from eroding and to capture LWD so channel changes may occur at increased rates causing increased erosion and a reduction of LWD. The down-cutting of the channel reduces or eliminates the floodplain width thereby reducing a potentially important mechanism for seed dispersal of woody plants and potential dispersal of LWD (Spence et al. 1996). The down-cutting also alters the hydrologic regime. Altered hydrologic regimes can cause increases in nitrate-nitrogen concentration which can be readily transported by subsurface flows to the stream channels causing an increase in turbidity, algal growth, and oxygen depletion (Spence et al. 1996), all of which degrade fish habitat.

Cattle and sheep tend to select riparian areas because riparian areas have water, shade and cooler temperatures, food, and cover from the weather. In mountainous terrain the preference of riparian areas may be related to hillslope gradient or available access to the water and seeps. Direct and indirect effects of livestock grazing can be minimized with range riders, fence exclosures, pasture rotations, timing restrictions, removal from heavily damaged pastures, and removal in areas where cumulative effects of grazing will negatively affect other forest management activities, including restoration activities such as road obliteration, riparian planting, and streambank restoration (Spence et al. 1996).

DNRC HCP Minimization/Mitigation Effects on Habitat Complexity/LWD

As mentioned above, the DNRC HCP commitments comprising the HCP riparian timber harvest conservation strategy and grazing strategy were designed to help ensure that important riparian functions are maintained at levels necessary to provide suitable habitat for HCP fish species. Important riparian functions specifically addressed in these strategies are LWD recruitment (i.e., habitat complexity), stream shading, and streambank stability. Sediment filtration is another important riparian function that is addressed under the HCP sediment delivery reduction conservation strategy.

The suite of HCP conservation measures and commitments under the riparian timber harvest and grazing conservation strategies that will be implemented programmatically to protect stream temperatures are basically the same for habitat complexity and will not be repeated here in detail (please refer to Effects on Stream Temperature section above). These same HCP minimization and mitigation measures will also ensure that appropriate levels of LWD are recruited to the adjacent stream channel during the Permit term in order to maintain or provide for in-stream habitat complexity for HCP fish species.

HCP conservation strategies addressing habitat complexity are based on existing state law and regulations directed at commercial riparian timber harvest and grazing regimes immediately adjacent to streams, lakes, and other water bodies. They are intended to minimize or avoid impacts to the structure and function of the riparian plant community, in particular the area nearest the stream channel where LWD recruitment potential is most affected. In addition, the measures allow DNRC to conduct timber and grazing management actions adequate to meet objectives in their forest management plan, ARMs, and SMZ law.

Riparian Timber Harvest Strategy – The riparian timber harvest strategy was purposely designed to build upon the requirements of the existing ARMs and SMZ law. DNRC's existing forest management practices must comply with these requirements and are intended to ensure the protection of important riparian functions, like LWD recruitment, suitable for HCP fish species. Under existing laws and regulations, harvest conducted within the riparian zone must retain all bank edge trees and enough other trees to ensure adequate potential for LWD recruitment to fish-bearing streams. Adequate LWD recruitment levels are defined under the ARMs as those that maintain channel form and function, such as the prohibition of harvesting bank-edge trees. The root systems of trees located near stream banks provide channel stability and potential in-stream habitat. Harvest and removal of such trees may increase the potential for bank erosion and decrease channel stability. Furthermore, DNRC determined that timber harvest in riparian areas could be adequately restricted to ensure conservation of riparian functions that are most important to maintaining or improving fish habitat, while still retaining sufficient flexibility for acceptable levels of timber harvest.

As previously mentioned in the stream temperature section, DNRC is required to establish a RMZ in addition to a SMZ when forest management activities (including timber harvest) are proposed on sites that are adjacent to fish-bearing streams. The DNRC HCP directs that riparian timber harvests conducted within an RMZ on a Class 1 stream or lake will establish a 50-foot no-harvest buffer zone immediately adjacent to the affected stream or lake. In the remaining portion of the Class 1 RMZ outside of the no-harvest buffer zone, timber harvest will retain a minimum

of 50 percent of the trees greater than or equal to 8 inches dbh and retain shrubs and sub-merchantable trees. In addition, the majority of timber harvests in the RMZ will retain a higher concentration of trees adjacent to the no-harvest buffer.

When DNRC plans a timber harvest within an RMZ of a Class 1 stream or lake, the length of the RMZ is established based on the 100-year site index tree height. The site index tree height at age 100 years in most DNRC streamside riparian stands generally ranges from approximately 80 to 120 feet. This range of distance of the RMZ falls within the range of potential recruitment of LWD to stream channels from adjacent forest stands found in the literature. In general, it is limited to an area located within a width equal to or less than the 100-year site index tree height as measured from the edge of the stream channel and is commonly used to delineate the width of SMZs or RMZs (Murphy and Koski 1989, McGreer 1994, McDade et al.1990, Robison and Beschta 1990).

The practice of using riparian buffers along streams is widely used to reduce impacts from timber harvest and other forest activities on aquatic habitat complexity including LWD. Wider buffers will insure to a larger degree that LWD levels remain on the floodplain and in the stream channels. The effect of large trees recruited into the stream channel, and thereby providing in-stream habitat complexity, decreases with increasing distance from the stream banks. The effectiveness of trees along constrained stream channels to deliver large wood is low at distances greater than approximately one tree height away from the channel. Therefore, effectiveness of the forest to deliver large wood from within riparian areas into the stream channel is naturally expected to decline at distances greater than one tree height from the stand edge (USDA et al. 1993).

The potential recruitment of LWD to stream channels from adjacent forest stands is generally limited to an area located within a width equal to or less than the 100-year site index tree height as measured from the edge of the stream channel. This conclusion is well documented in the literature and is commonly used to delineate the width of SMZs or RMZs. In a study of streams in southeast Alaska, Murphy and Koski (1989) found that almost all (99 percent) identified sources of woody debris in streams were within 100 feet of the stream bank. Nearly half of the woody debris came from trees located on the lower bank (less than 3 feet away) and 95 percent was from trees within 66 feet of the stream. McGreer (1994) reported a study by Andrus and Froehlich in the Oregon Coast Range in 1992 in which 70 to 90 percent of all LWD recruitment was found to occur within 100 feet of streams. McDade et al. (1990) reported that 85 to 90 percent of LWD recruitment comes from within 100 feet of stream channels in western Oregon. Robison and Beschta (1990) concluded that the probability of recruitment was primarily a function of tree distance from the stream and that part of the tree height that would provide woody debris of a minimum diameter to a stream.

Trees enter the stream channel from toppling as they die or are knocked down, or are undercut by streamflow and stream debris (Spence et al. 1996). The introduction of wood from hillslopes occurs from windstorms, mass slope failures, and debris and ice torrents (Spence et al. 1996; Keller and Swansen 1978). Wood is also introduced into streams from snow avalanches and ice loading (Keller and Swansen 1978). As a consequence, rates of LWD recruitment typically vary considerably throughout western Montana and on DNRC forested trust lands (DNRC 2008c).

Rates of LWD recruitment to a stream channel are also a function of riparian stand type, riparian stand structure, channel incision angles, side slope gradients, channel processes, disturbance regimes, and climatic or elevation factors associated with different physiographic regions (DNRC 2008c). During the last century in western Montana extensive fire suppression on DNRC forested trust lands have influenced ranges of LWD recruitment, which in general are thought to be higher than those that would otherwise occur naturally.

Measures under the DNRC HCP within Class 1 RMZ's are designed so that post-harvest riparian stand conditions are adequate to provide for natural rates of LWD recruitment over the Permit term, and avoid excessive rates of nutrient loading. The 50-foot no-harvest buffer adjacent to the stream channel and the higher concentration of retained trees next to this buffer ensure the attainment of these LWD rates of recruitment and appropriate nutrient loading rates. Beyond the 50-foot no-harvest buffer, DNRC needs to maintain the flexibility to manage the remainder of the RMZ (out to the 100-year site index tree height) to promote specific tree species and age classes for meeting desired future conditions. The retention tree commitments in this portion of the RMZ were designed to provide both short- and long- term riparian functions. In addition, under this strategy the RMZ will be extended in situations where the potential for channel migration within a CMZ is likely to occur, thereby providing additional opportunities for wood recruitment from the floodplain during flood events or channel migration events.

Grazing Strategy – Livestock grazing, if done improperly, can negatively alter watershed functions that provide habitat complexity in the form of in-stream cover for HCP fish species (Elmore and Beschta 1987; USDA et al. 1993). For example, in watersheds containing bull trout, changes in habitat features associated with reductions in habitat complexity include decreases in LWD and pool quality (MBTSG 1998). In-stream cover for bull trout is reduced and occupied bull trout habitat is negatively affected (Howell and Buchanan 1992; Mullan et al. 1992; Platts et al. 1993; Henjum et al. 1994; MBTSG 1995 a,b,c; USDA and USDI 2000).

The details of the proposed grazing strategy will not be repeated here (please refer to the Effects on Stream Temperature section for details of the grazing strategy); however, the grazing strategy is expected to provide for the function of habitat complexity in much the same manner as it does for stream temperature. Healthy riparian vegetation provides shade which functions to maintain appropriate stream temperatures, and it also provides for appropriate rates of LWD recruitment which functions to provide for and maintain habitat complexity - largely through pool formation and channel stability.

As previously mentioned under the Effects on Stream Temperature section above, the grazing strategy of the DNRC HCP adopts and applies the existing provisions of the ARMs for grazing and also includes specific commitments to identify and address grazing problems more quickly. As with stream temperature, the conditions required in a grazing license issued by DNRC are expected to provide for suitable levels of in-stream LWD by minimizing impacts to streamside riparian vegetation that is accessible to livestock within an individual grazing allotment. Compliance with grazing license conditions is expected to minimize loss of riparian vegetation, minimize physical damage to stream banks, maintain channel stability and channel morphological characteristics, and promote diverse and healthy riparian plant communities. Protecting streambanks and streamside riparian vegetation from damage caused by livestock is

necessary in order to have LWD recruitment rates adequate to provide instream cover for HCP fish species. The frequency of the grazing license inspections should ensure that grazing management practices are effective, and if not, can be adjusted in time to prevent further damage.

Monitoring and Adaptive Management for Habitat Complexity – The DNRC HCP establishes a monitoring and adaptive management process to measure the effectiveness of the riparian harvest strategy to meet meaningful LWD targets and to ensure appropriate changes in management to help to meet the conservation objectives of the HCP. While the DNRC HCP includes conservation measures to maintain LWD in Class 1 streams, the commitments for Class 2 and 3 streams would be provided by existing regulations, which have shown to be effective at maintaining adequate LWD levels within most riparian stand and stream channel types (Final EIS/HCP 2010, Chapter 4, Figures 4.8-11 through 4.8-13).

LWD monitoring will include the steps described below:

1. DNRC will establish site-specific LWD targets using on-site stream reach baseline LWD data or local reference reach LWD data. When on-site or local reference reach data are not available, DNRC will use regional LWD targets established from reference reach data compiled for different physiographic regions across the state. Regional targets will be stratified by stream channel morphological classification, such as Rosgen (1994) channel types.

2. DNRC will assess pre-harvest stand conditions within the project RMZ and LWD amounts within the stream. Stand conditions will be characterized by tree diameters (at breast height) and tree density (trees per acre).

3. DNRC will evaluate post-harvest in-channel LWD and stand conditions within the RMZ.

4. DNRC will use model projections of forest stand growth, mortality, and LWD recruitment to evaluate whether both pre-harvest stand conditions and implemented harvest prescriptions meet LWD targets established for that specific stream reach.

DNRC will determine whether the proposed conservation strategy meets in-stream LWD targets by monitoring a total of five or more sites with riparian harvest units adjacent to Class 1 streams during the first 10 years that the HCP and Permit are in effect. For the first monitoring period (years 1 through 5), DNRC anticipates there is unlikely to be a large pool of RMZ harvest sites to select for monitoring projects due to the time lag between HCP implementation and actual harvest activities. Monitoring projects will include riparian harvest located on sites with slopes greater than 35 percent and on sites with slopes less than 35 percent. The distribution of monitoring sites between the two slope classes will be representative of the Class 1 RMZs harvested. If five or more monitoring sites are not available due to a lack of riparian harvest, monitoring will occur on all available sites.

If the monitoring results from 10 or more monitored sites that are representative of DNRC operations and riparian stand types (estimated monitoring duration of 10 years) indicate that the

conservation strategy is meeting the LWD recruitment objective on 80 percent of the RMZ acres harvested, DNRC may reduce the monitoring efforts to include a minimum of one ongoing LWD monitoring project through year 25 of HCP implementation, while continuing to implement the riparian conservation strategy. However, if the continued monitoring results indicate the strategy is not meeting the objective, the adaptive management process, which includes enhanced monitoring, will be implemented.

The enhanced monitoring that would be triggered if the RMZ harvest prescriptions implemented do not meet the 80 percent target, includes the following steps:

1. DNRC will establish site-specific LWD targets using on-site stream reach baseline LWD data or local reference reach LWD data. When on-site or local reference reach data are not available, DNRC will use regional LWD targets established from reference reach data compiled for different physiographic regions across the state. Regional targets will be stratified by stream channel morphological classification.

2. DNRC will assess pre-harvest stand conditions within the project RMZ. Stand conditions will be characterized by tree diameters (at breast height) and tree density (trees per acre).

3. DNRC will use the model projections of forest stand growth, mortality, and LWD recruitment to evaluate whether both pre-harvest forest stand conditions and implemented harvest prescriptions meet LWD targets established for that specific stream reach.

4. DNRC will ensure that harvest meets LWD targets on 80 percent or greater of the RMZ acres harvested affecting Class 1 streams.

Under this modified approach, stand conditions will be evaluated prior to RMZ harvests to ensure that the proposed prescriptions will retain an adequate number and size of trees to meet LWD targets. If, however, monitoring results are close to the target and/or the acres included in the analysis represented a small sample size, DNRC will continue to monitor implementation of this objective with the addition of another five monitoring sites. The modified approach incorporates a pre-harvest LWD recruitment assessment procedure into the proposed conservation strategy such that it provides assurance that LWD target levels should meet the 80 percent target objective.

<u>Analysis of Effects of HCP Measures on Habitat Complexity/LWD</u>
Habitat complexity can be compromised if the supply of LWD is diminished or if the rate of potential delivery of LWD is slowed due to timber harvest activities next to a stream. LWD added to a stream channel influences channel form and function by facilitating the creation and maintenance of hydrologic features such as pools, gravel bars, and backwater areas. In turn, reduction in LWD input to a stream may affect fisheries habitat by causing or contributing to channel instability, reducing pool formation, and influencing sediment transport and storage. LWD also provides nutrients to streams, as well as substrate for aquatic invertebrate production. The analysis of habitat complexity indicated that the DNRC HCP should ensure that LWD recruitment occurs at a rate that is adequate to maintain or provide for in-stream habitat complexity to conserve HCP fish species habitat.

The following evaluation is based on the analysis conducted in the Final EIS/HCP (2010) which is similar to the modeling approach for analyzing stream temperature over the Permit period. To determine the potential effects of riparian timber harvest on LWD recruitment, the Final EIS/HCP (2010) provides an analysis that modeled predicted recruitment rate of LWD by decade for the represented stand types examined under existing conditions. The modeled changes in LWD recruitment potential compare the HCP to a target recruitment level developed by analyzing reference LWD frequencies in unmanaged stands located on USFS land and stratified by Rosgen stream class and physiogeographic regions. DNRC performed statistical analyses on the data to quantify LWD targets based on reference conditions in unmanaged stands. Note that LWD levels are highly variable and closely tied to the associated riparian stand conditions (Teply et al. 2007; Light et al. 1999).

The LWD recruitment modeling was adapted from the RAIS model (Welty et al. 2002), which was originally developed to model LWD recruitment and shade in forested systems on the western slopes of the Cascade Mountains. In order to incorporate site-specific physical stand characteristics for forested sites specific to western Montana forests, some components of the original RAIS model were modified (Larix Systems 2007). Model input consisted of Forest Vegetation Simulator (FVS) tree lists for five representative riparian stand types (Beaver, Dingley, Gird, South Lost, and Swede Creeks) in the HCP project area. The LWD recruitment simulations used these data to analyze all combinations of stand types over three Rosgen stream channel types that are representative of stream channels occurring in the action area. Each simulation was projected over a period of 100 years.

For the purpose of RAIS modeling, model inputs for the physical characteristics (stream width, slope, etc.) of streams within the EIS planning area were based on three Rosgen stream channel types. Based on a data analysis of the Rosgen stream-typing from existing watershed inventories, Rosgen B channel types are the most common channel type on DNRC trust lands within the action area, representing about 55 percent of stream channels on DNRC trust lands. Rosgen A channels represent an additional 25 percent, and Rosgen D, E, F, and G channel types combined constitute the remaining 20 percent.

The RAIS model also incorporates average bankfull widths and riparian buffer slopes and channel gradients. Average bankfull widths were calculated for the three Rosgen stream channel classifications modeled, based on actual survey data gathered by DNRC during recent watershed inventories. Representative riparian buffer slopes and channel gradients were calculated based on the representative geometry of the respective Rosgen channel types.

The LWD simulations evaluated wood recruitment within the ordinary high water mark (OHWM) of the identified stream segments as a step-wise function. For each 10-year time interval (step), the amount of wood in the stream was a function of the in-stream wood in the previous time step, plus the amount subsequently recruited from the adjacent forest, minus the amount depleted through decay or transport since the previous time step (Welty et al. 2002). The modeled changes in LWD recruitment potential provide comparisons relative to a target recruitment level. DNRC performed statistical analyses on the data, to quantify LWD targets based on reference conditions in unmanaged stands. LWD targets range from 1 to 74 pieces per 1,000 feet of channel, depending on channel type and physiographic location. Note that the low

end of the target range is due to having to use one standard deviation of the mean found in the reference streams in order to capture the natural range of conditions found in the reference streams (pers comm. Jim Bower, DNRC, Fisheries Biologist, February 15, 2011).

Initial LWD frequencies were based on an analysis of in-stream LWD frequencies within managed DNRC lands gathered during recent stream surveys and watershed inventories. The initial LWD levels varied for the three simulated Rosgen channel types (Final EIS/HCP 2010, Chapter 4, Section 4.8.2.2 Habitat Complexity). Initial LWD levels were established for each stream channel type to facilitate the modeling exercise, even though LWD levels are highly variable and closely tied to the associated riparian stand conditions (Light et al. 1999; Teply et al. 2007).

The RAIS model simulates tree mortality and subsequent windthrow, but does not include recruitment resulting from streambank erosion, mass wasting, floods, or fire. A stand visualization feature (Forest Vegetation Simulator or FVS) was used to predict stand characteristics from tree lists for five representative stand types generated for each 10-year step to provide estimates of tree fall from mortality (Final EIS/HCP 2010, Chapter 4, Figures 4.8-6 through 4.8-10). As a result of the assumptions made regarding recruitment and depletion parameters, the modeling is believed to underestimate the number and variability of LWD pieces recruited to and retained in the modeled streams. Such an understanding of the relatively conservative model assumptions is critical for interpretation of results.

Results of the modeled outputs (in-stream LWD frequencies [pieces of LWD per 1,000 feet]) are reported by representative riparian stand types by Rosgen stream class by decade (Final EIS/HCP 2010, Chapter 4, Figures 4.8-11 through 4.8-13). LWD levels show a generally increasing or stable in-stream LWD level by the end of the 100-year modeling period, although tree growth within the riparian zone is likely slower, due to canopy closure conditions that offer less light penetration. The differences in LWD frequency curves are based on the relationships between initial mature tree density following harvest (where more density equals greater shorter- and medium term LWD recruitment) and tree growth rates over time as influenced by canopy openness (where greater initial canopy openness equals increased tree growth and accelerated increase in long-term recruitment). This pattern was similar for all stream channels and stand types modeled, except for the South Lost Creek stand type.

The DNRC HCP model simulations shows the HCP would generally result in increasing frequency rate of in-stream wood recruitment over the Permit period for Class 1 streams, likely due to the influence of the 50-foot no-harvest buffer directly adjacent to the stream channel and relatively less intense harvest out to the 100-year site index tree height distance for Class 1 streams. With the possible exception of the South Lost Creek stand type associated with Rosgen A and B stream channel types, all of the modeled scenarios exceeded the LWD target levels throughout the 100-year modeling period for the HCP. The period that the two exceptions may not meet the target levels is between 25 and 75 years of HCP implementation, although the trend for in-stream LWD in these scenarios is positive after 30 years. Worth re-iterating is that the outputs are highly conservative and more than likely target levels will be met for all scenarios especially considering the 50-foot no harvest buffer and the harvest restrictions for CMZs,

extended RMZs, and restriction on the total riparian area that can be in non-stocked or seed/sapling structural stages.

DNRC HCP allowances to enter the no-harvest portion of the RMZ on Class 1 streams (for salvage from fire, disease, and insect damage as well as to emulate natural disturbance) is limited to 20 percent of the Class 1 RMZ acres for any given core area. The limited amount of RMZ area managed under these allowances would still be subject to the requirements of the SMZ Law, including minimum tree retention requirements, retention of all bank edge trees and all downed trees lying within the stream channel or embedded within the stream bank. These limitations are so restrictive that the affect on the RMZ is expected to be negligible.

The model results presented in the Final EIS/HCP (2010) indicate that the existing laws and regulations (presented as the No-Action Alternative) are generally effective at maintaining adequate LWD levels within most stand and stream channel types. The results are consistent with a number of researchers that found that a substantial portion of LWD recruitment occurs from trees very near the stream banks (McGreer 1994; McDade et al. 1990; and Robison and Beschta 1990). In particular, Murphy and Koski (1989) found that about 50 percent of the LWD recruitment was from streambank trees. Also, LWD recruitment from windthrow and bank erosion can be important sources of in-stream LWD. Because the model did not assume the contribution of LWD from these sources, the results may underestimate the total amount of in-stream LWD provided.

Summary of Effects on Habitat Complexity/LWD

The bull trout core areas most likely to be affected by changing rates of LWD (recruitment and depletion) are those with the highest number of stream miles supporting HCP fish species. In descending order (based on stream miles with HCP fish species within the HCP project area) are the following core areas most likely to be affected: 1) Stillwater – 104.9 miles; 2) Middle Clark Fork – 75.7 miles; 3) Swan – 66.2 miles; and 4) Blackfoot – 44.3 miles. These four core areas comprise nearly 2/3 of the total stream miles supporting HCP fish species within the HCP project area, and have important bull trout and WCT tributary habitats where LWD plays a key role in maintaining habitat complexity, channel stability, and pool quality.

When considering the baseline conditions for the affected core areas, habitat complexity is most problematic in two of the core areas. The Middle Clark Fork core area is a concern because of the amount and location of private development at the lower stream reaches of key bull trout tributaries where bull trout are known to congregate prior to migrating upstream to spawning areas. The clearing of riparian forest on private land and the associated residential and commercial development could result in a reduction of LWD in the affected reaches. However, the upper forest habitat conditions appear to trend upwards especially on Federal lands where emphasis on riparian health and restoration has resulted in improved baseline conditions. Similar concerns exist for the Blackfoot River core area. However, the heavily managed landscapes that have resulted in depleted LWD supplies due to decades of poor forestry practices have in some cases recovered enough to recruit older aged riparian trees in the stream channel. Further, private development along streams has been somewhat deferred due to the efforts spearheaded by the Blackfoot Challenge to purchase riparian easements and fund watershed-based habitat restoration efforts.

To determine the potential effects of timber harvest in riparian areas on LWD recruitment, the analysis in the Final EIS/HCP (2010) modeled predicted recruitment rate of LWD by decade for the represented stand types examined under existing conditions. The comparison of the modeled changes in LWD recruitment potential between the HCP and target recruitment levels for various representative scenarios indicated that predicted LWD recruitment rates will be above target levels of natural rates of LWD in streams occupied by HCP fish species.

Based on the model assumptions, particularly the assumption that decadence alone produces LWD, the LWD frequency rates for the DNRC HCP are likely somewhat conservative, as windthrow, bank erosion, and insect damage and disease can all contribute significantly to LWD recruitment. Furthermore, the model runs did not incorporate the CMZs, which would in some cases expand the no-harvest and partial-harvest riparian buffer even farther from the stream channel. This would likely result in higher LWD frequencies at some locations over the Permit term.

In addition, DNRC will determine whether the HCP meets the in-stream LWD target levels by monitoring a total of five or more sites with riparian harvest adjacent to streams supporting HCP fish species during the first 10 years following implementation of the HCP. DNRC has committed to having 80 percent of the Class 1 RMZ acres harvested meet LWD targets by decade. DNRC has determined that any potential impacts, if they occur at all, would likely be associated with the 20 percent of RMZ harvest acres that would not have to meet LWD targets. However, the level of impact is not expected to cause an adverse affect to HCP species and their habitats. Even if all 20 percent of the allowable RMZ harvest acres ended up not meeting LWD targets, the risk of negative impacts would still be negligible because these acres would likely have a 50-foot no-harvest buffer and 50 percent retention out to the 100-year site index tree height which is typically 80 to 120 feet.

The HCP allows for the management of a portion of the total Class 1 RMZ acreage (20 percent of any one core area) using harvest prescriptions designed to meet the minimum retention tree requirement of the SMZ Law. DNRC determined that this allowance would be limited in extent and scope and therefore not expected to have a substantial effect on LWD recruitment on streams within the HCP project area. The limited amount of RMZ area managed under these allowances would be required to meet the SMZ Law's minimum tree retention requirement and would also be required to retain all streambank trees and all downed trees lying within the stream or embedded within the stream bank. In addition, literature reviews have documented that the allowance for 20 percent of the RMZ at the core area unit level to be harvested is at the lower end of the range of streamside riparian forest that DNRC would expect to be subject to stand replacement fire or other catastrophic disturbance under natural conditions (Final EIS/HCP, Appendix A (HCP), pages 2-82).

<u>Conclusion on Effects on Habitat Complexity/LWD</u>
Riparian timber harvest under DNRC HCP's timber harvest strategy is not expected to reduce the supply of LWD available for potential recruitment to a stream in any of the bull trout core areas, or alter natural rates of nutrient input because of the tree retention requirements within the RMZ, especially considering the 50-foot no-harvest buffer immediately adjacent to Class 1 streams. Trees retained in the 50-foot no-harvest buffer zone are the most likely to be recruited to a

stream channel and add to the in-stream channel habitat complexity (USDA et al.1993). Furthermore, the total RMZ width of a riparian harvest is based on the total combined width of the SMZ and RMZ, which is equal to the average SPTH at stand age 100 years. Trees retained in the remainder of the RMZ adjacent to the no-harvest buffer also have the potential to be recruited (albeit less potential), especially on steeper slopes with narrow valley bottoms. See Appendix D in Part IV of this BO for additional discussion regarding DNRC's of SPTH for establishing riparian buffer widths under the riparian timber harvest strategy.

The DNRC HCP should maintain LWD levels and nutrient loading rates in all core areas with Class 1 streams because the riparian harvest prescription for Class 1 streams is based on a distance of one SPTH from the stream channel edge from which the majority of LWD recruits into the stream channel (USDA et al. 1993). This prescription will be applied to all Class 1 streams programmatically in all core areas.

Potential effects on habitat complexity from DNRC riparian timber harvest activities under the HCP are not expected to result in adverse affects during the Permit term. Modeled outputs of LWD based on data from monitored sites will be compared to the referenced target levels to determine whether the HCP is maintaining, exceeding, or below expected target levels. If the RMZ harvest prescriptions implemented under the conservation strategy do not meet the 80 percent target, DNRC will develop and implement a modified approach to the design of Class 1 RMZ timber harvests. Given the required riparian harvest prescriptions, limitation in allowable riparian harvest entry, the level of monitoring, and the adaptive management strategy to determine effectiveness of the harvest prescriptions providing for LWD recruitment, it is likely that habitat complexity will not be adversely affected as a result of LWD depletion under the HCP harvest strategy.

The DNRC HCP riparian timber harvest conservation strategy addresses the critical riparian functions described most important to HCP fish species. The width of an effective riparian buffer is a commonly used function to measure aquatic habitat integrity. A buffer width of about 0.75 tree height is effective at protecting over 80 percent of the LWD functions. Other ecological functions (stream shading, root strength, and litter fall) are effective with smaller riparian buffers (USDA et al. 1993). The analysis of the effects of the riparian timber harvest on these riparian functions in the FEIS/HCP (2010) provides a high degree of certainty that the buffer widths and associated RMZ prescriptions will likely avoid or minimize the effects on riparian functions that support the habitat needs of the HCP fish species.

Analysis of Effects on Habitat Connectivity/Fish Passage

General Effects of Forest, Road, and Grazing Management Activities on Habitat Connectivity/Fish Passage

The primary forest management activity affecting fish passage and access to habitat is related to road construction, operation, and maintenance at stream crossings. In these situations, improperly designed or inadequately maintained road-crossing culverts is typically the most universal threat to adequate connectivity in the project area. Design features important for fish passage effectiveness include the size, shape, and slope of the culvert, as well as the stream channel characteristics at the road crossing. Excessive erosion or landslides caused by poorly

designed roads or culverts can also result in connectivity blockages, although these tend to be temporary.

Roads Management – Forest roads across streams can restrict channel geometry and prevent or interfere with migration of adult and juvenile salmonids (Furniss et al. 1991). Crossings can also be a source of sedimentation, especially if they fail or become plugged with debris, causing debris torrents and significant cumulative impacts downstream (Furniss et al. 1991; Murphy 1995). Furthermore, whether a crossing fails is less important than how it fails, meaning that failure can be catastrophic causing extensive local scour and deposition and downstream erosion that could last for years.

Impediment or delay in fish migration is often the result of culvert hydraulics, which create water velocity barriers, depth barriers, and/or vertical jump barriers. Fluvial and adfluvial fish movements occur at certain times of the year that can be critical for survival. For example, in the Blackfoot River in western Montana there is a movement of juvenile bull trout in mid-summer (July/August) into smaller streams presumably for thermal refuge (Pierce et al. 1997). Culverts installed with a perched outlet can create a vertical jump resulting in a fish passage barrier or obstacle at various flows for some species and life stages. Culvert designs should not create a vertical jump, but instead be placed on the average natural stream gradient. Often the water velocity within the pipe is more of a limiting factor that the vertical jump itself. Velocity of water through the pipe can exceed the swimming speed capability of fish. Culvert designs should incorporate the lowest maximum average water velocity for the weakest-swimming fish requiring passage, which is often determined by that which allows juvenile fish to pass safely (Furniss et al. 1991; Bates 1997; Bell 1990). To avoid delay due to water depth, culvert design should be based on timing of fluvial and adfluvial fish movements and life stages and to accommodate the natural hydrograph and a minimum water depth. Recommended water depths on the Lolo National Forest in July and August when it appears that large, adult bull trout have already migrated is four inches to provide for the juvenile run of bull trout (Hendrickson 2000, Knotek et al. 2001).

<u>DNRC HCP Minimization/Mitigation Effects on Habitat Connectivity/Fish Passage</u>
The DNRC HCP strategy (i.e., Fish Connectivity Strategy) to address barriers that prevent or impede HCP fish species migration or movements upstream or downstream focuses exclusively on road-stream crossings. This is because the primary DNRC forest management activity affecting fish passage and access to habitat is related to road construction, operation, and maintenance at stream crossings. DNRC would use a review process in collaboration with MFWP and other stakeholders to determine on a case-by-case basis whether establishing connectivity at a specific site is warranted. This decision is important because in some cases (i.e., to prevent hybridization, predation, and the spread of disease) it may be desirable to maintain a barrier between non-introgressed WCT and potentially hybridizing species.

When it is desired to provide fish passage at a stream crossing, DNRC would design a fish passage structure to accommodate background levels of streambed form and function that would otherwise occur at the site. By emulating these streambed processes, ordinary stream habitat features and properties would develop in a crossing structure, thereby allowing naturally occurring levels of connectivity. This strategy will ensure connectivity from low to bankfull

flows because it is during these periods that the vast majority of HCP fish species migration and/or movement occur. Stream crossings would be designed to accommodate runoff events greater than bankfull flows (for example, 25-, 50-, or 100-year flow events) when feasible.

DNRC's fish connectivity strategy evolved from DNRC's existing conservation strategies, identified gaps in existing strategies, and new management concepts. In addition, DNRC conducted a Fish Passage Assessment Project to inventory and analyze all road-stream crossings where native fisheries connectivity is an issue on forested trust lands. The inventory will be continually updated as the data are refined or projects are completed. A detailed description of the project protocol is provided by Bower (DNRC 2006c). Using this inventory information, DNRC has identified approximately 106 fish passage culvert barriers in the HCP project area (Final EIS/HCP 2010, Appendix A, Chapter 2).

DNRC will set target rates for priority road-stream crossing improvements based on a timetable for allowing connectivity of adult and juvenile HCP fish species during low to bankfull flows within the first 30 years that the HCP and Permit are in effect. DNRC will commit to specific improvement rates over this time period. In addition, all high-priority sites will be improved within the first 15 years that the HCP and Permit are in effect. DNRC has also formulated design options by preference and feasibility. However, the selection of a road-stream crossing design will be determined by DNRC based on stream channel form and function, flow regimes, costs, anticipated use, and regulatory approval.

The DNRC HCP fish connectivity strategy follows existing management direction and provides more commitments and detail as follows:

1. This strategy for connectivity applies to HCP project area lands and those roads and stream crossings that DNRC has access to and sole ownership of. For roads with shared ownership, DNRC will work with other road cooperators to address fish passage issues.

2. DNRC will provide connectivity to adult and juvenile bull trout, WCT, and RBT during low to bankfull flows by emulating streambed form and function at stream crossings. DNRC will use the best available design technology while considering site conditions and cost efficiencies.

3. DNRC will inventory and assess connectivity on all existing stream crossings on known and presumed bull trout, WCT, and RBT habitat not surveyed during the DNRC Fish Passage Assessment Project. DNRC will also foster cooperative relationships with other agencies and landowners to further refine the status and prioritization of bull trout, WCT, and RBT connectivity on the watershed scale.

4. DNRC will prioritize road-stream crossing improvements based on existing levels of connectivity, as well as species status and population biological goals established while taking into consideration other regulatory agencies' or cooperative organizations' activities and goals. Genetic data used for a coarse filter will be obtained primarily from MFWP data sets. Where practicable and time is permitting, DNRC will collaborate with MFWP to collect species genetics information to supplement those data sets.

a. Fish connectivity coarse filter

i. Priority 1 – Habitat includes any bull trout life stage

ii. Priority 2 – Habitat includes 100 percent genetically pure WCT or RBT

iii. Priority 3 – Habitat includes WCT or RBT of unknown genetic purity

iv. Priority 4 – Habitat includes 80 to 99 percent genetically pure WCT or RBT.

b. Fish connectivity fine filter (within priority groups)

i. Determine if the action of culvert removal or replacement meets conservation objectives (i.e., prevention of genetic introgression or displacement by non-native species) while considering the goals of MFWP, the USFWS, and other appropriate organizations (see commitment 5 below).

ii. Determine the status of existing connectivity for different life stages at varying flows through model outputs, field verification, and other available data.

iii. Crossing site improvements may also be prioritized based on management opportunities, such as associated timber sales and other projects, forest improvement funds, grant availability, and structural failure due to catastrophic natural events.

5. DNRC will maintain a planning schedule containing a list of road-stream crossing sites that will identify current site prioritizations, potential mechanisms for implementation, and project status. The schedule will be reviewed annually and updated as new road-stream crossing sites are identified, there are changes in crossing status, new information becomes available, or improvements are completed. DNRC will provide this planning schedule to MFWP, the USFWS, and other appropriate organizations to effectively collaborate with adjacent landowners and other agencies on bull trout, WCT, and RBT conservation objectives.

6. DNRC will improve all priority 1 sites determined to require connectivity within the first 15 years that the HCP and Permit are in effect.

7. Within the first 30 years that the HCP and Permit are in effect, DNRC will ensure that all road-stream crossings allow connectivity of adult and juvenile bull trout, WCT, and RBT during low to bankfull flows, except in those cases identified in item 4(b)(i) above.

8. Every 5 years, one-sixth of all sites that do not meet the objectives of the fish connectivity strategy as determined by the DNRC Fish Passage Assessment Project will be improved to meet the strategy or, at a minimum, have final plans and designs for improvements to meet the strategy. If, due to DNRC's initial programmatic adjustments in HCP implementation, the first one-sixth of the sites cannot be improved in the first 5-year period, then DNRC will improve those sites within the first 10 years that the HCP and Permit are in effect. Sites that may be delayed under this scenario would be

improved in addition to other sites selected for improvement during the second 5-year period.

9. DNRC will determine the selection of a road-stream crossing design on streams supporting HCP fish species based on stream channel form and function, costs, long-term environmental risk (sedimentation), and anticipated use. The majority of fish passage structures in streams supporting HCP fish species will be designed to pass a minimum of the 50-year flood event. In order of preference, subject to environmental, operational and economic feasibility, design options that DNRC would consider include:

    a. Permanent structure removal

    b. Temporary bridges

    c. Permanent bridges

    d. Bottomless arch culverts

    e. Fords – (1) reinforced fords such as armored fords, and (2) fords with streambeds suitable to handle predicted loads (they are generally only feasible in low-traffic areas)

    f. Box culverts (only in low-gradient streams where substrate retention can be ensured through sufficient culvert embeddedness)

    g. Round or elliptic corrugated metal pipe (CMP) – channel simulation design (Bates et al. 2003)

    h. Round or elliptic CMP – no-slope design (design option only for streams where gradients are generally less than 3 percent) (Bates et al. 2003)

    i. Round or elliptic CMP – hydraulic design (Bates et al. 2003).

10. DNRC will include the following mitigations on road-stream crossings constructed on streams with bull trout, WCT, and RBT habitat:

    a. Construction windows are generally July through mid-August (within habitat occupied by bull trout), July through November (within habitat occupied by WCT or RBT), or as specified by MFWP in a 124 permit.

    b. DNRC will implement reasonable measures to exclude and/or salvage fish from construction sites, such as constructing block nets and removing fish from de-watered stream sections, as practicable.

    c. As practicable and economically feasible, DNRC will redivert stream flows through newly constructed crossing structures to allow engineered substrates to adjust to stream energies and processes.

d. DNRC will meet all Montana Forestry BMPs at each site during and after modification or construction. A DNRC contract administrator will be present during all fish passage installations. The application of BMPs will occur during contract administration and after site modification or construction. DNRC contract administrators will have the authority to halt or modify a project if BMPs are not being met during construction.

e. DNRC will provide training on fish connectivity design and construction techniques for field staff responsible for fish passage installations. Training will occur early in the implementation of the HCP. Additional training will be provided as new technologies become available or there are changes in personnel.

11. DNRC's HCP fish connectivity strategy allows some departure from the above commitments in certain cases. In some instances a road-stream crossing may provide connectivity to only a very short reach of fish habitat (for example, 500 feet or less habitat). In another instance, a road-stream crossing may provide connectivity to stream reaches with only seasonal surface flows. In situations such as these, DNRC is allowed to provide less than full connectivity at a proposed road-stream crossing identified for replacement. However, the following information will be submitted to the USFWS for review and consideration: flow regime (i.e. perennial, intermittent, and disconnected flows); habitat types (e.g. rearing, spawning, and wintering habitats); quality and quantity of different habitat types; species composition and populations (e.g., native/non-native species presence, genetic status [if available], estimated numbers of individuals [if available], and stream temperature [if available]).

12. It should be noted that DNRC may be issued a 124 permit by MFWP which acknowledges a road-stream crossing to very limited or marginal fisheries habitat. In this case, MFWP may elect to issue a 124 permit that requires road-stream crossing installations with lower design standards for connectivity than those described in this strategy. In certain situations, MFWP may also issue 124 permits that require a barrier to connectivity in order to meet other long-term native fisheries biological goals. Regardless, DNRC will be required to notify the USFWS during the annual update that this has occurred.

Monitoring and Adaptive Management – Connectivity/Fish Passage – DNRC's HCP fish connectivity strategy includes an implementation monitoring component to ensure that commitments under this strategy are being implemented and timelines are being met. The effectiveness monitoring component will ensure that existing and new stream crossing structures are passing fish unimpeded and remain intact after flood events. DNRC's Fish Passage Assessment Project described above would continue and includes post-installation effectiveness monitoring at all new road-stream crossings where bull trout, WCT, or RBT connectivity has been facilitated. DNRC's monitoring would include qualitative assessments of the structure's capabilities to accommodate background ranges of different stream forms and functions. Monitoring design, methods, and protocols will be selected from established procedures that have been demonstrated to be practicable, cost-effective, and suited for addressing the project-specific monitoring objectives (Final EIS/HCP 2010, Appendix A). Variables to be assessed at

the road-stream crossing include substrate distribution and composition, step/pool frequency, natural distribution of habitat features, presence of channel head cutting, bank erosion, and uncontrolled scour. The road-stream crossing structure is presumed to provide naturally occurring levels of connectivity if background ranges of stream form and function are determined by DNRC to be emulated within and immediately adjacent to the structure.

The monitoring schedule will include the following:

- DNRC would conduct the first post-construction assessment of a stream crossing structure within 2 years because the failure of a stream crossing structure will generally occur within 2 years if improperly installed. By conducting the first post-construction assessment within 2 years of installation, the flows that would generally cause a site to fail should have occurred.

- DNRC will conduct a subsequent post-construction assessment of CMP installations within 5 years following the first post-construction assessment. Because a stream crossing structure designed to allow connectivity will generally fail within 2 years if improperly installed, the subsequent post-construction assessment will re-check the observations found during the first post-construction assessment. DNRC will use this opportunity to further evaluate the performance of road-stream crossing structures other than CMPs at fish passage sites.

- DNRC will conduct all other subsequent post-construction assessments installations within 10 years following the first post-construction assessment. Because a stream crossing structure designed to allow connectivity will generally fail within 2 years if improperly installed, the subsequent post-construction assessment will re-check the observations found during the first post-construction assessment. This assessment will also be used as an opportunity to further evaluate the performance of road-stream crossing structures other than CMPs at fish passage sites.

- DNRC will evaluate damage of stream crossing structures facilitating bull trout, WCT, or RBT connectivity after experiencing a known 25-year or greater flood event. Major flood events at stream crossing structures designed to provide fisheries connectivity can severely compromise those structures' abilities to emulate streambed form and function. Major flood events include incidents such as debris torrents and debris jams. The purpose of these evaluations by DNRC is to determine if affected structures continue to: 1) emulate streambed form and function, and 2) retain the structural and design integrity to perform as expected under the conservation strategy.

Adaptive management for DNRC's fish connectivity strategy includes the following:

- DNRC will use the best available technology and research for (a) identifying new criteria or models to assess connectivity at existing road-stream crossings; (b) re-evaluating site prioritization due to updates or changes in species' status, population trends, or other information; and (c) identifying newer and more cost-effective installation methods or techniques for providing connectivity.

- If DNRC discovers that a new installation fails to emulate streambed form and function as determined by post-installation effectiveness monitoring, the following remediation process will be implemented: (a) a new technical survey of the affected stream reach will be conducted, (b) the cause of the problem(s) will be determined within 1 year of the discovery of the failure, and (c) the site re-installation will be scheduled according to the current planning schedule.

- DNRC will provide the USFWS with updates on all connectivity monitoring and implementation activities and issues, including stream crossing failures and associated corrective actions, at the annual update and 5-year monitoring meetings. Annual updates will include a summary of accomplishments, the status of ongoing projects, and schedules for planned activities. DNRC's 5-year monitoring reports will include a detailed analysis of the monitoring results.

Analysis of Effects of HCP Measures on Habitat Connectivity/Fish Passage

DNRC implemented a project called the Fish Passage Assessment Project to inventory and analyze all road-stream crossings where native fisheries connectivity is an issue on forested trust lands. As of the end of 2006, the preliminary inventory of the applicable road-stream crossing sites in the project area was completed. However, the inventory will be continually updated as the data are refined or projects are completed. The four objectives of the project are: 1) establish an inventory of every road-stream crossing within known and suspected native fisheries habitat, 2) collect sufficient detailed information from each site to facilitate an accurate assessment of connectivity, 3) conduct detailed analysis of each site and compile results into a database, and 4) develop a maintenance planning schedule focusing on the status of the stream crossings and the need to provide connectivity at those sites. A detailed description of the project protocol is provided (DNRC 2006c).

The results of DNRC's Fish Passage Assessment Project inventory found 124 known culvert barriers to fish passage on trust lands. Of these, 106 (85 percent) occur on streams supporting HCP fish species and 18 (15 percent) occur on other streams (DNRC 2006b) (Table IV-15). The 106 fish passage culvert barriers within the HCP project area were classified by DNRC into four HCP priority levels (Final EIS/HCP 2010, Appendix D, Figure D-9). The priority levels are based on the occurrence and genetic integrity of HCP fish species in the culvert barrier streams:

- Priority 1. Habitat supporting any bull trout life stage

- Priority 2. Habitat supporting 100 percent, genetically pure, WCT or RBT

- Priority 3. Habitat supporting WCT or RBT of unknown genetic purity

- Priority 4. Habitat supporting 80 to 99 percent, genetically pure, WCT or RBT.

Table IV-15. DNRC Fish Passage Inventory Results by Bull Trout Aquatic Analysis Unit for Culverts in the HCP Project Area.

Bull Trout AAU	Number of Barriers	Stream Miles Upstream of Barriers	Priority 2 Barriers	Stream Miles Upstream of Priority 2 Barriers	Priority 3 Barriers	Stream Miles Upstream of Priority 3 Barriers	Priority 4 Barriers	Stream Miles Upstream of Priority 4 Barriers
Bitterroot	3	3.2	0	0.0	3	3.2	0	0.0
Blackfoot	10	20.3	0	0.0	8	19.8	2	0.4
Flathead Lake	2	2.1	0	0.0	1	1.3	1	0.8
Lower Clark Fork	0	0.0	0	0.0	0	0.0	0	0.0
Lower Kootenai	0	0.0	0	0.0	0	0.0	0	0.0
Middle Clark Fork	15	45.2	2	9.5	13	35.7	0	0.0
Middle Kootenai	3	5.8	0	0.0	3	5.8	0	0.0
North Fork Flathead	8	8.5	0	0.0	8	8.5	0	0.0
Rock Creek	0	0.0	0	0.0	0	0.0	0	0.0
Stillwater	49	41.3	0	0.0	48	37.5	1	3.7
Swan	8	7.3	0	0.0	8	7.3	0	0.0
Upper Clark Fork	3	6.1	0	0.0	3	6.1	0	0.0
Upper Kootenai	3	6.2	0	0.0	3	6.2	0	0.0
Upper Missouri[2]	2	3.9	1	1.4	1	2.4	0	0.0
TOTAL	106	149.9	3	11.0	99	134.0	4	4.9

Source: Final EIS/HCP 2010, Chapter 4, Table 4.8-12.

1. There are no priority 1 barriers in any of the bull trout AAUs and as such this data was not presented in this Table.
2. Note the Upper Missouri unit is not a bull trout core area, but included for analytical and comparative purposes.

Within the HCP project area, there are three Priority 2 barriers, 99 Priority 3 barriers, and four Priority 4 barriers (see Table IV-15). However, there are no Priority 1 barriers. Priority 2 culvert barriers occur only in the Middle Clark Fork core area and the Upper Missouri AAU, blocking a total of about 11 miles of stream habitat. Most of the barriers are classified as Priority 3, primarily because of insufficient genetic information to classify them. Culvert barriers are also further classified within each priority level to address the various degrees of fish passage blockage.

Seventy-four (70 percent) of the 106 identified culvert barriers in the HCP project area occur in the Stillwater (49), Middle Clark Fork (15), and Blackfoot (10) core areas. These three cores also contain about 71 percent of the almost 150 miles of stream habitat blocked by barriers within the HCP project area (Table IV-15). With the exception of three core areas with no identified barriers (Lower Clark Fork, Lower Kootenai, and Rock Creek core areas), the remaining units contain between two and eight barriers, which block between 2.1 and 8.5 miles of stream.

DNRC's stream crossing inventory also indicated that some culverts may be approximately 50 years old, although the estimated average functional life of a culvert is about 35 years. Replacing these culverts every 35 years would result in a baseline average of about 3.5 culvert replacements per year (124 culverts in 35 years) (Table IV-16). DNRC determined that by using

the proportion of HCP to non-HCP fish species passage sites, this replacement rate would result in replacing culverts at about 3.0 HCP fish species passage sites per year.

DNRC acknowledged that there is an identified need to regularly replace culverts before they fail. A separate DNRC road inventory classified 132 culverts on 430 miles of road as having moderate or high risk of failing. Of these potential problem sites, about 38 percent would be likely to be replaced due to fish passage concerns (i.e., insufficient capacity or structure damage).

Table IV-16. Estimated timeframe and average yearly replacement rate of culverts within the HCP project area.

TIMEFRAME AND REPLACEMENT RATE	DNRC HCP
Estimated Culvert Replacement Rate for All Known Barrier Culverts on Streams with HCP Fish Species in HCP Project Area. (Number per Year)	3.5[1]
Estimated Timeframe to Replace All Known Barrier Culverts on Streams With HCP Fish Species in HCP Project Area. (Years)	30[1]
Estimated Culvert Replacement Rate for High-risk Culverts in HCP Project Area. (Number per Year)	9.5[2]
Estimated Timeframe to Replace All High-risk Culverts in HCP Project Area. (Years)	25[2]

[1] Replacements completed in 15 years for bull trout streams and 30 years for WCT or RBT streams.
[2] Replacements completed in 15 years for bull trout streams and 25 years for WCT or RBT streams

Some culverts pose a higher risk of failure than others and assessing culvert problems can be difficult. Therefore, to get an idea of the general range of the sediment delivery potential at identified problems sites, DNRC conducted an evaluation of the range of potential sediment delivery volumes at identified crossing sites and the general spatial extent of these problems (November 22, 2006, memorandum to the ATWG). This information helped inform DNRC about the extent of corrective actions within the HCP project area.

DNRC assessed the sediment delivery potential resulting from a catastrophic culvert failure during an infrequent, high intensity flood event. DNRC determined that 74 percent of the identified crossing sites have a potential to deliver 100 cubic yards or less of sediment in the event of a culvert failing during a storm. A regression analysis of average volume of sediment per site to physical properties of the watershed (slope) poorly described the observed variance (R2 =0.15).

On average, the Stillwater watershed, a high precipitation zone, had the highest sediment volume per site at 132.80 cubic yards/site (Table IV-17). DNRC noted that crossings with native soils pose the highest risk of sediment delivery and were not included in this analysis because depth of fill data was not available for all of the identified locations which were small in number relative to stream CMP sites.

Table IV-17. Average sediment volume per identified problematic site.

Watershed Inventory	Calculated Volume	Number of Sites	Cubic yards / Site
Blanchard Creek	188.48	6.0	31.41
Fish Creek	512.26	10.0	51.23
Lower Swift Creek	3983.90	30.0	132.80
Lower Thompson River	715.85	11.0	65.08
Middle Swift Creek	1386.73	31.0	44.73
Praine/Andrews		2.0	39.43
Upper Thompson River	827.23	13.0	63.63
West Fork Swift / Fitzsimmon Creek	1373.49	29.0	47.36

This evaluation provided DNRC with a general qualitative description of the extent of problem stream crossings in the HCP project area and aided in setting a realistic and prioritized timeline for DNRC corrective actions for the fish connectivity strategy.

The DNRC HCP fish connectivity strategy would require that DNRC apply all existing stream crossing regulations and BMPs for fish passage and conduct and update ongoing DNRC fish passage assessments within the HCP project area, specifically targeting those areas with known and presumed HCP fish species habitat. These data would allow DNRC to prioritize road-stream crossing improvements for streams with HCP fish species based on existing levels of connectivity, HCP fish species status, and population conservation goals. This prioritization would lead to completing the connectivity improvements within 15 years for bull trout streams (if found) and 30 years for streams with WCT or RBT. DNRC would be required to follow a consistent timetable for progressive improvements to meet fish passage standards at all problem crossings on HCP fish species streams. This timetable would result in a culvert replacement rate of about 3.5 per year and with the prioritization schedule to ensure that the most problematic culverts would be improved first, thus improving connectivity for all HCP aquatic species within a defined timeframe.

Depending on the type of new crossing structure, DNRC would conduct post-installation effectiveness monitoring at improved road crossings on known or suspected HCP fish species streams to verify that the road crossing improvements adequately provide the connectivity conditions necessary for viable HCP fish populations. The monitoring schedule would include assessments at 2, 5, and 10 years following structure installation, as well as inspections after large flood events. Furthermore, as explained below, through adaptive management practices, DNRC will use the best available technology and research to assess connectivity at existing road-stream crossings, by re-evaluating site prioritization status, and continuing to evaluate new installation methods or techniques for providing connectivity. As part of adaptive management, DNRC would commit to prescribed actions to correct deficiencies if a new installation fails to emulate the streambed form and function (as determined by post-installation effectiveness monitoring), as well as a reporting schedule with the USFWS to review and discuss HCP fish connectivity issues.

Design features important for fish passage effectiveness include the size, shape, and slope of the culvert, as well as the stream channel characteristics at the road crossing. Poorly designed or installed culverts can result in partial or complete fish passage barriers. Therefore, on Class 1 streams DNRC will design fish passage structures by emulating stream channel form and function and ordinary stream habitat features and properties in a crossing structure that allow naturally occurring levels of connectivity. Culverts of the corrugated metal pipe (CMP) type are the most popular stream crossing structures that DNRC will likely construct and install.

Emulating stream channel form and function within and immediately adjacent to a CMP culvert can be technically challenging and involve critical measurements that need to be obtained prior to construction and then later accounted for during the culvert installation. DNRC will closely survey the streambed and channel morphology adjacent to the crossing site, and include the following critical measurements: variability of natural channel elevations as determined from a longitudinal profile, ordinary low and high flows, flows during major flood events, substrate budget, bankfull widths, channel form and pool spacing, natural grade controls, stream velocities and resistance to flows, geomorphological processes, sinuosity, channel stability, channel cross-sectional profiles, streambed porosity or permeability, and stream gradients, among other general field observations. Assuming that natural channel simulation has been accomplished at the culvert stream crossing, it is expected that connectivity for all life stages of HCP fish species will occur throughout the natural flow regimes with this design. DNRC's required monitoring of these installations should ensure their effectiveness. In addition, any future permitting requirements by MFWP for some level of stream channel simulation through preservation of natural channel form, stream velocity, and minimum channel bankfull width could be met through this approach under the fish connectivity strategy.

The selection of a road-stream crossing design on streams supporting HCP fish species will be determined by DNRC based on stream channel form and function, costs, long-term environmental risk (sedimentation), and anticipated use. However, where round or elliptic corrugated metal pipe (CMP) installations are considered, DNRC would likely select the streambed simulation design (Bates et al. 2003) on streams with HCP fish species. In addition, the majority of fish passage structures in streams supporting HCP fish species will be designed by DNRC to pass a minimum of the 50-year flood event.

<u>Summary of Effects on Habitat Connectivity/Fish Passage</u>
Seventy-four (70 percent) of the 106 identified culvert barriers in the HCP project area occur in the Stillwater (49), Middle Clark Fork (15), and Blackfoot (10) core areas. These three analysis units also contain about 71 percent of the almost 150 miles of stream habitat blocked by barriers within the HCP project area (see Table IV-15). The culvert barriers are currently blocking HCP fish species from accessing upstream spawning and rearing habitats. Therefore, the local population inhabiting these streams is restricted from expanding their distribution and is likely limiting their abundance as well.

Most of the spawning and rearing habitat for bull trout in the Stillwater core area is located in the Stillwater State Forest and is managed timberlands by DNRC. The entire local population (spawning and rearing) of bull trout is distributed in one or two headwater tributaries; however, three to four additional streams likely provide some rearing opportunities for juvenile bull trout.

The bull trout population has been restricted to the headwaters of this system as a result of habitat degradation lower in the system off the Stillwater State Forest where stream temperatures are extremely warm in the summer months and lake environments harbor abundant predators like northern pike and lake trout. This population previously had an adfluvial life history component, but is now restricted to a fluvial existence. It is unknown what effect potential conversion from an adfluvial to a fluvial or resident population may have, but the resiliency built into multiple bull trout year classes in the lake habitat appears to have been compromised.

Roads exist throughout the upper Stillwater River drainage and have contributed to the fragmentation issue. There are legacy concerns associated with past land management (i.e., forestry) practices and roads and precipitation patterns in this core area appear conducive to higher frequency of rain-on-snow conditions, as has been exhibited in several recent year events. Several major runoff events have occurred in recent years that resulted in BMP applications to most of the road system such that some of the legacy issues have been stabilized. Precipitation patterns appear conducive to higher frequency of rain-on-snow conditions, as has been exhibited in several recent year events.

There are no barriers in the system between Upper Stillwater Lake and upstream spawning and rearing habitat. The Stillwater River is mostly unobstructed to the Flathead River upstream of Flathead Lake (approximately 55 miles), but much of it is degraded and extremely warm in the summer months. Furthermore, the nonnative species influences, combined with a high proportion of the drainage in heavily managed lands, make long-term prospects for bull trout in this core area rather tenuous. This core area will benefit greatly from the DNRC HCP due to the commitments to remove culvert barriers that would allow access by WCT to over 40 additional stream miles of habitat. Until the fish passage barriers are fixed, WCT could be adversely affected.

The trend of the baseline habitat and population conditions for bull trout and its habitat is uncertain in the Middle Clark Fork core area. Several significant actions have been taken in the past few years to restore connectivity for migratory bull trout in the Clark Fork River drainage. This includes the following: 1) development of a trap and haul fish passage program at Cabinet Gorge and Noxon Rapids dams; 2) a fish ladder recently completed at Thompson Falls Dam downstream of this core area; 3) the development of fish passage at MWC Dam on Rattlesnake Creek; and 4) removal of Milltown Dam in the upstream end of this core area. As a result, connectivity within the Middle Clark Fork River is now enhanced by improved fish passage on either end. Six of eight local populations are fully connected. The potential to restore an adfluvial form of bull trout to this core area now exists with the breach of these fish passage barriers on the mainstem which ostensibly connects Lake Pend Oreille to this core area for adult migratory bull trout attempting to return to Montana to spawn.

Forest habitat conditions have trended upward, with an improved baseline (B. Riggers, USFS, pers. comm.) in the Middle Clark Fork core area and particular emphasis on road BMPs and improvement of fish passage in tributary systems. Prospects for continued habitat conservation activities are good; however, population response as a result of these activities is not certain, given the nonnative species, habitat and connectivity concerns. Furthermore, the cumulative effect of impacts in this part of the Middle Clark Fork River system is problematic. Under the

DNRC HCP, connectivity in tributary streams on HCP project lands should get better in this core area with the restoration of the 15 identified fish passage barriers thus allowing WCT and bull trout upstream access to 45 miles of potential spawning and rearing habitat. HCP fish species would have the opportunity to potentially expand their distribution and increase their numbers of the affected local populations. Until the fish passage barriers are fixed, WCT could be adversely affected.

Status of bull trout in the Blackfoot core area was considered "depressed" and trend was "unknown" based on information available at the time of listing (USFWS 1998a). The current status of bull trout indicates it is one of the strongest among fluvial populations in the Clark Fork River Basin (USFWS 2005b). Five of the six local populations are well connected. Intensive efforts have been made over the past decade to reopen blocked portions of the subbasin through renovation of irrigation and culvert barriers as well as by providing instream flow enhancements to improve seasonal migratory deficiencies (Pierce et al. 2003). Cottonwood Creek and portions of the upper basin suffer from dewatered sections in late summer, but continual improvements are being applied through a series of projects involving diversion upgrades and screening, habitat improvements, and instream flow acquisition. An example of this expanding distribution is Snowbank Creek (a tributary of Copper Creek) where a problematic diversion was corrected. The removal of Stimson Dam on the lower Blackfoot and Milltown Dam on the mainstem Clark Fork River immediately downstream of the Blackfoot confluence in 2008 should provide additional opportunity for genetic exchange and return migration of bull trout from the Clark Fork River.

Despite the improvements in habitat conditions and population status of bull trout in the Blackfoot core area, the combined effects of over a century of farm and ranch-related land management uses, including dewatering, grazing, and water quality impairment (temperature, sediment and runoff), are considered to have the greatest existing impacts in this core area. The existing legacy of forest roads and forest practices are also an ongoing concern as well as issues with angling overutilization. Many of these problems are being systematically corrected, but their legacy endures. Intertwined with these impacts are the effects of introduced species, primarily brook trout and brown trout, which are notoriously able to thrive in degraded ecosystems (temperature, water quality, sediment) where native fish are less viable. The DNRC HCP will address the 10 fish barriers in this core area (and others that are identified over the Permit term) which will allow access to at least 20 stream miles of habitat for WCT and bull trout. These improvements in connectivity should increase their distribution and abundance in this core area and add to the baseline to help improve the ongoing efforts that are and will continue to address the effects of legacy actions that have eroded the habitat conditions for HCP fish species. However, until the fish passage barriers are fixed, WCT could be adversely affected.

The DNRC HCP will address all the fish passage barriers caused by inadequate installation of culverts due to poor forest road practices in all the core areas (including the Upper Missouri AAU) where culvert barriers were identified. Therefore, it is expected that fish passage barriers will be removed on HCP project lands in all of these units and that baseline conditions will improve over time. As culverts are replaced there will be an associated pulse of sediment input that could cause a short-term adverse affect on fish and habitats in the vicinity of the culvert

project. However, the long-term benefits outweigh the short-term affects. Additionally, not all culverts barriers will be fixed simultaneously under the HCP and during the period of time to replacement there could be adverse affects to HCP fish species.

Conclusion on Effects on Habitat Connectivity/Fish Passage

DNRC has determined that inadequate design and improperly installed stream crossing structures could diminish connectivity of HCP fish species to the extent of causing adverse impacts that could incidentally take an HCP fish species (Final EIS/HCP 2010, Appendix A). The USFWS concurs with this determination that improperly installing a new stream crossing structure, improperly replacing an existing stream crossing structure, or improperly rehabilitating a site where an existing structure is being removed could fully or partially obstruct fish passage. In turn, the impediment to migration and movement could adversely affect the ability of HCP fish species to find and use spawning and rearing habitats necessary for their survival. The HCP fish species use different habitat characteristics for spawning, juvenile rearing, and adult rearing and sometimes these habitat requirements necessitate the movement of fish between lake and riverine environments. The blockage of fish from any of these habitats could lead to unsuccessful spawning, increased predation, or reduced growth or survival rates. In turn, local populations could be diminished if adequate spawning and rearing areas are inaccessible.

DNRC estimates that there are currently 106 existing culverts within the HCP project area that are impacting fish passage to some degree, including potential access to approximately 150 miles of stream. DNRC has assigned priority levels to these crossing structures and will replace or remove all structures that are barriers to fish passage within 15 years on bull trout streams and 30 years on streams supporting WCT or RBT. This timetable will result in a culvert replacement rate of about 3.5 per year, which will ensure that the most problematic culverts are improved first, resulting in a longer period for fish to re-populate upstream areas previously blocked or restricted. Addressing these existing legacy stream crossing sites will provide for an improving trend and baseline conditions for connectivity over the HCP project area, especially in the units having the highest number of existing fish passage barriers - Blackfoot, Middle Clark Fork, and Stillwater core areas. The improved connectivity is expected to reduce the isolation of potentially at-risk local populations and contribute to recovery of listed species.

The risk of impacts to fish connectivity that have the potential to adversely affect HCP fish species would likely be limited to those cases where impacts occurred due to an ineffective crossing structure after installation, but prior to monitoring; or during the period between monitoring events; or during the period between the discovery of an ineffective installation and the first opportunity to correct the deficiency. The most likely core areas that this would occur are the Stillwater, Middle Clark Fork, and Blackfoot. Seventy percent of the 106 identified culvert barriers in the HCP project area are located in these core areas. These three analysis units also contain about 71 percent of the almost 150 miles of stream habitat blocked by barriers within the HCP project area (see Table IV-15). Nevertheless, the risk of these impacts occurring is likely to be infrequent and isolated.

It is estimated that by the end of the Permit term 417 new stream crossings are anticipated to be constructed (Final EIS/HCP 2010, Chapter 4, Table 4.8-20), most of which are likely to be culverts. Based on the previous findings that 20 percent of the existing stream crossings

occurred on streams that supported at least one HCP fish species (Final EIS/HCP 2010, Chapter 4, Table 4.8-8, and page 4-256) and applying this value to new stream crossings, it is estimated that 83 culverts could be installed on HCP fish streams. Further, of the stream crossings DNRC inventoried, 38 percent of the culverts on HCP fish streams had potential fish passage problems (Final EIS/HCP 2010, Chapter 4, page 4-256). If this value is applied to the 83 culverts, about 32 culverts could potentially become problem sites for connectivity during the Permit term. This figure may be inflated however, because new culvert installations achieve successful fish passage at a much higher rate due to better stream crossing criteria, design, and installation procedures.

The fish connectivity strategy will ensure adequate passage of HCP fish species from low to bankfull flows because it is during these periods when the vast majority of bull trout, WCT, and RBT migrations occur. Road-stream crossings will be designed to accommodate flows during runoff events that are greater than bankfull flows, which will in turn accommodate the majority of streambed functions. DNRC will ensure that designs of stream crossing structures on streams supporting all HCP fish species emulate, to the extent possible, site-specific streambed and stream channel form and function, thereby allowing naturally occurring levels of connectivity. In addition, the majority of fish passage structures in streams supporting HCP fish species will be designed to pass a minimum of the 50-year flood event.

DNRC's fish connectivity strategy is intended to minimize the risk that new stream crossing structures would be ineffective at providing unimpeded passage either due to inadequate design or poor implementation. DNRC will be required to conduct installation effectiveness monitoring on all new and upgraded stream crossing structures to verify that those structures adequately provide the connectivity necessary for viable HCP fish populations. The monitoring schedule will include assessments at 2, 5, and 10 years following structure installation, as well as inspections after large flood events.

The HCP also incorporates adaptive management practices that would utilize the best available technology and research to assess connectivity at existing road-stream crossings, by re-evaluating site prioritization status, and continuing to evaluate new installation methods or techniques for providing connectivity. Through adaptive management, DNRC will commit to prescribe actions to correct deficiencies if a new installation fails to emulate the streambed form and function (as determined by post-installation effectiveness monitoring), as well as a reporting schedule with the USFWS to review and discuss HCP fish connectivity issues.

In summary, DNRC's forest management activities that could cause adverse impacts to HCP fish species is related to the installation, maintenance, and removal of stream crossing culverts. As mentioned above, improperly designed or installed culverts are typically the most universal threat to fish passage. The potential effect of fish passage barriers, mainly culverts, is impaired access of HCP fish species to spawning, feeding, and cover areas, which could include reductions in survival and production of HCP fish species in the affected watersheds. However, the DNRC HCP would minimize the potential for these impacts by designing new road-stream crossing installations to simulate natural streambed form and function. The intent is to provide the same levels of connectivity to adult and juvenile HCP fish species as are provided by an undeveloped stream channel during low to bankfull flows. The USFWS has determined that

DNRC's fish connectivity strategy would likely minimize the potential for adverse impacts of HCP fish species at new and existing stream crossings. However, there will remain a risk that incidental take could occur due to lack of fish passage (fully or partially) of some life stage of an HCP fish species at new or existing stream crossings during the term of the Permit. It would take some time to fix all the fish passage barriers (up to 30 years for WCT and RBT affected sites) and in the interim there would be a risk of incidental take. In addition, when considering discovery of a new fish passage barrier problem, there is likely to be a lag time between its discovery and correcting the problem in which incidental take to HCP fish species could occur.

Analysis of Effects on Cumulative Watershed Effects

General Effects of Forest, Road, and Grazing Management Activities on Cumulative Watershed Effects

A general cumulative effect of forest practices has been a reduction in the complexity of stream macro- and microhabitats. Substantial decreases in the number of large, deep pools in river systems west of the Cascades Mountains have been documented in FEMAT (USDA et al.1993) and similar declines in pool frequency in river basins of eastern Oregon and Washington are described by McIntosh et al. (1994) as due to the reduction of LWD from wood removal programs and riparian timber harvests. Hicks et al. (1991) describes the changes in the distribution and abundance of LWD in streams as being among the most important long-term effects of forest management on fish habitat in Western North America. Hicks et al. (1991) discusses that overall trends include the reduction in the frequency of large pieces of LWD, stable debris in streams, concentrations of large accumulations; and the loss of important sources of new woody materials for stream channels as noted by Bisson et al. (1987). Hicks et al. (1991) refers to Sedell and Luchessa (1982), Narver (1971), and Rothacher and Glazebrook (1968) when describing these trends as having been accelerated by stream channelization, by debris removal for navigation for upstream fish migration, and for reduction of property damage during floods.

CWE concerns are often related to the potential for increased water yields and increased magnitude and duration of peak flows. Water quantity (hydrologic regime) and water quality (physical and chemical constituents) are important components of aquatic habitats (USDA and USDI 2000). The USDA and USDI (2000) reported that at a broad scale within the Interior Columbia River Basin (east of the Cascades' crest) water quantity (surface water volume and flow) has been affected by road construction and vegetation changes associated with silvicultural practices, livestock grazing, and agriculture. These activities also can affect water quality by contributing to increased sediment loads, water temperatures, and nutrient and contaminant levels. The USFWS (1998a) reported that within the Columbia River Basin, many subpopulations of the Columbia River DPS of bull trout are threatened by impaired water quality.

Many of the same adverse effects on water quantity and quality can result from improper forest, road, and range management practices. These effects can consequently cause the alteration and degradation of aquatic and riparian habitat for resident and anadromous native salmonids, as well as non-salmonids. These changes can negatively affect fish migration, spawning, incubation, emergence, and rearing success through various factors, such as increased peak flows, channel

scour, changes in seasonal base flows, and the presence of contaminants (USDI and USDA 2000, Quigley and Arbelbide 1997).

CWE are important to the protection of fish populations because the effects of an individual action or activity might only result in an incrementally small change in habitat, but still have a substantial effect relative to the needs of a fish species. For example, a small increase in water temperature might result in little or no effect on fish when existing temperatures are in the middle of the tolerance range for the species. However, if the existing water temperatures are near the extreme of the tolerance range, the small additional change might result in exceeding the tolerance range. CWE can also include impacts to limited habitat features. If previous activities have resulted in a substantial decrease in an ecologically important habitat, any additional impacts (however small) can have a substantial effect of fish species dependent on that habitat.

Forest and grazing management activities can alter watershed processes that create and maintain riparian and aquatic habitats, often resulting in reductions of habitat complexity and the diversity of aquatic species (Elmore and Beschta 1987; USDA et al. 1993). In watersheds containing bull trout, changes in habitat features associated with reductions in habitat complexity and functional capacity include decreases in: LWD; pool quality; channel stability; substrate quality; groundwater inflows; and suitable habitat serving as corridors between habitat patches (e.g., resulting from increases in water temperature (MBTSG 1998). Livestock grazing has promoted formation of incised channels, reduced pool frequency, increased soil erosion, and altered water quality (Platts 1981; Kauffman and Krueger 1984; Henjum et al. 1994; Overton et al. 1993). These effects increase summer water temperatures, promote formation of anchor ice in winter, and increase sediment into spawning and rearing habitats. Overall, cover for bull trout is reduced and occupied bull trout habitat is negatively affected by livestock grazing (Howell and Buchanan 1992; Mullan et al. 1992; Platts et al. 1993; Henjum et al. 1994; MBTSG 1995a,b,c; USDA and USDI 2000). Bull trout are more strongly associated with the habitat characteristics of stable stream channels of only lightly disturbed sub-basins (Brown 1992; Clancy 1993; Cross and Everest 1995; Huntington 1995; Ratliff and Howell 1992).

<u>DNRC HCP Minimization/Mitigation Effects on Cumulative Watershed Effects</u>
The CWE strategy will apply to those DNRC forested trust lands within sixth-order HUC watersheds providing habitat for one or more HCP fish species. DNRC provided GIS information indicating that approximately 453,099 acres of the HCP project area are located within sixth-order HUC watersheds providing habitat for one or more HCP fish species. Also, approximately 296,087 acres of the HCP project area are located within sixth-order HUC watersheds that provide habitat for one or more HCP fish species, and include 303(d) listed water bodies. DNRC's ARM 36.11.423(1)(g) states that the maximum allowable risk of CWE is low in 303(d) listed water bodies. For DNRC's forested trust lands west of the Continental Divide that are covered by the HCP CWE strategy, the existing management prescription currently limits the risk of CWE to 65 percent (Final EIS/HCP 2010, Appendix A, Chapter 2, pg 2-128) of those parcels providing habitat for one or more HCP fish species. DNRC expects this percentage to decrease over time as water bodies are removed from the state 303(d) lists.

The CWE strategy is based primarily on DNRC's existing CWE program. The concept of CWE has been part of DNRC's management philosophy of forested trust lands since the early 1980s.

However, DNRC acknowledged that CWE are exceedingly difficult to measure because the actions affecting watershed resources occur across multiple land ownerships, are temporally and spatially complex, and are typically problematic to accurately inventory and evaluate. The USFWS also acknowledges this difficulty.

The HCP essentially formalizes this program by clarifying the existing Forest Management ARMs (36.11.423, Watershed Management – Cumulative Effects). Under the DNRC HCP CWE strategy, DNRC would continue to analyze the potential for impacts due to CWE as currently conducted under ARM 36.11.423. Additional commitments included in this strategy are designed to: 1) specify the type of forest management activities that will be analyzed for CWE, 2) define the described levels of risks, 3) implement alternatives or measures to offset potential impacts, and 4) provide consistent documentation of analysis methods and rationale used for risk determinations.

DNRC's existing ARMs provide a framework for assessing the highly variable conditions that may contribute to CWE in both scattered and blocked forested trust lands. The framework is specifically designed to evaluate past, present, and future conditions unique to the different physiographic regions of Montana. The framework also supports the flexibility to use appropriate analysis tools and methods for different sites, watersheds, regions, and conditions. This strategy applies to forest management activities within the watershed boundary containing the headwater streams to drainage(s) up to a maximum of the sixth-order HUC designation, and that contain one or more HCP fish species.

The CWE strategy, would require DNRC to analyze CWE on all forest management projects involving the following: 1) upland timber and salvage harvest of more than 15 acres or 50 mbf, 2) RMZ harvest of green timber, 3) salvage harvest within the RMZ of 1 or more acres of dead and dying timber, 4) new road construction greater than 0.5 mile, 5) new road construction located within the RMZ of a Class 1 stream crossing supporting HCP fish species, or 6) construction of any length of new road that includes the installation of a new Class 1 stream crossing.

DNRC water resource specialists would complete CWE assessments and ensure that a forest management project will not increase impacts beyond the physical limits imposed by the stream system for supporting its most restrictive beneficial use(s), when considered with other existing and proposed state activities for which DNRC's scoping process has been initiated. DNRC will identify specific measures, where appropriate, for mitigating adverse effects on beneficial water uses. Beneficial uses are those uses of a water body that are classified by MDEQ in established water quality standards such as the support of cold-water fisheries and drinking water.

DNRC HCP requirements under the CWE strategy include the following:

1. DNRC will determine the necessary level of CWE analysis on a project-level basis, and, at a minimum, will complete a watershed coarse-filter (Level 1) analysis (Final EIS/HCP 2010, Appendix A). The level of analysis conducted by DNRC will depend on assessment of the following factors:

- The extent of the proposed activity will be determined through evaluation of the magnitude, range, or geographic scope of the activity. Extent will also consider the degree or level of intensity of the activity. For example, regeneration harvest would be considered a high-intensity activity, and salvage harvest of individual dead trees would be considered a low-intensity activity.

- Levels of past activities will be determined through the Level 1 analysis and then integrated into further analysis if necessary.

- Beneficial uses at risk are those beneficial uses considered to be impaired relative to established water quality standards.

- DNRC will use the factors listed above during the Level 1 analysis to determine the risk of existing CWE or the potential for CWE to result from a proposed DNRC forest management activity. If a Level 1 analysis determines there is only a low potential for adverse cumulative impacts, then the analysis will be considered complete. Low potential for impacts implies there is a low likelihood that adverse CWE of a proposed DNRC action can be detected and foreseen by DNRC. If there is a moderate to high potential for adverse CWE to result from the proposed DNRC forest management activity as determined by a Level 1 analysis, then a Level 2 or Level 3 analysis will be conducted.

a. DNRC will complete a preliminary watershed coarse-filter (Level 1) analysis on all eligible projects. This analysis will rely primarily on existing data and information, and will include documentation of rationale describing those variables that may contribute to CWE, an assessment of adverse CWE risk, and a description of future detailed analysis, if required.

b. DNRC will complete a more detailed Level 2 and/or Level 3 watershed analysis on projects where DNRC determines (through the Level 1 analysis) there is greater than a low potential for CWE.

   A low potential for CWE implies that there is a low likelihood that adverse CWE of a proposed action can be detected and foreseen by DNRC when considering past and present activities on all ownerships. Future actions are also considered when they are state-sponsored actions that are under concurrent consideration by any state agency through environmental analysis or permit processing procedures.

   Level 2 watershed analysis will generally include four steps:

   i. Evaluation of Level 1 analysis results.

   ii. Field review of the project area by a DNRC watershed resource specialist.

   iii. Evaluation of existing direct and indirect effects on watershed resources within the project area to establish a baseline of existing conditions.

   iv. Qualitative assessment by DNRC of both the watershed coarse-filter (Level 1) analysis data and collective projected direct and indirect effects of the proposed action relative to the baseline of existing conditions.

[Examples of current Level 2 watershed analysis methodologies that DNRC may use include the MEPA Environmental Assessment Checklist (DNRC 1998b), Pfankuch channel stability rating (USFS 1974), Lassen National Forest method (Young 1989), and A Framework for Analyzing the Hydrologic Condition of Watersheds (McCammom et al. 1998)].

c. DNRC will complete a detailed Level 3 watershed analysis when the Level 1 or Level 2 analysis predicts or indicates the existence of or potential for unacceptable CWE as a result of the proposed forest management activity.

   i. A Level 3 watershed analysis uses appropriate levels of information and technology in a quantitative assessment by DNRC of both (1) the Level 1 and Level 2 analysis data, and (2) the collective projected direct and indirect effects of the proposed action relative to the baseline of existing conditions.

      [Examples of current Level 3 watershed analysis methodologies that DNRC could use include water yield increases relative to equivalent clearcut areas (USFS 1974), Washington Forest Practices Board (WFPB) Standard Methodology for Conducting Watershed Analysis (WFPB 2002), Forest Practices Cumulative Watershed Effects Process for Idaho (IDL 2000), An Approach to Water Resources Evaluation of Non-Point Silvicultural Sources (EPA 1980), and WATSED (water and sediment yields) (USFS 1992)].

   ii. Unacceptable CWE implies there is a high degree of risk that an adverse CWE of an action can be foreseen and detected by DNRC when considering past and present activities on all ownerships. Future actions are also considered when they are state-sponsored actions under concurrent consideration by any state agency through environmental analysis or permit processing procedures.

2. DNRC will establish thresholds for CWE on a watershed-level basis when completing all Level 2 or Level 3 analyses. Thresholds will take into account items such as stream channel stability, beneficial water uses, and existing watershed conditions.

   a. Thresholds are either qualitative (including narrative descriptions) or quantitative standards used to describe acceptable levels of risk of CWE. For example, thresholds for a Level 2 analysis may be low, moderate, and high, while thresholds for a Level 3 analysis may be 5 percent, 10 percent, and 15 percent.

   b. A watershed-level basis is specific to the watershed boundary containing the headwater streams to the drainage(s) within the project area up to a maximum of the sixth-order HUC designation.

   c. Stream channel stability describes the ability of a given stream reach or network to facilitate the movement of relatively equal quantities of incoming and outgoing sediment classes. Stream channel stability also describes the ability of a given stream reach or network to facilitate a range of flow regimes without increased rates of in-

stream erosion, migration, or flooding beyond those that would otherwise be expected to occur.

d. Existing watershed conditions include variables such as forest cover, road construction, road conditions, flow regimes, natural disturbance, geology, susceptibility to erosion, and other concurrent management proposals.

DNRC will use general indices as indicators of the potential for CWE during the Level 1 (coarse-filter) analysis process. DNRC will use more specific thresholds at the project- or watershed-level scale where specific proposals can be evaluated in conjunction with site-specific watershed values, issues, characteristics, and conditions.

3. DNRC will set water quality thresholds at a level that ensures compliance with water quality standards and protection of beneficial water uses, including HCP fish species habitat with a low to moderate degree of risk.

   a. Water quality standards are established by MDEQ (ARM 17.30.641, Water Quality – Surface Water Quality Standards and Procedures).

   b. DNRC will set thresholds in watersheds of water-quality-limited water bodies at a level providing a low degree of risk to beneficial water uses.

   c. A water body identified on a current 303(d) list is determined by MDEQ to have impaired water quality for one or more reasons. The MDEQ maintains 303(d) listings through an interagency agreement with the EPA, the entity responsible for implementation of the CWA. A watershed of a water-quality-limited water body is analogous with the sixth-order HUC watershed contributing to a 303(d) listed water.

4. DNRC will implement management mitigations or project alternatives to offset potential impacts when a high risk of CWE is apparent after Level 2 or Level 3 analysis. Management mitigation measures will be designed to reduce the potential for CWE to a moderate or low level.

5. DNRC will consider implementing management mitigation or project alternatives when a moderate risk of CWE is apparent after Level 2 or Level 3 analysis.

6. Whenever feasible, DNRC will cooperate with other landowners in watersheds with mixed ownership to minimize CWE within acceptable levels of risk. Feasibility for cooperation with other landowners in a watershed to minimize CWE will depend on DNRC time, financial, and logistical constraints; and the willingness of other landowners to cooperate in such efforts.

Monitoring and Adaptive Management – Cumulative Watershed Effects – DNRC will be required to conduct the following implementation monitoring as part of the CWE conservation strategy.

1. In order to ensure that risk assessments, project mitigation development, and action decisions are founded and consistent with the appropriate levels of information and technology, DNRC will review and use appropriate levels of information and technology as described in the CWE conservation strategy for conducting Level 1, Level 2, and Level 3 analyses (based on the scale and scope of the proposed activity).

2. DNRC's Forest Management Bureau will review and compile the Level 1, Level 2, and Level 3 analyses for completeness and consistency, which should ensure a high level of analysis oversight and internal conservative strategy implementation monitoring.

3. DNRC will provide the USFWS with copies of Level 1, Level 2, or Level 3 analyses upon request and allow the USFWS to observe the CWE analysis process, which will inform the USFWS regarding the success of implementation of this conservation strategy.

CWE are the result of the collective effects of two or more independent management variables within a watershed. As such, specific CWE are extremely difficult to differentiate and measure. Nevertheless, DNRC will monitor the effectiveness of all other aquatic conservation strategies in the HCP, which will closely monitor independent variables such as LWD, sediment, fisheries connectivity, and stream temperature. DNRC will set water quality thresholds at levels that ensure compliance with water quality standards and protection of beneficial water uses, including HCP fish species habitat, with a low to moderate degree of risk. The USFWS will review the adequacy of threshold levels in protecting HCP fish species habitat.

For projects with high or moderate risk of CWE, DNRC will provide documentation to the USFWS stating which mitigation measures or alternatives were considered and/or selected for implementation. Additionally, DNRC will review emerging science for its applicability to effectiveness monitoring for the CWE strategy. If relevant, new information becomes available, the adaptive management process will be used to consider modifications to the HCP CWE strategy.

DNRC will provide the USFWS with updates on all CWE conservation strategy implementation activities and issues at annual meetings and 5-year monitoring meetings. Annual updates will consist of a list of CWE implementation activities that includes the number, type, and location of CWE analyses completed. Every 5 years, the USFWS and DNRC will meet to evaluate the effectiveness of the CWE process. The 5-year monitoring meeting will serve as a coordination effort to ensure that DNRC is providing adequate levels of mitigation for CWE. Adaptive management for CWE will include evaluating the cumulative effects process during the 5-year monitoring meetings.

<u>Analysis of Effects of HCP Measures on Cumulative Watershed Effects</u>
In 2004, DNRC conducted a sustained yield calculation (SYC) that identified all forested parcels that were located in watersheds where future DNRC harvest activities are likely to be constrained by existing or the potential for CWE. These parcels were identified by DNRC as "sensitive." CWE of concern were primarily related to the potential for increased water yields and increased magnitude and duration of peak flows. The sensitive watersheds were identified through a

coarse-filter process that primarily relied on the knowledge of DNRC forest management program hydrologists and existing TMDL data and/or CWE data/analyses.

Criteria used by DNRC to identify parcels likely to be constrained by CWE included the following: 1) documented CWE concerns from previous DNRC project analysis, existing, or ongoing TMDLs or 303(d) listing, 2) watersheds with high levels of timber harvest or stand-replacement fire, 3) watersheds in which a majority of the ownership is industrial timberland, and 4) municipal watersheds. Conversely, DNRC eliminated watersheds if there were offsetting reasons thought to reduce the risks of future CWE constraints on DNRC timber harvest. These criteria included the following: 1) forested stands located in watersheds whose area is dominated by non-forest rangeland, 2) areas that are drained by ephemeral or discontinuous drainage features, 3) those areas with no surface drainage features such as terraces on large rivers, or 4) those watersheds where recent project-level analysis had demonstrated low risk of CWE. DNRC's forest management model for the 2004 SYC timber harvests located in sensitive watersheds were constrained so that no more than 25 percent of the acres could be less than 40 years old at any point in time.

DNRC currently identified 225 sensitive parcels within classified forest trust lands in the HCP project area that encompass about 109,155 acres or approximately 19.9 percent of HCP project area acres (Final EIS/HCP 2010, Chapter 4, Table 4.8-13). The Stillwater core area has more sensitive parcels (71 parcels) than any other core, and nearly 36 percent of all the sensitive parcel area in the HCP project area. Four other core areas (Bitterroot, Blackfoot, North Fork Flathead, and Swan) each contain between 10 and 15 percent of the acres of HCP project area sensitive parcels, totaling about 52 percent of the total sensitive parcel area. The other nine units each contain less than 5 percent of the sensitive parcels, totaling about 13 percent of the sensitive parcel acres in the HCP project area.

Of the estimated 109,155 acres of sensitive parcels in the HCP project area, about 107,617 acres (99 percent) occur in basins occupied by WCT and 101,510 acres (93 percent) by bull trout (Final EIS/HCP 2010, Chapter 4, Table 4.8-13). There is limited distribution of RBT in the project area having 2,145 acres (2 percent) of the sensitive parcels in basins occupied by RBT (Middle and Upper Kootenai core areas). The Stillwater core area contains about 38 and 36 percent of the total sensitive parcel acres occupied by bull trout and WCT, respectively.

There is a total of about 1,578 miles of streams in the HCP project area (Final EIS/HCP 2010, Appendix E, Table E4-4) and about 374 (24 percent) of these stream miles occur within sensitive parcels (Final EIS/HCP 2010, Chapter 4, Table 4.8-14). This is similar to the proportion of sensitive parcel area (20 percent) within the HCP project area (Final EIS/HCP 2010, Chapter 4, Table 4.8-13). About 33 percent (123 miles) of the sensitive area stream miles occur in the Stillwater core area. An additional 55 percent of the sensitive parcel stream miles occur in four other core areas (Bitterroot, Blackfoot, North Fork Flathead, and Swan), each containing between about 42 and 67 stream miles.

Although a total of about 451 miles (29 percent) of HCP project area stream habitat supports at least one HCP fish species (Final EIS/HCP 2010, Appendix E, Table E4-4), about 36 percent (162 miles) of this HCP fish habitat occurs in sensitive parcels (Final EIS/HCP 2010, Chapter 4,

Table 4.8-14). While WCT occur in nearly all of these sensitive area stream miles (162.3 miles), bull trout occur in about 88 percent of these areas (143.6 miles). However, only 1.2 miles of known RBT habitat occur in the sensitive area parcels in the HCP project area. About 33 percent (123 miles) of the sensitive area stream miles occur in the Stillwater core area. An additional 55 percent of the sensitive parcel stream miles occur in four other core areas (Bitterroot, Blackfoot, North Fork Flathead, and Swan), each containing between about 42 and 67 stream miles.

Summary of Effects on Cumulative Watershed Effects

DNRC identified sensitive watersheds containing CWE concerns, which were primarily related to the potential for increased water yields and increased magnitude and duration of peak flows. This coarse-filter process primarily relied on the knowledge of DNRC forest management program hydrologists and existing TMDL data and/or CWE data/analyses. The sensitive parcel analysis identified those watersheds where HCP species may be at-risk due to CWE concerns based on past and ongoing activities as well as anticipated actions likely to occur within watersheds that are managed for timber production.

The Stillwater core area has more sensitive parcels (71 parcels) than any other units, and nearly 36 percent of all the sensitive parcel area in the HCP project area. The Stillwater core area contains about 38 and 36 percent of the total sensitive parcel acres occupied by bull trout and WCT, respectively. Four other core areas (Bitterroot, Blackfoot, North Fork Flathead, and Swan) each contain between 10 and 15 percent of the acres of HCP project area sensitive parcels, totaling about 52 percent of the total sensitive parcel area. The other nine units each contain less than 5 percent of the sensitive parcels, totaling about 13 percent of the sensitive parcel acres in the HCP project area.

With 275 miles of stream within the HCP project area, and about 105 of these stream miles supporting bull trout and WCT, the Stillwater core area is notable. The next highest core area supporting both of these species within the HCP project area is the Middle Clark Fork core area with 75 stream miles, followed by the Swan at 66 miles. The North Fork Flathead, Bitterroot, Blackfoot, and Upper Clark Fork core areas range from 44 to 26 stream miles.

The DNRC HCP CWE strategy is expected to take into account the existing baseline conditions and potential CWE by means of a process that is sensitive to the anticipated impacts to watershed functions from a project proposal. In turn, this process would make the necessary modifications to preclude adverse CWE from occurring. This process would be done on all parcels classified as sensitive. Consequently, the DNRC HCP should maintain or improve baseline conditions in sensitive watersheds and not adversely affect the functions (e.g., water yield, flow regimes, channel stability) that support and/or maintain habitat conditions for HCP fish species.

Conclusion on Effects on Cumulative Watershed Effects

CWE are important to the protection of HCP fish populations and represent the collective aquatic impacts specifically affecting a wide range of watershed processes. Such processes include water yield, flow regimes, channel stability, and in-stream and upland sedimentation due to surface erosion and mass wasting. CWE also refers to existing watershed conditions, relative to additional risks associated with land use management activities on specific in-stream habitat elements, including temperature, sedimentation, and habitat complexity. One can easily surmise

that CWE are exceedingly difficult to measure because the forest management actions affecting watershed resources occur across multiple land ownerships, are temporally and spatially complex, and are typically problematic to accurately inventory and evaluate.

The concept of CWE has been part of DNRC's management philosophy of forested trust lands since the early 1980s. DNRC conducts CWE assessments as part of its current forest management program and under the HCP would continue to do so. Based on the relevant baseline conditions and CWE assessments, DNRC would design projects with the necessary measures to conserve and protect HCP fish species habitat, as they have done historically. Furthermore, DNRC will monitor implementation and periodically determine the effectiveness of the CWE strategy with the USFWS's input.

DNRC evaluated and considered the potential impacts of the HCP CWE strategy on HCP fish species (Final EIS/HCP 2010, appendix A, Chapter 7). DNRC's assessment indicated that the incremental effect of the HCP on covered species would likely be positive and not cause or contribute to negative "cumulative effects" in watersheds occupied by HCP fish species. The USFWS concurs with this determination which was based on the EIS analysis and discussion above.

Effects of the Action On Designated Bull Trout Critical Habitat

The effects of some management activities under the HCP have the potential to result in habitat degradation to some degree. The jeopardy analysis conducted under section 7 of the Act that is conducted as a standard evaluation of the effects of the proposed action (i.e., HCP) on the species, includes an assessment of how the conservation or functionality of habitat for bull trout is also affected by the action. With the addition of designated critical habitat, the analysis is comparable, though conducted using a slightly different approach. As such, the USFWS does not anticipate that the outcome to address critical habitat will result in any significant additional project minimization or mitigation requirements. This assertion aligns with the October 18, 2010, Final Rule (FR 75, No. 200, Pg 63898 – 64070) that states the conservation role of bull trout critical habitat is to support viable core area populations, and therefore we (the USFWS) do not anticipate many circumstances that the "outcome of the consultation to address critical habitat will result in any significant additional project modifications or measures."

Critical habitat is defined in section 3 of the Act "as the specific areas within the geographical area occupied by the species, at the time it is listed in accordance with the Act, on which are found those physical and biological features essential to the conservation of the species and that may require special management considerations or protection; and specific areas outside the geographical area occupied by a species at the time it is listed, upon a determination that such areas are essential for the conservation of the species." To be included in a critical habitat designation, "the habitat within the area occupied by the species must first have features that are essential to the conservation of the species. Critical habitat designations identify, to the extent known using the best scientific and commercial data available, habitat areas that provide essential life cycle needs of the species - areas on which are found the PCEs (as defined at 50 CFR 424.12 (b)." PCEs are those habitat components that are essential for the primary biological needs of foraging, reproducing, rearing of young, dispersal, genetic exchange, or sheltering.

As previously mentioned in Section B, designated bull trout critical habitat was recently revised and a final rule was published on October 18, 2010 (FR 75, No 200, 63898-64070). The PCEs in the 2010 final rule (FR 75, No 200, 63898-64070) represent our best current understanding of habitat requirements for bull trout and that contains physical or biological features essential to bull trout conservation. The PCEs are described in Section B.

Note that the analysis of the potential effects to bull trout as a species and their associated habitat can be used to determine the effects to the PCEs for bull trout designated critical habitat by using a companion analysis of related habitat indicators. This Crosswalk shows that the matrix analysis for environmental baseline conditions thoroughly addresses the PCEs for baseline conditions of designated critical habitat for bull trout (Appendix C).

Effects to Primary Constituents Elements (PCEs) by Core Area

Critical habitat in the HCP project area is primarily concentrated in three core areas - Stillwater, Swan, and North Fork Flathead. The total amount of stream miles of critical habitat in these core areas is shown in Table IV-8. The proportion of stream miles that are critical habitat in the HCP project area for each of these core areas is 61.6 percent, 11.2 percent, and 7.6 percent respectively, for the Stillwater, Swan, and North Fork Flathead. These are the core areas where the DNRC HCP would have the most influence on critical habitat and the PCEs that support it. On average the remaining core areas contain less than 1 percent (~0.7 percent) critical habitat in the HCP project area.

Table IV-9 above displays the dominant impacts to the 9 PCEs in each of the bull trout core areas. Noteworthy, is that PCE 9 is at most risk across all the core areas. In the Bitterroot core area, PCE 2, 5, 6, and 7, which are habitat-related PCEs, are also at high risk of impacts; however, only about 1 stream mile in total of critical habitat for this core area occurs within the HCP project area. All the PCEs in the Upper and Middle Clark Fork core areas are subject to high risk of impacts under existing conditions. Again, a total of a little over 1 mile of critical habitat combined occurs in these core areas within the HCP project area. With the exception of the North Fork Flathead, Stillwater, and Swan core areas the PCEs at-risk in the remainder of the core areas is associated with a very small amount of critical habitat. Therefore, this evaluation of affected PCEs will focus on the 3 core areas where the majority of critical habitat occurs within the HCP project area.

<u>Stillwater Core Area</u>
There is a high amount of HCP project area in this core area that is bull trout critical habitat in the Stillwater State Forest (35.4 miles, or nearly 40 percent of the total for the project). Therefore, forest management activities implemented under the DNRC HCP could have a high likelihood of influencing, both positively and negatively, the PCEs associated with this habitat.

The Stillwater core area occurs in a high precipitation zone where highest sediment production values are likely to occur from forest roads. The Stillwater core area has 382 miles of existing forest road within the HCP project area, almost 91 miles of which is within 300 feet of a stream, and of the 91 miles nearly 44 miles is within 300 feet of a bull trout stream (Final EIS/HCP 2010, Chapter 4, Table 4.8-7). An additional 34 new road miles and 11 new stream crossings are

expected during the Permit period (Table IV-13). The net increase in road segments within 300 feet of streams for the Stillwater core area is 1.2 miles (Final EIS/HCP 2010, Chapter 4, Table 4.8-20). The sediment production analysis conducted in support of the EIS (Final EIS/HCP 2010, Chapter 4, Table 4.8-19) calculated a total potential sediment production value of 370 tons/year without BMPs; however, when applying BMPs the expected value decreases to 84 tons/year by the end of the Permit period – a 77 percent reduction.

Because the Stillwater core area occurs in a high precipitation zone, the risk of sediment delivery from DNRC HCP forest management actions, such as road construction and maintenance, to a HCP fish species stream is elevated and the likelihood of some unpredictable amount of sediment entering a stream increases. The function of PCE 6 could be adversely affected from sediment input during a high precipitation event, which in turn could negatively affect the quality and quantity of spawning and rearing habitat. However, the threat of sediment actually reaching a stream from new roads constructed close to a stream is diminished somewhat because of BMPs (and other sediment abatement measures as needed) that would be applied as required under the HCP. Additionally, only 1.2 miles of new road within 300 feet of stream is expected to be constructed. Habitat conditions in this core area are somewhat stable. Nevertheless, there is a possibility that during the Permit period sediment input could occur to a HCP fish stream. As a result, PCE 6 could decrease in function, most likely a temporary affect, but the actual effects to spawning and rearing habitat would be difficult to precisely determine.

Roads exist throughout the upper Stillwater River and Whitefish drainages. There are legacy concerns associated with past land management (i.e., forestry) practices and roads, on State, National Forest, and private lands. Several major runoff events have occurred in recent years that resulted in BMP applications to most of the road system such that some of the legacy issues have been stabilized. Precipitation patterns (perhaps related to changing climate) appear increasingly conducive to higher frequency of rain-on-snow conditions. The natural hydrograph (e.g., peak flows, base flows) (PCEs 7 and 8) may have been further altered due to changing runoff patterns influenced by aggressive past timber harvest in these watersheds, particularly on private lands. The DNRC HCP would address legacy issues on the HCP project area where PCE 7 and 8 have been negatively impacted. This would likely occur through the cumulative effects process or through a DNRC project proposal designed specifically to protect water quality, such as a TMDL.

The DNRC HCP is expected to conserve and protect baseline conditions of riparian habitat by implementing the HCP RMZ buffer widths and associated tree retention requirements. HCP riparian prescriptions will provide for adequate levels of shade for appropriate stream temperature regimes for bull trout (PCE 5) and for adequate levels of LWD (PCE 4) and LWD recruitment rates over the Permit period. Where adequate stream temperatures and LWD levels exist in the HCP project area, the DNRC HCP is not anticipated to have a measurable affect on PCEs 4 and 5, and where baseline conditions in riparian areas are degraded due to past timber practices, the HCP is expected to improve PCEs 4 and 5.

DNRC's Fish Passage Assessment Project inventory found 106 known culvert barriers to fish passage that occur on streams supporting HCP fish species on the HCP project area. The highest number of these barriers (49) occurs in the Stillwater core area and blocks access to 41 miles of

upstream habitat for WCT because these barriers occur as priority 3 types (all but one - a priority 4) that support WCT [no priority 1 types (bull trout) barriers were observed]. Consequently, PCE 2 is not affected by these barriers because presently none exist on bull trout streams on HCP project lands in this core area.

On average, the Stillwater watershed, a high precipitation zone, had the highest sediment volume per site at 132.80 cubic yards/site (see Table IV-17) when considering the sediment delivery potential resulting from a catastrophic culvert failure during an infrequent, high intensity flood event (Final EIS/HCP, Chapter 4, 2010). The analysis indicated that this volume per site could occur at 30 sites in the Lower Swift Creek drainage (a bull trout stream and designated critical habitat) for a total volume of 3,984 cubic yards. If a culvert barrier fails during a storm event, PCE 6 would immediately be functioning at-risk for as long as until the site is fixed and erosion potential alleviated.

This core area will benefit HCP fish species greatly from the DNRC HCP due to the commitments to remove legacy culvert barriers which would allow access by WCT to over 40 additional stream miles of habitat, some of which may be available to bull trout in the future. The USFWS has determined that DNRC's fish connectivity strategy would likely minimize the potential for adverse impacts of HCP fish species at stream crossings; however, there will remain a low risk that incidental take could occur due to lack of fish passage (fully or partially) of some life stage of an HCP fish species at new or existing stream crossings during the term of the Permit. Until the legacy fish passage barriers are fixed, WCT, and possibly bull trout, could be adversely affected, and therefore, a risk (albeit low risk) that incidental take could occur because of the lag time to correct the problem at existing fish passage barriers. It would take some time to fix all the fish passage barriers (up to 30 years for WCT and RBT affected sites) and in the interim there would be a risk of incidental take. In addition, when considering discovery of a new fish passage barrier problem, there is likely to be a lag time between its discovery and correcting the problem in which incidental take to HCP fish species could occur.

Most of the spawning and rearing habitat for bull trout in the Stillwater core area is located in the Stillwater State Forest. The entire spawning and rearing (i.e., local population) of bull trout is distributed in one or two headwater tributaries, although some rearing likely occurs in three to four other lower reaches of other headwater tributaries. The bull trout population has been restricted to the headwaters of this system as a result of habitat degradation lower in the system off the Stillwater State Forest where stream temperatures are extremely warm in the summer months and lake environments harbor abundant predators like northern pike and lake trout. This population use to have an adfluvial life history component which is now restricted to a fluvial existence. The risk of impacts to PCE 2 (i.e., connectivity) in this core area would likely be limited to those cases on bull trout streams where impacts occurred due to an ineffective crossing structure after installation and prior to monitoring; or during the period between monitoring events, or during the period between the discovery of an ineffective installation and the first opportunity to correct the deficiency.

In summary, it is clear that the main concern in this core area is PCE 9 being non-native species and the negative affects to native fish (i.e., HCP fish species). Lake trout have invaded the Upper Stillwater Lake and have been becoming increasingly evident over the past 15 years.

Combined with the already high density of northern pike, former foraging and migratory habitat for bull trout in Upper Stillwater Lake and portions of the Stillwater River has been severely compromised. Bull trout are increasingly isolated in the headwaters of this core area and, while they appear to be thriving there based on recent redd counts and juvenile abundance surveys, the life history form that was formerly predominantly adfluvial has been increasingly relegated to fluvial/resident form. Relatedly, a century of degradation of the 55 miles of the valley portion of the Stillwater River, downstream of Upper Stillwater Lake to its eventual junction with the Flathead River, some 22 miles upstream from Flathead Lake, render it mostly unsuitable for bull trout and it is increasingly unlikely that migration of bull trout from the Flathead ever occurs in the Stillwater. As such, likelihood of persistence of bull trout in the headwaters of the Stillwater core area is compromised.

North Fork Flathead Core Area

The North Fork Flathead core area has about 205 stream miles of critical habitat and of this total, 15.7 stream miles, or 7.6 percent, occurs within the HCP project area. Forest management activities implemented under the DNRC HCP could have a high likelihood of influencing, both positively and negatively, the PCEs associated with this habitat. However, it is apparent that PCE 9 is the single greatest limiting factor to support bull trout in this core area. Other PCEs that are habitat related such as PCE 4, 5, 6, 7 and 8 and which are influenced by forest management activities appear to be improving but probably function at a slightly lower level than optimum for bull trout in some local populations in this core area. Under the DNRC HCP the improving trend in these habitat-based PCEs (PCE 4, 5, 6, 7 and 8) would continue throughout the permit period. Therefore, negative impacts to the function of PCEs caused by the implementation of the DNRC HCP are not anticipated.

DNRC's Fish Passage Assessment Project inventory (DNRC 2006c) found 8 known culvert barriers (priority 3) to fish passage that occur on streams supporting WCT species on the HCP project area. In total these barriers block access to 8.5 miles of upstream habitat for WCT. No priority 1 type barriers, which would occur on bull trout streams, were found. Consequently, PCE 2 is not affected by these barriers because presently none exist on bull trout streams on HCP project lands in this core area.

The risk of impacts to PCE 2 (i.e., connectivity) in this core area would likely be limited to those cases on bull trout streams where impacts occurred due to an ineffective crossing structure after installation and prior to monitoring, or during the period between monitoring events, or during the period between the discovery of an ineffective installation and the first opportunity to correct the deficiency. The USFWS has determined that DNRC's fish connectivity strategy would likely minimize the potential for adverse impacts of HCP fish species at stream crossings; however, there will remain a risk that incidental take could occur due to lack of fish passage (fully or partially) of some life stage of an HCP fish species at new or existing stream crossings during the term of the Permit. Until the legacy fish passage barriers are fixed, WCT, and possibly bull trout, could be adversely affected.

The magnitude of the lake trout threat has increased in the Flathead River system since the early 1990's and some local populations of bull trout, particularly in the North Fork Flathead, are at precariously low levels. In the near term, some local populations of bull trout in this core area

should be able to sustain a continuation of limited short-term impacts from land management activities in the watershed, especially if the current trend of long-term habitat improvement results. However, due to the above-described threats from nonnative species invasion, there is ongoing uncertainty whether all local bull trout populations will remain viable in this core area. For the most part, the habitat remains capable of supporting a much larger bull trout population than currently exists. Intense predation and competition between lake trout, an introduced nonnative species, and bull trout in Flathead Lake is the highest ranking threat to bull trout in this core area and far exceeds other impacts. Thus PCE 9 functions at unacceptable levels for bull trout.

Swan Core Area

There is a relatively high amount of HCP project area that is bull trout critical habitat in the Swan River State Forest (16.4 miles, or nearly 18 percent of the total for the project) and of the total of 49.4 miles of critical habitat in this core area, nearly 23 miles (46 percent) (including the Swan State Forest) of this total occurring within the HCP project area.

The Swan core area is estimated to have a nearly 55 miles of existing roads within 300 feet of a stream in the HCP project area, and of this total about 24.4 miles is within a bull stream (Final EIS/HCP 2010, Chapter 4, Tables 4.8-7 and 4.8-20). An increase of 8.6 miles of new road within 300 feet of a stream is expected during the Permit term and an additional 42 culverts (Final EIS/HCP 2010, Chapter 4, Table 4.8-20). The Swan core area is anticipated to have a total potential of 288 tons/year of sediment production, but with BMPs this amount will be reduced to 63 tons/year, or a 78 percent reduction (Final EIS/HCP 2010, Chapter 4, Table 4.8-19). Because this core area occurs in a high precipitation zone, the risk of sediment delivery to a HCP fish species stream is elevated and the risk of some loss in function of PCE 6 is also increased. However, this risk would likely be temporary and localized to the affected reach because effects of sediment input from new forest roads are typically dissipated after 2 years of construction due to revegetation of denuded areas and stabilizing of road fill (Furniss et al. 1991).

Habitat conditions in this core area are somewhat stable with the main concern being non-native species and the negative affects to native fish (i.e., HCP fish species). There is a possibility that during the Permit period sediment input could occur, but the actual effects to spawning and rearing habitat would be difficult to precisely determine, but likely to be temporary and localized.

Forest management practices on public and private lands in the Swan River drainage has been a historical and ongoing concern. Strong emphasis has been placed on protection of habitat in important spawning and rearing streams on both public and private lands. Through recent conservation planning and agreements on private lands to protect riparian areas related to timber harvest, expanded protection along bull trout streams in this core area is occurring. The large amount and wide distribution of groundwater-fed spawning and rearing streams in the Swan River drainage is considered relatively unique and apparently has contributed to the relatively robust status of bull trout in this core area to date, despite intensive forestry management activities especially on private lands.

DNRC's Fish Passage Assessment Project inventory found 8 known culvert barriers (priority 3) to fish passage that occur in this core area on streams supporting WCT species on the HCP project area. In total these barriers block access to 7.3 miles of upstream habitat for WCT. No priority 1 type barriers, which would occur on bull trout streams, were found. Consequently, PCE 2 is not affected by these barriers because presently none exist on bull trout streams on HCP project lands in this core area.

The risk of impacts to PCE 2 (i.e., connectivity) in this core area would likely be limited to those cases on bull trout streams where impacts occurred due to an ineffective crossing structure after installation and prior to monitoring, or during the period between monitoring events, or during the period between the discovery of an ineffective installation and the first opportunity to correct the deficiency. The USFWS has determined that DNRC's fish connectivity strategy would likely minimize the potential for adverse impacts of HCP fish species at stream crossings; however, there will remain a risk that incidental take could occur due to lack of fish passage (fully or partially) of some life stage of an HCP fish species at new or existing stream crossings during the term of the Permit. Until the legacy fish passage barriers are fixed, WCT, and possibly bull trout, could be adversely affected.

PCE 9 has functioned at relatively low levels in this core area for some time due to the widespread abundance of brook trout. That circumstance is now exacerbated due to the recent lake trout expansion in this core area and is far and way the greatest threat to bull trout persistence at this time. Unless a successful suppression effort is sustained on lake trout there is considerable uncertainty whether bull trout will remain relatively robust in the Swan core area in the near term and whether the population will even persist in the future. PCEs 6, 7, and 8 are likely also functioning below optimum levels, mostly due to legacy roads and other past forest management practices. However, current declines in bull trout populations are largely being influenced by the ecological changes in Swan Lake and not local habitat conditions. Furthermore, the DNRC HCP will address legacy issues within the HCP project area and continue to protect riparian areas through the RMZ prescriptions, BMPs, and other state-of-the-art forest management practices that provide for more conservation on the ground.

Summary of Conservation Role of Affected PCEs

The analytical framework described in the Director's Memorandum (USDI 2004) is used to complete section 7(a)(2) analysis for Federal actions affecting bull trout critical habitat (Appendix B). The key factor related to the adverse modification determination is whether, with implementation of the proposed Federal action, the affected critical habitat would continue to serve its intended conservation role for the species, or retain those PCEs that relate to the ability of the area to periodically support the species. Activities that may destroy or adversely modify critical habitat are those that alter the PCEs to an extent that appreciably reduces the conservation value of critical habitat for bull trout. As discussed earlier in this BO (Part IV), the role of critical habitat is to support the life history needs of the species and provide for its conservation. Generally, the conservation role of bull trout critical habitat units is to support viable core area populations.

The adverse modification analysis focuses on the rangewide status of critical habitat, the factors responsible for that condition, and what is necessary for critical habitat to provide the necessary conservation value to the bull trout. An emphasis is placed on characterizing the functional condition of critical habitat PCEs in the area affected by the proposed Federal action. This analysis then addresses how the critical habitat PCEs will be affected, and in turn, how this will influence the conservation role of critical habitat units in support of viable core area populations. That context is then used to determine the significance of adverse and beneficial effects of the proposed Federal action and any cumulative effects for purposes of making the adverse modification determination at the rangewide scale.

For most proposed Federal actions, the jeopardy analysis under section 7 of the Act most likely evaluates the effects of the action on the conservation or functionality of the habitat for the bull trout. Because of this, the USFWS has taken a viewpoint that in many cases the analysis of the proposed project to address designated critical habitat will be comparable. As such, the USFWS does not anticipate, for many circumstances, that the outcome of the consultation to address critical habitat will result in any significant additional project modifications or measures (FR 75, No 200, 63898-64070).

Considering the jeopardy analysis in this part of the BO (Part IV) for the DNRC HCP, the USFWS has examined all the important habitat parameters for bull trout that could be adversely affected by implementation of the proposed DNRC HCP. Those habitat parameters that are likely to be at-risk of adverse effects at sometime during the Permit period are sedimentation (from forest roads within 300 feet of HCP fish species streams and associated stream crossings) and connectivity (fish barriers blocking upstream passage). The PCEs corresponding to these habitat parameters are PCE 6 and PCE 2, respectively.

In the Stillwater, the risk of adverse effects to PCE 6 (sedimentation) is greater than all other core areas, including the North Fork and Swan. This is due to the 44 miles of existing road within 300 feet of a bull trout stream (Final EIS/HCP 2010, Chapter 4, Table 4.8-7), the additional 34 miles of new road construction (although only 1.2 miles would be built within 300 feet of stream), eleven new stream crossings expected during the Permit period, and the location of this core area in a high precipitation zone. All these factors suggest that the function of PCE 6 could be diminished, at least temporarily, which in turn could negatively affect the quality and quantity of spawning and rearing habitat of the affected localized area for the relatively short time period (~2 years) during which sediment levels are returning to baseline conditions. Nevertheless, the conservation role of the other 8 PCEs in this core area would remain functional at or near baseline conditions and PCE 6 would be functional but at a diminished level. PCE 2 could be adversely affected as well as described above; however, the conservation role of this PCE would only be affected temporarily, if at all, and then is likely to improve at least in some legacy situations.

PCE 6 and PCE 2 in the North Fork Flathead and Swan core areas could be adversely affected as indicated above, but the risk is lower than in the Stillwater because of the reduced risk of sediment delivery due to fewer miles of roads next to streams and lower number of stream crossings. The adverse affects, should they occur, would only diminish the function of these two PCEs a small amount, would be temporary (not lasting more than 2 years, and likely less than 1

year), and localized to the affected reach. It is expected the functionality of the PCEs would be restored to pre-disturbance levels within two years as baseline conditions are re-established. The conservation role of the affected PCEs in these bull trout core areas would be expected to continue, but may be slightly diminished during the period of sediment delivery or culvert failure.

In summary, if implementation of the DNRC HCP would alter the physical or biological features of critical habitat to an extent that appreciably reduces the conservation role of a core area population of bull trout a finding of adverse modification of the entire designated critical habitat for the proposed action may be warranted. The USFWS has determined that none of the nine PCEs of designated critical habitat for bull trout would be adversely affected by implementation of the DNRC HCP to the extent that it would appreciably reduce the conservation value of a core area for bull trout. Therefore, the conservation role that critical habitat provides for bull trout in a core area will not be negatively affected to any great degree (only temporary and a small amount), and therefore the recovery function that is supported by the critical habitat in each core area will continue to be maintained, and likely improved in some cases such as where a PCE has been enhanced or restored (e.g., fish barrier removed). Consequently, because the conservation role would not be appreciably reduced for any core area it is reasonable to assume the recovery function of a core area, and associated Subunits and Basin Units (Clark Fork River and Kootenai River basin units), and ultimately the coterminous United States, would not be precluded by implementation of the DNRC HCP.

Effects of HCP Implementation on Land Disposition and Acquisition

The HCP includes conservation measures within the Transition Lands Strategy (Final EIS/HCP 2010, Appendix A (HCP), Chapter 3) for the addition and removal of lands from the HCP project area. The effects of this strategy are described below.

Effects of Removal of Lands

The HCP allows DNRC to remove lands from the HCP project area. The removal of lands within bull trout core habitat areas (as defined in MBTRT 2000) is capped at 5 percent (5 percent of the baseline HCP project area, meaning no more than 10,880 acres could be removed from LMAs, grizzly recovery zone, or bull trout core areas). The removal of lands within the remainder of the HCP project area is capped at 10 or 15 percent over the permit term. The cap is 10 percent of the original baseline acres unless and until DNRC acquires large amounts of former industrial timber lands (e.g., through the Montana Working Forests Project) and adds at least 15,000 acres to the HCP project area. At that time, the cap will increase to 15 percent of the original baseline. The 10 percent cap will allow removal of 33,090 acres from 330,900 acres, and the 15 percent cap will allow removal of 49,640 acres from 330,900 acres in the HCP project area. The strategy also requires DNRC to notify conservation entities of the sale of HCP lands and allows those entities time to purchase or apply conservation agreements for the subject lands as well as the option for DNRC to apply deed restrictions.

Prior to the removal of lands from the HCP, DNRC would assess the status of its HCP commitments relative to sediment delivery and culvert barriers to ensure that mitigation needed to meet the terms of the Permit is completed prior disposal of lands.

DNRC HCP disposed lands may be subject to subsequent development or management that no longer provides equal conservation value to HCP fish species. Lands removed from the HCP and subject to development or management that does not provide adequate riparian protection could adversely affect aquatic habitat for HCP fish species, including critical habitat for bull trout. Development or changes in land management can increase the risks to HCP fish species from sources of direct mortality, habitat loss, habitat fragmentation, and watershed disturbance. Connectivity of streams is important for resident, fluvial and adfluvial movements of HCP fish species in order to reach spawning and rearing areas. In turn, this would maintain genetic dispersion between local populations of HCP fish species, especially for ameliorating losses associated with catastrophic events such as floods, fires, and landslides, which can isolate and on occasion eliminate small, local populations of these native trout (Gresswell 1999; Rinne 1996; Rieman at al. 1997b; Reiman and Clayton 1997c; Novak and White 1990; Bisson et al. 2003). Residential and commercial development or intensive land management along streams occupied by HCP fish species may lead to impacts to the riparian vegetation community that influence stream channel-forming processes such as LWD recruitment which provides for pool formation. Extensive removal of streamside vegetation that provides shade over a stream could lead to increased stream temperatures. Loss of these types of riparian functions could lower the quality and quantity of spawning and rearing habitat for HCP species either directly or subtlety over time.

Removal of lands from the provisions of the HCP within core areas (including the Upper Missouri AAU) that contain significant Class 1 streams occupied by HCP fish species could potentially have negative impacts to HCP fish species and their habitats because these streams support known populations of bull trout, WCT, or RBT. In core areas (including the Upper Missouri AAU) where the disposal of HCP lands to another landowner that does not provide HCP-like conservation measures, some high priority habitats may be at-risk such as those lands having bull trout critical habitat or lands where a local bull trout population depends on a single spawning reach. However, we anticipate the likelihood and magnitude of this effect to be extremely low for several reasons.

First, bull trout core habitat (as defined in MBTRT 2000) would be subject to the more restrictive cap on removing lands (5 percent of the baseline HCP project area, meaning no more than 10,880 acres could be removed from bull trout core areas, LMAs, or grizzly bear recovery zone). Second, DNRC is less likely to sell its lands within its blocked ownership because these areas facilitate efficient management and increase opportunities for meaningful and effective landscape–scale conservation of fisheries habitat. Third, in determining the HCP project area, DNRC identified lands likely to be targeted for disposal and excluded those parcels from the HCP project area.

Fourth, through the process of removing lands from the HCP, DNRC is required to notify conservation buyers of proposed sales to provide opportunities for outright sale to a conservation entity or easement purchase. The USFWS also has the opportunity to request the attachment of

deed restrictions to a proposed sale, although, DNRC's decision to include deed restrictions is discretionary.

Fifth, lands identified for potential disposal undergo considerable evaluation and analysis as outlined in the Real Estate Management Rules and MEPA process, as described in the Final EIS/HCP 2010 (Section 4.9.5 Effects of the Transition Lands Strategy, 4.9.5.1 Affected Environment, page 4-381). Through the disposal process and in accordance with ARM 36.25.803, DNRC may sell a parcel of trust land that is determined significant to threatened or endangered species only if the Land Board provides or approves compelling reasons for the sale. These layers of review and consideration (Real Estate Rules, MEPA process, and Land Board approval) decrease the likelihood that Class 1 streams with bull trout core habitat or designated bull trout critical would be disposed or would be subject to major developments with substantial adverse effects on Federally-listed species. If disposals did occur on blocked lands, these disposals may have some adverse effects to bull trout through the removal or alteration of the riparian plant community that functions to support channel form and function for maintenance and/or development of bull trout spawning and rearing habitat. However, disposals will be restricted and therefore is not anticipated to be a great enough number of riparian acres located in sensitive enough habitat to affect the overall habitat integrity of affected bull trout core habitat. Thus, such disposals would be unlikely to significantly impair a bull trout's ability to feed, breed, or shelter. Disposal and ensuing development of blocked lands that could affect bull trout core habitat is unlikely to impede connectivity because of the state's existing regulatory requirements to provide for fish passage at stream crossings and the SMZ law that addresses riparian protection and road construction in riparian zones.

All 14 AAUs (13 bull trout core areas and the Upper Missouri AAU) are comprised of DNRC HCP lands that are mostly scattered parcels. Some AAUs have primarily smaller blocks of land and other AAUs have both small blocks and large contiguous blocks of land. Interspersed among DNRC HCP lands is a mosaic of Plum Creek, USFS, or BLM lands, and private ownership. We anticipate that scattered parcels are typically more likely to be targeted for disposal. We do not expect that the large blocks of state forest lands in the Stillwater, Swan, and North Fork Flathead bull trout core areas would be disposed and these 3 areas contain nearly 60 percent of the stream miles on HCP lands that are occupied by bull trout (101, 57, and 36 stream miles respectively). Smaller blocks and extensive scattered HCP lands occur in the Middle Clark Fork core area and Blackfoot core area with 52 and 23 stream miles respectively occupied by bull trout. In the Blackfoot core area and Swan core area we do not anticipate any disposal to private development because DNRC has already excluded developable parcels from the HCP.

Disposal of scattered lands in the Middle Clark Fork, Bitterroot, and Upper Clark Fork could occur in these core areas where bull trout occupy 52, 20, and 16 miles respectively in Class 1 streams. The likelihood of disposals in these core areas may be higher because of the large amount of scattered parcels and the increased development pressures in these areas. However, the precise impact of these disposals would depend on the location of the individual parcel or parcels and its importance to the affected stream segment for bull trout. Although unlikely, removal of a scattered parcel from the riparian provisions of the HCP could reduce the quality of bull trout spawning and rearing habitat to the point that it could affect an individual bull trout's ability to feed, breed, or shelter.

Summarizing, we expect the likelihood that disposed lands subject to major developments with potential adverse effects on the HCP fish species would be low. This is attributed to the cap on removal of lands, layers of review by DNRC (Real Estate Rules, MEPA process, Land Board approval), and notification of conservation entities prior to a land disposal (described in Part I. Introduction). Additionally, subsequent actions on disposed parcels would be subject to the Act and ideally, any landowner anticipating incidental take of HCP fish species would develop an HCP to minimize or mitigate the impacts of that take.

Effects of Adding Lands

When the state acquires forested trust lands with habitat for HCP fish species, DNRC may propose the addition of these lands to the HCP and Permit as described in Section 3.3 Addition of Lands to the HCP in the DNRC HCP, Chapter 3 (Final EIS/HCP 2010).

On occasion, DNRC completes a land exchange with an adjacent national forest. National forest lands are subject to robust federal guidelines on timber harvest and road construction (e.g., INFISH). Their removal from federal regulations and addition to the HCP may somewhat decrease LWD contributions and shade levels in certain circumstances. However, although the HCP commitments are not as conservative as INFISH, the HCP riparian timber harvest strategy is adequate to protect the most important riparian habitat features for native fish such that overall, the effects would not likely be discernable. Road densities on these lands would likely increase over time under the HCP resulting in the potential for adverse effects on HCP fish species. However, the DNRC HCP commitments for new road construction would reduce the potential for new roads to contribute sediment to HCP fish bearing streams and would reduce the annual rate (tons per year) of total road-generated sediment across the HCP project area.

Nevertheless, new road segments located within 300 feet of HCP fish streams and new stream crossings could potentially result in increased levels of sediment input in the HCP project area that could have adverse effects on fish. If DNRC acquires lands with sediment problem sites or culvert barriers, those sites would be inventoried and prioritized and added to the HCP timeline for corrective actions, resulting in a net reduction of sediment input and increase in available habitat for HCP fish species. Given that at this time, there is a limited amount of ongoing timber harvest on Federal lands, the potential for CWEs on HCP fish species may increase for these Federal lands acquired by DNRC and added to the HCP. However, the potential effects would be offset through the application of the DNRC CWE commitments.

Many recent and ongoing acquisitions by DNRC involve lands managed for commercial timber harvest under the Plum Creek HCP, which covers the same native fish species as the DNRC HCP. The effect on the HCP fish species of managing these industrial commercial lands under the DNRC HCP would be similar to that under the Plum Creek HCP and in some cases may result in a net benefit to the species. For lands where HCP minimization and mitigation measures have been applied by Plum Creek (corrective actions for sedimentation issues, culvert replacements, etc.) continued timber management by DNRC under their HCP would likely result in similar or improved benefits/effects on HCP fish species as under the Plum Creek HCP. Furthermore, before Plum Creek can dispose of their HCP lands, all required mitigation must be completed before the land transaction, or at minimum, an agreement put in place to obligate

Plum Creek's HCP mitigation commitment as soon as practicable. Overall, improvements for the HCP fish species would likely result from the transfer of lands to the DNRC HCP because DNRC would manage these lands under its sustainable yield mandate and provide conservation value for native fish for a longer period (50 years versus 30 years under the Plum Creek HCP) and with a lower overall road density (Final EIS/HCP 2010, Chapter 4).

Overall, for any lands added to the HCP project area and managed under the terms of the HCP, the effects would be similar to those disclosed in the EIS analysis (Final EIS/HCP, Chapter 4, 2010) and Part IV of this BO. While some adverse effects may occur, particularly related to sediment input from roads, we anticipate that the DNRC would maintain existing baseline conditions or improve habitat conditions for HCP fish species for any lands added over the permit term.

Lands being considered for addition to the HCP project area are also described in Part II Section D. Briefly, the availability of habitat for the HCP aquatic species on these lands includes 32.3 stream miles in the Lolo Land Exchange, of which 3.7 stream miles are likely fish-bearing; WCT streams on the Chamberlain Creek Acquisition, native fish-bearing streams, including WCT on the Potomac Acquisition, and one WCT stream on the scattered Parcels in the DNRC SWLO.

E. CUMULATIVE EFFECTS

Cumulative effects include the effects of future State, tribal, local or private actions reasonably certain to occur in the action area considered in this part of the BO (Part IV). Future Federal actions unrelated to the proposed action are not considered in this section because they require separate consultation pursuant to section 7 of the Act.

Cumulative Effects to the HCP Aquatic Species

The DNRC HCP project area comprises 1.4 percent of the action area. Most of the watersheds inhabited by HCP fish species in western Montana are comprised of federal lands administered by the USFS especially in the higher elevations. Large portions of some major watersheds with HCP fish species habitat occur on corporate timber lands, but also include small inclusions of other federal (BLM), state, and private lands.

Plum Creek Timber Company is a major land owner in western Montana, with about 900,000 acres of forested habitat, most of which occurs in watersheds within the Final EIS/HCP (2010) Planning Area containing bull trout or WCT or both species. The company participates in the Sustainable Forest Initiative program, which is a comprehensive system of principles, objectives, and performance measures developed by foresters, conservationists, and scientists which combines the growth and harvest of trees and protection of wildlife, plants, soils, and water quality (Sustainable Forestry Initiative 2010). Plum Creek lands in western Montana are also managed under its Native Fish HCP. Both of these programs moderate to an extent, the potential adverse impacts of forestry practices on riparian areas and risks to water quality. Noteworthy, is the recent purchase of Plum Creek HCP lands by The Nature Conservancy (TNC) of 320,000 acres between 2008 and 2010. Approximately 111,720 acres were subsequently transferred to the USFS and are now managed under Federal standards and practices. The remainder of the

acreage was transferred to various agencies of the State of Montana, or is still owned by TNC with the intention to be transferred to conservation or private organizations or the State of Montana.

Other smaller parcels of private lands in the action area are primarily used for residential areas, or may be used for small scale forestry, or will be developed for business uses in the future. Also, some corporate timber lands are being divided into smaller parcels and offered for sale to private landowners. For example, in the Swan core area, a bull trout stronghold, Plum Creek has sold some corporate timber land for (primarily) residential development.

In addition to timber management, activities on non-Federal lands may include mineral extraction, oil and gas exploration, urban and rural development, recreation site construction and use, road construction, and utility corridors. Residential development is anticipated to increase as more areas in the action area become populated. Both commercial and residential development on private lands often occur along stream corridors, which could lead to stream channel alterations exacerbating water temperature, nutrient, and bank stability problems. Private forest activities related to salvage harvest and associated road construction may increase in the future and could lead to potential woody debris contributions, increase sediment, and increase summer stream temperatures within the action area.

Inadvertent angler harvest and poaching have been identified as reasons for bull trout decline (USFWS 2002). It is likely that recreational fishing in the action area will increase as the general residential population of the area increases. As access to watersheds increase or improve, opportunities may also increase for poaching of large adfluvial bull trout, which are vulnerable in the fall when fish are easily observed holding in small pools or on spawning areas. Recreational fishing is known to occur in key areas and poaching of bull trout has occurred in numerous streams in the action area (Pratt and Houston 1993). Poaching is difficult to quantify, but generally increases in likelihood as the human population in the vicinity grows (Ross 1997). In addition, misidentification of bull trout has been a concern because of the similarity of appearance with brook trout, which occur in most streams throughout the action area. Although harvest of bull trout is illegal, incidental catch does occur and the fate of the released bull trout is unknown, but some level of hooking mortality is likely due to the associated stress and handling of the release (Long 1997).

The harvest of bull trout, either unintentionally or illegally, could have a direct effect on the affected local resident bull trout population in the action area and very possibly where the migratory adfluvial component of bull trout attempting to spawn in certain creeks of certain core areas in the fall. The extent of the effect would be dependent on the amount of increased recreational fishing pressure, which is a function of the increased number of fishermen utilizing the fish resources each season in each core area. Depending on the severity of the direct losses due to fishing pressure, local populations of bull trout are likely to withstand some impact; however, over time without further protection some populations may show some evidence of weakening when combined with other impacts on habitat conditions. This is especially disconcerting in the face of major threats from introduced species like lake trout.

With an increasing human population expected in the action area over the next 50 years, the risk of illegal introduction of non-native fish looms. Over 100 illegal fish introductions have been documented in northwest Montana during the past 20 years (MBTSG 1995d, USFWS 2002), and existing regulatory mechanisms failed to prevent these illegal fish introductions even though MFWP aggressively prosecutes anyone caught illegally transferring live fish or attempting to do so. Concerns of illegal introductions stem from the historic issues of northern pike that were established by illegal introduction in the 1970's in places like the Stillwater River drainage in the Flathead River subbasin (MBTSG 1995d), and the recent establishment of illegally introduced walleye in Noxon Reservoir in the Clark Fork River subbasin where monitoring indicates this population is continuing to grow (MBTSG 1996b). The magnitude and imminence of threats from nonnative species is elevated in the action area as it is the highest threat to bull trout in most areas, as well as to WCT in areas such as the Clearwater River system where the highly predacious northern pike was illegally introduced (MBTSG 1995c, USFWS 2002). Concerns continue today as more is learned about species like black crappie which have been illegally introduced into a number of interconnected Flathead lakes and appear to be established and spreading. Scattered reports of smallmouth bass have also occurred.

Lake trout have become a significant threat to the recovery of bull trout in major portions of the action, and efforts are underway to address this issue. In 1998, lake trout were first detected in Swan Lake (likely originating from either illegal stocking or accidental transport over Bigfork Dam some years earlier). By 2010, exponential growth of the population had led to circumstances where experimental suppression efforts were conducted to determine if the lake trout population can be dramatically reduced in the near term such that the threat may be moderated and not lead to irreversible declines in the bull trout population. But there remains considerable uncertainty about the efficacy and costs of a long-term lake trout suppression program. Compounding this is the recent discovery of lake trout in at least one of the upstream core areas (Lindbergh Lake). At the same time, there is abundant evidence that the lake trout population in the Flathead Lake is roughly 100 times larger than the adult bull trout population, as much as 395,000 catchable-sized fish by one recent mark-recapture estimate (B. Hansen, CSKT Fisheries, pers. comm. 2009). Intense predation and competition between lake trout and bull trout in Flathead Lake remains the highest ranking threat in this core area (MBTSG 1995d, USFWS 2002). In general, non-native fish species that have become established in the action area such as lake trout, northern pike, and largemouth bass are expected to remain a major concern for several years.

There are efforts underway to address existing fish passage problems through the range of bull trout and WCT. For example, PPL Montana, a private utility recently completed construction of a fish ladder in late 2010 (GEI 2007c) to allow bull trout to pass upstream of the Thompson Falls Dam on the lower Clark Fork River which has blocked fish movement since 1913. This is the largest operational fish passage ladder in the State of Montana. Similarly, Avista Utilities is currently developing upstream fish passage design options for permanent volitional fish passage at Cabinet Gorge and Noxon Rapids dams in the same area. In the interim the trap and transport program will continue to move adult bull trout upstream of the dams and juvenile bull trout downstream to Lake Pend Oreille, providing a modicum of functional connectivity. Restoring

connectivity in the Lower Clark Fork River system by providing timely fish passage at these dams is a major objective to aid the recovery of bull trout and other native salmonids.

Extensive bull trout restoration activities are presently occurring in the Jocko River watershed (CSKT 2000), and prospects for continued habitat conservation activities in this watershed are excellent. Additionally, CSKT has placed strong emphasis on protection of habitat in important spawning and rearing streams on Tribal lands. The CSKT have initiated a well-funded and prioritized recovery effort (CSKT 2000).

In recent years many habitat improvement and restoration efforts in the important bull trout, WCT, and RBT streams and rivers have occurred in the action area. For example, surveys of the West Fork Thompson River and Fishtrap Creek drainages have been conducted under the Plum Creek Native Fish HCP program. Habitat protection and improvements to important bull trout, WCT, and RBT spawning and rearing reaches are being evaluated on a case-by-case basis under this program. An extensive survey by Avista fish biologists of the Prospect Creek drainage in 2003 led to a determination that bull trout habitat and use of this drainage was more extensive than previously known (Moran 2004a) and consequently more focused habitat needs have been and will continue to be addressed in this drainage. A TMDL has been instituted on Prospect Creek, which should result in long-term benefits of sediment reduction in this drainage. The Avista studies have also collected extensive habitat information as part of an overall evaluation of many portions of the Bull River, Rock Creek, and other watersheds. Furthermore, MFWP has implemented and sponsored numerous and varied efforts annually to restore bull trout, WCT, and RBT populations (Dickson, T., Montana Redband Trout, May-June 2011 issue, Montana Outdoors) and their habitats. These types of projects are expected to continue subject to available state funds annually and other sources of funds such as Federal and state grants.

Cumulative Effects to Designated Bull Trout Critical Habitat

Private forestry practices and some private mining activities that occur on private lands in the action area currently are expected to continue in the foreseeable future and may degrade some designated critical habitat for bull trout. Other risks to critical habitat include environmental instability from landslides and rain on snow events, illegal harvest, thermal barriers, rural and residential development, and presence of non-native fish in the action area.

Residential development in the action area is growing at a steady pace in most of the core areas with few exceptions. Development along stream and river corridors is highly sought after by developers and, if development occurs along stream corridors that contain critical habitat for bull trout, this could lead to stream channel alterations that exacerbate water temperature increases, nutrient inputs, and bank stability problems. Private and corporate salvage harvest and associated road construction could reduce potential woody debris contributions, increase sediment, and increase summer stream temperatures.

The function of the PCEs that support critical habitat for bull trout are expected to be as similarly impacted as the habitat and population parameters mentioned in the above section under cumulative effects. For example, where fish ladders are provided over hydropower dams the function of PCE 2 would be improved. Habitat restoration projects that stabilize streambanks

would likely improve the function of PCEs 4, 5, and 6. Lake trout suppression efforts would enhance the function of PCE 9 as well as more liberal harvest of non-native species under new angling regulations.

The DNRC HCP is designed to protect native fish habitat, including designated critical habitat, relative to forest management and associated actions on state school trust lands located in the action area. These efforts should positively affect (either directly or indirectly) the habitat values associated with all the habitat-related PCEs (PCEs 1 thru 8) of designated bull trout critical habitat.

F. CONCLUSION

As discussed earlier in Section A the approach to jeopardy analysis for bull trout in relation to the proposed action follows a hierarchal relationship between units of analysis (i.e., geographical subdivisions) that characterize effects at the lowest level or smallest scale (local population) toward the highest level or largest scale (Columbia River Interim Recovery Unit) of unit of analysis. However, because of the programmatic approach and scale of the proposed action (i.e., the extensive landscape covered by the HCP project area), we analyzed potential effects to bull trout beginning at the core area population unit level and not the lowest scale of the local population. Our determination is that adverse effects of the proposed action do not rise to the level where it appreciably reduces both survival and recovery of the species at a core area population level, and by extension, the proposed action does not jeopardize bull trout in the coterminous United States (i.e., range-wide).

The USFWS has determined that during the Permit period of the DNRC HCP, considering the extensive area and many watersheds covered by the plan, some adverse affects to the HCP fish species is likely to occur. For example, the adverse effects of sediment entering a stream may result in harm to the species habitat, and/or possibly individual fish being killed, injured, or harassed. The actual severity of an adverse impact under the DNRC HCP is extremely difficult to quantify–because the point at which relatively subtle aquatic effects such as increased sediment levels actually result in death, injury, or harassment of individual fish is unknown, and because the extent to which such events, even when they occur, can be attributed to obvious habitat modifications is also difficult to determine.

Consequently, the USFWS concluded that an unquantified, but limited, amount of incidental take of the HCP's covered fish species would likely occur at some point during the Permit period of the DNRC HCP (see below). To make the determination that the proposed action will not jeopardize the continued existence of listed or proposed species, or adversely modify or destroy designated critical habitat, the USFWS must consider the status of the species under the environmental baseline, and any associated direct, indirect or cumulative effects. A similar approach has been taken for unlisted species. When we considered these status conditions and project effects individually for each HCP fish species' (i.e., current status, the existing environmental baseline, and the direct, indirect, and cumulative expected effects) relative to the term of the DNRC HCP, we conclude there are likely to be beneficial effects to all three fish species, as well as some, albeit limited in extent, that are detrimental effects. More importantly, when considering the overall effects, implementing the DNRC HCP for 50 years will support the

conservation and recovery of threatened bull trout, and the conservation of the unlisted native fish covered by the DNRC HCP.

Conclusion for Bull Trout

Jeopardy determinations for bull trout are made at the scale of the listed entity, which is the coterminous United States population (64 FR 58910). Regulations implementing section 7 of the Act define "*jeopardize the continued existence of*" as: "*to engage in an action that reasonably would be expected, directly or indirectly, to reduce appreciably the likelihood of both survival and recovery of a listed species in the wild by reducing the reproduction, numbers, or distribution of that species*." (50 CFR 402.02).

For the jeopardy determination, as described above, the jeopardy analysis in this part of the BO (Part IV) follows a hierarchal relationship between units of analysis, but starts at the core area population level. After reviewing the current status of the bull trout, the environmental baseline for the action area, the effects of the proposed action, and the cumulative effects in the action area, the best information and analysis presented in Part IV of this BO suggests that forest management activities managed under the conservation commitments of the DNRC HCP would not appreciably reduce the reproduction, numbers, or distribution of bull trout at the scale of a core area and by extension not likely to reduce appreciably the reproduction, numbers, or distribution of bull trout at the Clark Fork River Management Unit or Kootenai River Management Unit, and the larger scale of the Columbia River Interim Recovery Unit. Consequently, the USFWS concludes that the DNRC HCP will not appreciably reduce the survival and recovery of the coterminous United States population of the bull trout in the wild by reducing the reproduction, numbers, or distribution of that species and therefore, would not jeopardize bull trout in the coterminous United States (i.e., range-wide) (64 FR 58910; April 20, 2006, memorandum to Ecological Services Project Leaders from Assistant Regional Director – Region 1, subject line, Jeopardy Determinations under section 7 of the Act for the Bull Trout) (Appendix A).

The USFWS has determined that recovery of bull trout will not be precluded by implementation of the DNRC HCP. Baseline habitat conditions are expected to improve over the Permit term, especially in areas where numerous legacy roads have been constructed. For example, under the HCP the most severe existing sediment road problems will be fixed quickly such that by the end of the Permit term, sediment production from all problem road segments will be reduced from 62 percent to 79 percent depending on the bull trout core area. This is especially important in the core areas with high precipitation zones and high numbers of stream crossings (e.g., Stillwater, Swan, Upper Clark Fork). The recovery response of an individual bull trout core area population will likely be variable resulting from these habitat improvements due to many factors, but because the HCP maintains or directs the trend upward overall for all the important habitat parameters (stream temperature, sediment, LWD, connectivity, CWE) in most core areas for the 50-year Permit term, we expect the rate of recovery to be maintained or to improve for bull trout.

Our conclusion is based on, but not limited to, the body of literature and information referenced in this document, meetings and discussions with DNRC, the draft recovery plan for bull trout, and the information and analysis in the Final EIS/HCP (2010). The *Effects of the Action* section

analyzed and summarized key factors in detail. HCP minimization and mitigation measures that support the "no-jeopardy" determination are the following:

1. DNRC anticipates conducting RMZ harvest on only 32 to 64 acres annually.

2. The DNRC HCP would maintain or improve stream temperature for bull trout by ensuring adequate streamside shade levels in relation to riparian timber harvest and by ensuring that grazing parcels maintain healthy riparian vegetation plant communities. Consequently, baseline conditions of summer maximum or winter minimum stream temperatures are not anticipated to be measurably affected over the Permit period.

3. The DNRC HCP is expected to reduce total existing sediment production from problem road sources in those areas prioritized for corrective actions by 10 percent per decade for the Permit term. Thus, baseline conditions are expected to improve in the areas where chronic sources of sediment from existing roads exist within 300 feet of bull trout streams (including all Class 1 streams), as well as problem culverts and stream crossings.

4. The DNRC HCP will identify sediment sources on bull trout streams caused by livestock grazing, prioritize the problem sites, and implement corrective actions on prioritized sites before the next grazing season and on non-prioritized sites within one year of verification.

5. The DNRC HCP would maintain baseline conditions or improve existing LWD recruitment levels on bull trout streams (including all Class 1 streams) in relation to timber harvest by ensuring, at minimum, to having 80 percent of the RMZ acres on bull trout streams meet LWD targets by decade. Verification of meeting LWD target levels would be done by pre and post harvest monitoring of representative riparian stand types throughout the Permit term, and although unlikely, if the 80 percent target level is not met, a modified approach to the design of the RMZ harvest would be developed and implemented to ensure adequate levels of LWD recruitment. Consequently, recruitment rates of LWD to bull trout streams are not anticipated to be measurably affected over the Permit period.

6. The HCP would require DNRC to install all new culverts and stream crossing structures to ensure safe and effective fish passage on all bull trout streams (including all Class 1 streams) by removing or replacing all fish passage barriers based on prioritization of the most severe problems. DNRC will monitor fish passage effectiveness of bull trout (and other fish species) on new and upgraded culvert installations to verify connectivity and correct fish passage barrier problems in a timely fashion.

7. The DNRC HCP would ensure minimizing adverse CWE from occurring by taking into account existing watershed conditions and implementing a process that is sensitive to the anticipated impacts to watershed functions from a project proposal. These functions include, but are not limited to, water yield, flow regime, and channel stability that support and/or maintain habitat conditions for bull trout. The process would ensure that proposed

projects would not exacerbate degraded habitat conditions for bull trout or contribute to poor water quality and quantity conditions.

8. The DNRC HCP would support and likely contribute to the conservation role of bull trout critical habitat by maintaining or improving the overall functions of PCEs in all bull trout core areas over the Permit term. It is expected that baseline habitat conditions would be maintained or improved for eight of the nine PCEs which are the PCEs (PCEs 1 through 8) that potentially could be affected by forest management under the HCP.

9. The DNRC HCP would not preclude recovery of bull trout and is likely to contribute to bull trout recovery by helping reduce habitat threats in some core areas such as those where sediment sources from legacy roads continue to exist (e.g., Bitterroot, Blackfoot, and Middle Clark Fork bull trout core areas).

10. The potential disposal of 45,500 acres from the DNRC HCP would not compromise the HCP's ability to complement recovery efforts on adjacent Federal lands managed by the Forest Service, because sufficient amounts of habitat would remain in the HCP to support bull trout conservation on DNRC lands.

11. The DNRC HCP would employ a monitoring and adaptive management program to ensure HCP provisions are implemented as intended and are effective throughout the Permit term. This program provides assurances that the HCP aquatic minimization and mitigation measures will be done appropriately and if these measures are not yielding the desired results for bull trout and its habitats, the program outlines a process and course of action to make the necessary changes to achieve the intended results.

Overall, the DNRC HCP supports the conservation of bull trout and their habitats through increased conservation commitments in forest management practices, supplementary commitments that ensure timely corrective actions, additional measures that fill gaps in some Forest Management ARMs, monitoring, adaptive management, and other measures.

Our "no-jeopardy"conclusion is further supported by the following:

1. The DNCR HCP project area comprises only 2.47 percent of the total habitat acres occupied by bull trout in bull trout core areas within Montana (Final EIS/HCP 2010, Chapter 4, Table 4.8-16).

2. The DNRC HCP project area contains 8 percent of the total stream miles occupied by bull trout not under DNRC ownership (Final EIS/HCP 2010, Appendix E, Table E4-4) and only 2.8 percent of the total stream miles of bull trout critical habitat (Final EIS/HCP 2010, Chapter 4, Table 4.8-17). The majority of critical habitat for bull trout occurs on Federal lands in western Montana.

3. The action area contains only 2 of at least 20 major watersheds forming the Columbia River basin, though it is amongst the largest (USFWS 2002).

4. Only 2 of 42 core area populations of bull trout have listed forest management as the number one threat category within the action area, and neither one of these occurs on HCP project lands.

5. Significant progress has been made with fish passage over large hydroelectric dams on major bull trout river corridors in western Montana (e.g., all Clark Fork River mainstem dams) and on several privately owned small irrigation dams within the action area. For example, in the Lower Clark Fork River core area the first full length fish ladder for bull trout was constructed in 2009-2010 and became operational in 2011, which has improved baseline conditions for connectivity in this core area. Planning and designs for bull trout fishways are currently under development at the two remaining major dams on the mainstem river in this core area.

6. Countless habitat restoration projects throughout the range of bull trout in western Montana have been implemented, which has improved baseline conditions on bull trout streams in areas that have had channel stability problems because of lack riparian vegetation and/or forest road encroachment (e.g., Jocko River Restoration, Blackfoot River Restoration, Fish Creek Restoration, Vermillion River Chappel Hill Channel Stability Project, East Fork Bull River Slide Restoration).

7. Bull trout conservation is being implemented through Habitat Conservation Plans (HCP) in place on about 930,000 acres of private land (Plum Creek Timber Company Native Fish HCP, Stimson Lumber Company) within the action area.

8. The Montana Legacy Project administered by The Nature Conservancy (TNC) who have applied robust riparian protection measures on lands that encompasses about 320,000 acres, the majority of which contain primary bull trout watersheds in the action area. TNC intends to transfer the majority of these lands to public ownership (a process that is partially complete) where conservation measures are likely to focus protection and special management needs on these important aquatic habitats.

9. The majority of the lands occupied by bull trout and that contain most of the critical habitat within the action area are owned by the USFS, the agency largely responsible for implementing management and development of programs and projects that promote recovery of the species. The DNRC HCP would contribute to the USFS recovery efforts in areas of mixed ownership.

10. The USFWS's 5 year status review (USFWS 2008a) for bull trout indicated "no change" in the overall status of bull trout throughout its entire range, and no overall decline in western Montana, although individual core area status has changed in some cases.

<u>Conclusion for Designated Bull Trout Critical Habitat</u>

After reviewing the current status of bull trout, the environmental baseline for the action area, the effects of implementing the DNRC HCP, and the cumulative effects, it is the USFWS's biological opinion that the actions as proposed, are not likely to destroy or adversely modify bull

trout critical habitat. This conclusion is based, in part, on the magnitude of the project effects in relation to the designated critical habitat at the Columbia River basin scale. Guidance for analysis of designated critical habitat for bull trout was provided in the final rule (FR 70, No 185, 56211- 56311) and in the Director's Memorandum (USDI 2004) and was promulgated in response to litigation on the regulatory standard for determining whether proposed Federal agency actions are likely to result in the "destruction or adverse modification" of designated critical habitat under section 7(a)(2) of the Act (Appendix B). The Director's Memorandum outlines interim measures for conducting section 7 consultations pending the adoption of any new regulatory definition of "destruction or adverse modification." Consequently, we have relied upon the statutory provisions of the Act to complete the preceding effects analysis and conclude the following determination with respect to critical habitat. Critical habitat is defined in section 3 of the Act "as the specific areas within the geographical area occupied by the species, at the time it is listed in accordance with the Act, on which are found those physical and biological features essential to the conservation of the species and that may require special management considerations or protection; and specific areas outside the geographical area occupied by a species at the time it is listed, upon a determination that such areas are essential for the conservation of the species."

As proposed, implementation of the DNRC HCP is anticipated to negatively impact designated critical habitat in affected localized segments of bull trout streams associated with stream crossings (typically culverts - new and old) and/or road-related failures due to new construction or legacy roads in need of repair. Streams in certain core areas that are high precipitation zones are at greater risk of these problems especially during unusual storm events, floods, and rain on-snow events that cause culverts to wash out or road segments in close proximity to streams to fail. Increases in sedimentation could affect the function of some PCEs in support of the critical habitat for bull trout and thus have an adverse effect. The function of PCE 6 may be adversely affected from road-related activities like culvert removals and replacements, but the effects are expected to be short-term. The areas of critical habitat mostly affected would be small localized stream segments and the duration of the effect would most likely be temporary (e.g., less than 2 years).

DNRC forest management activities in the action area associated with fish passage barriers could affect the function of PCE 2 if this function decreases, thus preventing migratory bull trout or resident bull trout from accessing suitable spawning and rearing areas. Fish passage issues in the action area should be identified quickly by DNRC under the HCP, and the most serious problems prioritized for corrective actions promptly. High priority fish passage issues are first assigned to bull trout streams. It seems reasonable to assume that affected PCEs are expected to remain functional, albeit at times there could be a diminishment of function temporarily associated with road-related failures and stream crossings, or fish passage problems.

Increases in sedimentation and the associated changes in channel and habitat complexity related to sediment input are anticipated to reduce the functional ability of some PCEs to a level slightly below baseline, and in turn affect critical habitat to a small degree and most likely temporarily. In general, less than 2 years following new road construction, construction repairs, and culvert replacement is the typical time period it takes to completely revegetate and stabilize the affected area. Fish passage problems would only continue to exist for as long as it takes to correct the

problem. However, the function of this PCE to support critical habitat is expected to improve over time and no new problems are anticipated due to the requirement to provide effective fish passage when constructing new stream crossings. Therefore, baseline conditions for connectivity are expected to get better under the DNRC HCP.

Anticipated impacts would be confined to localized road segments of designated bull trout critical habitat in the action area. Therefore, by extension the overall impact on the abundance and quality of designated critical habitat in the affected core areas and the Clark Fork River and Kootenai River management units would be diminutive, and therefore, not likely to be appreciably affected. The following reasons are the basis for our conclusion:

The function of designated critical habitat in the action area would not be significantly reduced because none of the PCEs would be eliminated. It is anticipated that at most, affected PCEs would be diminished functionally (likely PCE 6 and 2) to only a small degree.

1. Only 2.8 percent of the total stream miles of bull trout critical habitat in the planning area occur within the HCP project area (Final EIS/HCP 2010, Chapter 4, Table 4.8-17). The majority of critical habitat for bull trout occurs on Federal lands in western Montana.

2. Kootenai and Clark Fork river subbasins consists of major river drainages occupied by bull trout and with hundreds of miles of designated critical habitat including the Tobacco, Blackfoot, Clark Fork, Swan, Flathead, and Bitterroot rivers.

3. The Clark Fork River and Kootenai river subbasins are only 2 of at least 20 major watersheds forming the Columbia River basin, though the Clark Fork is amongst the largest (USFWS 2002).

4. Significant progress has been made in fish passage in the Clark Fork river subbasin and several successful habitat restoration projects in both the Kootenai and Clark Fork river subbasins have been implemented.

5. Bull trout conservation is being implemented on thousands of acres of critical habitat associated with private industrial lands through existing Habitat Conservation Plans that are adjacent to or intermixed with DNRC HCP scattered lands. For example, under the Plum Creek Native Fish HCP, approximately 5 miles of riparian vegetation has been actively restored through control of Reed Canarygrass and replantings of native shrubs in the upper Thompson River watershed. Baseline habitat conditions are gradually improving in bull trout core areas due to projects like these.

6. The DNRC HCP is not expected to alter the physical or biological features of critical habitat to an extent that appreciably reduces the conservation role of a core area population of bull trout. This is due in large part because the function of the PCEs that support bull trout critical habitat will not be diminished by implementation of the HCP. It is expected that the HCP provisions are likely to maintain or improve most baseline habitat conditions, although PCE functions for sediment may slightly decrease

temporarily in certain core areas where new roads are anticipated – e.g., Stillwater core area.

The intended purpose of bull trout critical habitat is to support viable core areas. The USFWS has determined that none of the nine PCEs of designated critical habitat for bull trout would be adversely affected by implementation of the DNRC HCP to the extent that it would appreciably reduce the conservation value of a core area for bull trout or reduce the function of critical habitat to support the recovery of bull trout. Therefore, the conservation role that critical habitat provides for bull trout in a core area will not be negatively affected to any great degree (only temporary and at most a small amount of area affected). Consequently, it is reasonable to assume that the impacted PCEs would continue to function (although at times at a lower level) in support of designated critical habitat. Therefore, it is the USFWS's conclusion that the proposed action (i.e., implementation of the DNRC HCP) is not likely to destroy or adversely modify designated critical habitat of the Columbia River basin.

Conclusion for Unlisted Westslope Cutthroat Trout and Columbia Redband Trout

After reviewing the current status of WCT and RBT, and the environmental baseline for the action area, the effects of the proposed action, and the cumulative effects, it is the USFWS's conference opinion that the proposed action is not likely to jeopardize the continued existence of these two unlisted fish species by appreciably reducing the reproduction, numbers, or distribution of any of these affected populations.

Should any of these species be listed in the future, the issuance of the subject Permit for the proposed action, as set forth in the DNRC HCP, are not likely to jeopardize the continued existence of the unlisted covered species, WCT and RBT. Furthermore, in the USFWS's best professional judgment we suggest that because the baseline habitat conditions are likely to improve for WCT and for RBT during the Permit term, the HCP would not preclude the recovery of either WCT or RBT. In our judgment, it is likely the HCP would help contribute to recovery of each species based on the same reasoning for bull trout in that the most important habitat parameters (stream temperature, sediment, LWD, connectivity, CWE) for recovering these species are expected to improve over the Permit term. In addition, based on information presented earlier in this BO (Part IV), the major threat to WCT and RBT appears to be introgression by the nonnative rainbow trout. Assuming this major threat continues (and likely expands as predicted) and becomes a primary premise for listing, subsequent recovery planning efforts by the USFWS would likely include recovery actions to address this threat.

No critical habitat has been designated for the aforementioned unlisted fish species, therefore none will be affected.

Summary of All Conclusions

It is the USFWS's biological opinion that the DNRC HCP adequately conserves aquatic species habitat, and adequately minimizes or mitigates for adverse effects on the three HCP fish species such that the HCP would not: 1) impede the recovery or survival of the listed bull trout, 2) destroy or adversely modify bull trout critical habitat, or 3) contribute to the listing of either of

the unlisted species. Although some individual forest management practices implemented under the DNRC HCP may result in adverse effects to HCP fish species, the effects are expected to be short term and relatively minor in scope (e.g., periods of temporary increases in sediment levels followed by a long-term beneficial habitat condition), impacting very small amounts of habitat and very few individual fish. The proposed action adequately minimizes effects of forest management on HCP fish species to levels that are conducive to the continued conservation and recovery of the HCP fish species populations. The proposed action is not likely to jeopardize the bull trout or the unlisted species, WCT and RBT.

The DNRC HCP would employ a monitoring and adaptive management program to ensure HCP provisions are implemented as intended and are effective throughout the Permit term. This program provides assurances that the HCP aquatic minimization and mitigation measures for bull trout, WCT, and RBT and their habitats will be done appropriately and if these measures are not yielding the desired results, the program outlines a process and course of action to make the necessary changes to achieve the intended results.

G. INCIDENTAL TAKE STATEMENT

Section 9 of the Act and Federal regulation pursuant to section 4(d) of the Act prohibit the take of endangered and threatened species, respectively without special exemption. Take is defined as to harass, harm, pursue, hunt, shoot, wound, kill, trap, capture or collect, or to attempt to engage in any such conduct. Harm is further defined by the USFWS to include significant habitat modification or degradation that results in death or injury to listed species by significantly impairing essential behavioral patterns, including breeding, feeding, or sheltering. Harass is defined by the USFWS as intentional or negligent actions that create the likelihood of injury to listed wildlife by annoying it to such an extent as to significantly disrupt normal behavior patterns, which include breeding, feeding, or sheltering. Incidental take is defined as take that is incidental to, and not the purpose of, carrying out an otherwise lawful activity. Under the terms of section 7(b)(4) and section 7(o)(2), taking that is incidental to and not intended as part of the agency action is not considered to be prohibited taking under the Act provided that such taking is in compliance with the terms and conditions of this Incidental Take Statement.

The proposed DNRC HCP and its associated documents clearly identify anticipated adverse effects to covered HCP fish species likely to result from the proposed action and the measures that are necessary and appropriate to minimize those adverse effects. All conservation measures described in the DNRC HCP, together with the provisions described in the associated Implementation Agreement and the section 10(a)(1)(B) permit expected to be issued with respect to the DNRC HCP are hereby incorporated by reference as reasonable and prudent measures and terms and conditions within this Incidental Take Statement pursuant to 50 CFR §402.14(i). The measures described below are non-discretionary, and must be undertaken by the USFWS so that they become binding conditions of the incidental take permit issued to DNRC, as appropriate, for the exemption in section 7(o)(2) to apply. The USFWS has a continuing duty to regulate to the full extent of its authority the activities covered by this Incidental Take Statement wherever they occur. If the USFWS fails to require the applicant to adhere to the terms and conditions of the Incidental Take Statement through enforceable terms of the Permit, the protective coverage of section 7(o)(2) may lapse [50 CFR § 402.14(i)(3)]. In order to monitor the impact of incidental

take, the applicant must report the progress of the action and its impact on the species to the USFWS as specified in the Incidental Take Statement (50 CFR 402.14(i)(3)).

Note that two of the species, WCT and RBT trout addressed in this Biological/Conference Opinion are not currently listed or proposed. Therefore, no take prohibition is in place for these species as of the date of this BO. The Incidental Take Statements below, and the section 10(a)(1)(B) Permit as it pertains to these species, do not become effective unless (and until) the currently unlisted species are listed under the Act.

It is our policy (per Region 1 memorandum of July 27, 1998) to not consider for inclusion, pesticide and herbicide applications as a covered activity under section 10(a)(1)(B) Permits. The exceptions are those HCPs that address this topic and were submitted to us before July 27, 1998. The subject HCP was submitted to the USFWS after 1998. Pesticide or herbicide use is not a proposed covered activity. No take is authorized for pesticide or herbicide use under the proposed permit. No take is anticipated herein as a result of pesticide or herbicide use in the HCP area as a result of the proposed action.

Amount or Extent of Incidental Take

The USFWS expects that the proposed action is likely to result in incidental take of bull trout, WCT, and RBT in the form of harm, harassment, and injury or death due to effects from forest management operations related to road activities that generate sediments in close proximity to Class 1 streams; from livestock grazing licenses in close proximity to Class 1 streams; or from stream crossings that fully or partially obstruct fish passage. Incidental take of these species may occur through the impairment of essential foraging, rearing, and spawning behaviors associated with the direct and indirect effects of sediment in spawning, rearing, overwintering, and migratory habitats and inability of the species to access habitats. Life-history forms of HCP fish species that may be taken by elevated sediment levels under the HCP are primarily eggs and alevins, but may also include fry, juveniles and, in some instances, subadult and adult fish. Obstruction of fish passage may affect all life-history forms of HCP fish species. Because of the inherent biological characteristics of bull trout, WCT, and RBT, the likelihood of discovering an individual death or injury attributable to an individual action associated with these activities is very small.

The analyses in the Final EIS/HCP (2010) and in Part IV Section D of this BO indicate two main sources of covered HCP activities that may cause incidental take of HCP fish species. One source is sediment generated from road related activities or from livestock grazing licenses that enters a Class 1 stream where bull trout, WCT, and RBT are physically present or where HCP fish species habitat occurs (e.g., spawning area). The second source is caused by blockage of fish passage at stream crossings where bull trout, WCT, and RBT cannot access upstream habitat to fulfill their life requisite needs – that is feeding, breeding, and sheltering.

The amount of take expected from the DNRC HCP is difficult to quantify because of the wide ranging distribution of bull trout, WCT, and RBT which makes identification and detection of dead or impaired species at the egg and larval stages unlikely. In addition, losses may be masked by seasonal fluctuations in numbers and aquatic habitat modifications that are very difficult to

ascribe to particular sources, especially in already degraded watersheds. Consequently, the effects of management actions associated with some forest operations are largely unquantifiable to the species or population levels. Furthermore, incidental take is largely dependent upon the effectiveness of the aquatic conservation measures in the DNRC HCP, which in large part, have been judged to be effective according to findings in the scientific literature. However, to confirm their effectiveness, data will be forthcoming early in the Permit term through effectiveness monitoring, which would inform and possibly trigger adaptive management processes. Therefore, even though the USFWS expects incidental take to occur from the effects of the action, the best scientific and commercial data at this time is not available or sufficient to enable the USFWS to estimate a specific number of individuals that may be incidentally taken based on loss or injury of individuals of the species.

The difficulty in quantifying incidental take also relates to how fish respond to environmental disturbances which can be different depending upon a variety of factors. Factors that may affect fish response to perturbations are size and species of fish, age of fish, condition of fish, complexity of habitat, seasonal behavior, inter-specific and intra-specific competition, dissolved oxygen and water temperatures, turbidity, and other physical and biological processes. In addition to the various possible responses of fish to disturbances, fish occupy their stream environment in often patchy distribution, and therefore, DNRC HCP activities that have been determined to contribute to take would not always cause the same fish response. An activity that may cause an adverse fish response in one stream may not have the same result in another stream. The same activity could influence adult fish substantially differently than juvenile fish. As such, the incidental take estimates are used to judge the negative activities implemented under the DNRC HCP, but they are not always a reliable tool for accurately measuring incidental take due to the complexity of biological systems.

In cases where we determine the level of take is unquantifiable, or undeterminable, the USFWS uses surrogates to measure the amount or extent of incidental take, and whether the amount of take anticipated has been exceeded. We have identified particular surrogates for the three HCP fish species to describe the amount or extent of incidental take from the two sources that are anticipated to result in take – adverse effects from sediment and adverse effects from full or partial fish blockage at stream crossings. Thus, the extent of incidental take anticipated is the amount of HCP fish species habitat modification that may occur as a result of the DNRC HCP.

Incidental Take Attributed to Sediment Delivery from Road Management

The USFWS anticipates that incidental take of HCP fish species and their habitats due to excessive sediment produced from road construction activities (especially new road construction) and associated stream crossings and delivered to a Class 1 stream is likely at some point during the 50-year term of the Permit. In these situations “harm” will accrue from the sediment effects on spawning, rearing, overwintering, and migratory habitats such that HCP fish species are unable to meet their feeding, breeding, and/or sheltering needs. The site-specific location and timing of these sediment effects is nearly impossible to predict. However, the most likely scenario of an event happening that causes incidental take, is in those core areas (i.e., AAUs) that occur in the highest precipitation zones, with the maximum sediment production, and the greatest amount of stream crossings and road segments within 300 feet of a Class 1 streams – specifically

the Stillwater, Swan, and Upper Clark Fork core areas (i.e., AAUs) Nevertheless, it is possible that these same effects could occur in other core areas because all core areas will have some increase in stream crossings and road segments within 300 feet of Class 1 streams. When DNRC forest management activities within these core areas (i.e., AAUs) are at high levels during the Permit term, especially when significant road construction is occurring in proximity to a Class 1 stream, the probability of sediment delivery will increase and therefore the prospect of incidental take also increases.

In Part IV of this BO, we use the surrogate of DNRC HCP stream miles that are within 300 feet of a forest road to measure incidental take from sediment delivery. Table IV-14 above, illustrates the conditions in which take in the form of harm is likely to occur - those conditions where roads are within 300 feet of a HCP fish species stream, including road segments for new roads expected to be constructed during the term of the Permit. The mechanism(s) in which harm accrues at these sites is articulated in the effects analysis in Section D.

We anticipate incidental take of bull trout associated with sediment delivery would occur on 207.2 miles of bull trout streams within 300 feet of a forest road within the HCP project area. The extent of this take is expected throughout all core areas (i.e., AAUs) in the HCP project area, except the Upper Missouri core area (i.e., AAU). Take of WCT associated with sediment delivery is expected on 276.1 miles of WCT streams within 300 feet of a road within the HCP project area. The extent of this take is expected throughout all bull trout core areas (i.e., AAUs) in the HCP project area including the Upper Missouri core area (i.e., AAU)– meaning <u>all</u> WCT sub-basins in the HCP project area. Take of RBT associated with sediment delivery is expected on 13.8 miles of RBT streams within 300 feet of a road within the HCP project area. The extent of this take is expected only in the Lower and Middle Kootenai bull trout core areas (i.e., AAUs) in the HCP project area.

Incidental take from sediment delivery associated with roads within 300 feet of streams and stream crossings would be exceeded when the following occurs:

- The miles of stream affected by roads within 300 feet of the stream exceed 207.2 miles supporting bull trout in the thirteen bull trout core areas (i.e., AAUs) in the HCP project area.

- The miles of stream affected by roads within 300 feet of the stream exceed 276.1 miles supporting WCT in the fourteen bull trout core areas (i.e., AAUs) in the HCP project area.

- The miles of stream affected by roads within 300 feet of the stream exceed 13.8 miles supporting RBT in all RBT subbasins within the Lower and Middle Kootenai bull trout core area (i.e., AAUs) in the HCP project area.

Incidental Take Attributed to Sediment Delivery from Grazing Management

The USFWS anticipates incidental take of HCP fish species and their habitats due to excessive sediment produced from grazing activities delivered to a Class 1 stream is likely at some point

during the 50-year term of the Permit. In these situations "harm" will accrue from the sediment effects that modify habitat and cause a reduced habitat function for HCP fish species to meet their feeding, breeding, and/or sheltering needs.

Under the DNRC HCP, grazing practices would be implemented that would reduce the existing and potential for delivering fine sediment to HCP fish streams on grazing parcels within the HCP project area. In addition to the existing grazing inspection and monitoring program, DNRC would use these data as a coarse filter to identify potential problem areas, then develop a process and timeline for verifying and prioritizing the problems affecting aquatic habitat, develop and implement corrective actions, and follow-up with implementation and effectiveness monitoring. In addition to the grazing management ARMs, the HCP establishes specific numerical guidelines for riparian zone utilization and streambank disturbance levels. This approach is expected to minimize the loss of riparian vegetation and physical damage to stream banks, maintain channel stability and channel morphological characteristics, and promote diverse and healthy riparian plant communities. As a result, the HCP is expected to reduce the amount or the extent of incidental take throughout the Permit term.

Nevertheless, incidental take is anticipated within those bull trout core areas (i.e., AAUs) where livestock have direct access to streams for extended periods because there is a high probability of sediment delivery to a HCP fish species stream. Consequently, it is likely that incidental take would occur during the Permit term. The site-specific location, timing, and actual levels of sediment input due to grazing are nearly impossible to predict.

Therefore, we use the surrogate of DNRC HCP stream miles that are located on grazing parcels within the HCP project area to describe the extent of incidental take. These are the locations subject to sediment contribution and modification of HCP fish species habitat. Table IV-18 illustrates the conditions in which take in the form of harm is likely to occur – stream miles of HCP species habitat currently exposed to habitat modifications on active grazing parcels within the DNRC HCP project area. We do not expect new areas to be affected beyond those that are currently active grazing parcels unless DNRC adds lands to the HCP that would include additional grazing licenses or expand existing licenses. The mechanism(s) in which harm accrues at these sites is articulated in the effects analysis in Section D.

Table IV-18. Extent of Habitat Affected by Stream Miles by HCP Fish Species on Grazing License Parcels Within the HCP Project Area.

Bull Trout Core Area[1] (AAU)	Stream Miles on Grazing License Parcels Within the HCP Project Area				
	Total Stream Miles	Bull Trout Habitat	WCT Habitat	RBT Habitat	Total HCP Fish Species Habitat
Bitterroot	85.7	15.5	19.5	0.0	**19.5**
Blackfoot	102.1	14.6	25.5	0.0	**25.5**
Flathead Lake	9.9	0.0	1.4	0.0	**1.4**
Lower Clark Fork	4.1	0.0	0.0	0.0	**0.0**
Lower Kootenai	0.5	0.5	0.5	0.5	**0.5**
Middle Clark Fork	145.2	30.5	45.1	0.0	**45.1**
Middle Kootenai	25.2	2.5	4.9	3.4	**4.9**
North Fork Flathead	7.0	5.2	5.2	0.0	**5.2**
Rock Creek	8.4	0.8	1.1	0.0	**1.9**
Stillwater	6.4	3.0	2.5	0.0	**3.0**
Swan	2.5	1.5	2.0	0.0	**2.0**
Upper Clark Fork	46.2	5.0	7.9	0.0	**7.9**
Upper Kootenai	13.0	2.5	5.0	0.0	**5.0**
Upper Missouri[1]	45.9	0.0	0.0	0.0	**0.0**
TOTAL	**502.1**	**81.6**	**120.8**	**3.9**	**122.1**

Source: DNRC (2008a).

[1] The Upper Missouri River unit (AAU) is not a bull trout core area or an area where RBT is present. Only WCT is present in this unit within the HCP project area.

In summary, the USFWS anticipates incidental take of bull trout associated with sediment delivery from livestock grazing on 81.6 miles of bull trout streams within the HCP project area. The extent of this take is expected throughout all bull trout core areas (i.e., AAUs) in the HCP project area, except the Upper Missouri AAU where bull trout do not occur. Incidental take of WCT associated with sediment delivery from livestock grazing is anticipated on 120.8 miles of WCT streams within the HCP project area. The extent of this take is expected throughout all bull trout core areas (i.e., AAUs), which includes all WCT sub-basins (and all 14 AAUs) in the HCP project area. Incidental take of RBT associated with sediment delivery from livestock grazing is anticipated on 3.9 miles of RBT streams within the HCP project area. The extent of this take is expected only in the Lower and Middle Kootenai bull trout core area (i.e., AAUs) in the HCP project area.

Incidental take from sediment delivery associated with roads within 300 feet of streams and stream crossings would be exceeded when the following occurs:

- The miles of stream affected by livestock grazing on bull trout streams exceed 81.6 miles in the thirteen bull trout core areas (i.e., AAUs) in the HCP project area.

- The miles of stream affected by livestock grazing on WCT streams exceed 102.8 miles in all bull trout core areas (i.e., AAUs) (including the 14 AAUs) in the HCP project area.

- The miles of stream affected by livestock grazing on RBT streams exceed 3.9 miles in all RBT subbasins within the Lower and Middle Kootenai bull trout core area (i.e., AAU) in the HCP project area.

Incidental Take Attributed to Connectivity/Fish Passage

The USFWS has determined that inadequate design and improper installation of stream crossing structures could diminish connectivity of streams supporting HCP fish species to the extent that adverse impacts result in incidental take of bull trout, WCT, and RBT by impairing their feeding, breeding, and sheltering. Improperly installing a new stream crossing structure, improperly replacing an existing stream crossing structure, or improperly rehabilitating a site where an existing structure is being removed could fully or partially obstruct fish passage. In turn, the impediment to migration and movement could adversely affect the ability of bull trout, WCT, and RBT to find and use spawning and rearing habitats necessary for their survival and recovery. The DNRC HCP would minimize the potential for these impacts by designing road-stream crossing installations to simulate natural streambed form and function. The intent is to provide the same levels of connectivity to adult and juvenile HCP fish species as are provided by an undeveloped stream channel during low to bankfull flows. We have determined that DNRC's fish connectivity strategy would likely minimize the potential for adverse impacts of HCP fish species at stream crossings; however, there will remain a risk that incidental take could occur due to lack of fish passage (fully or partially) of some life stage of an HCP fish species at new or existing stream crossings (e.g., culverts) during the 50-year term of the Permit.

There are currently 106 existing culverts within the HCP project area that are impacting fish passage to some degree, including potential access to approximately 150 miles of stream (Final EIS/HCP 2010, Chapter 4). The amount of incidental take is described as the short-term impacts (i.e., full or partial fish passage barrier) associated with the 106 existing problem culverts until their replacement. In addition to these 106 existing culverts, there is an estimated 32 new culverts anticipated during the Permit term that potentially could become problem sites for fish passage (see Effects Section, subsection Habitat Connectivity/Fish Passage). Therefore, we expect incidental take is likely from the short-term impacts (i.e., full or partial fish passage barrier) associated with 32 new culverts until their replacement.

DNRC has assigned priority levels to these crossing structures and will replace or remove all structures that are barriers to fish passage within 15 years on bull trout streams and 30 years on streams supporting WCT or RBT. This timetable will result in a culvert replacement rate of about 3.5 per year on Class 1 streams, over the first 30 years of the 50-year permit term, which will ensure that the most problematic culverts are improved first, resulting in a longer period for fish to re-populate upstream habitats previously blocked or restricted. Within the HCP project area there are no priority 1 culvert barriers (i.e., none occurring on bull trout streams), three priority 2 culvert barriers, ninety-nine priority 3 culvert barriers, and four priority 4 barriers.

In summary, we use the 106 existing culverts and an expected 32 new culverts to describe the amount and extent of take associated with fish passage barriers. However, none of these existing barriers occur on bull trout and RBT streams; therefore, no incidental take to bull trout and RBT is expected from removal or replacement of these culverts. Consequently, there are no priority 1 level assignments (see Table IV-15 above) which would require culvert removal or replacement within 15 years. All 106 culverts are associated with WCT streams. Thus, the amount of take for WCT is 106 culverts (DNRC 2006c; pers. comm., Jim Bower Fisheries Biologist, DNRC) located in WCT streams throughout the HCP project area. The amount of take of WCT is expected to decline at the rate of 3.5 culverts per year over the Permit term, such that in 30 years the amount of take associated with baseline conditions under the HCP should be reduced to zero. Because culvert inventories will continue over the HCP permit term, additional culverts may be added. Stated another way, DNRC has committed to improving one-sixth of all barriers every 5 years.

It is unknown how the 32 new culverts would impact HCP fish species because their precise location cannot be ascertained at this point in time. Nonetheless, these culverts are expected to be installed on a stream with at least one HCP fish species.

Incidental take associated with stream culvert barriers would be exceeded if the following occurs:

> If, every 5 years, necessary improvements have not been implemented, planned or designed for one-sixth of all identified fish passage barriers (including the baseline 106 barriers and 32 new barriers identified over the Permit term).

Effect of the Take

In Part IV of this BO, the USFWS determined that the anticipated level of incidental take is not likely to result in jeopardy to bull trout or destruction or adverse modification of bull trout critical habitat. Although the covered activities under the HCP have the potential to result in adverse effects on the bull trout and some PCEs of bull trout critical habitat in certain circumstances, the anticipated effects and level of incidental take do not rise to a level that appreciably reduces the reproduction, numbers, or distribution of bull trout for any core area populations in the action area such that the conservation value of the core area for bull trout is reduced. The best information of impacts on bull trout, including anticipated levels of incidental take, as a result of forest and grazing management practices under the HCP indicate that they will not appreciably reduce survival or the recovery of the species.

Although the covered activities under the HCP have the potential to result in adverse effects on WCT and RBT in certain circumstances, the anticipated effects and level of incidental take do not rise to a level that appreciably reduces the reproduction, numbers, or distribution of WCT or RBT for any populations in the action area. The best information of impacts on WCT and RBT, including anticipated levels of incidental take as a result of forest and grazing management practices under the HCP, indicate that they will not appreciably reduce survival or the recovery of the two species, and that the proposed action is not likely to jeopardize the continued existence of these two unlisted fish species (see below under Conference Report).

H. REASONABLE AND PRUDENT MEASURES AND TERMS AND CONDITIONS

Under the terms of section 7(b)(4) and section 7(o)(2), taking that is incidental to and not intended as part of the agency action is not considered to be prohibited taking under the Act provided that such taking is in compliance with the terms and conditions of this incidental take statement.

The proposed DNRC HCP and accompanying documents identify anticipated impacts to HCP covered fish species likely to result from the proposed action, and the specific measures and levels of species and habitat protection that are necessary and appropriate to minimize those impacts. All of the conservation and management measures in the final HCP are hereby incorporated by reference as reasonable and prudent measures and terms and conditions for this Incidental Take Statement pursuant to 50 CFR §402.14(i). Such terms and conditions are non-discretionary and must be undertaken by DNRC for the exemptions under section 10(a)(1)(B) and section 7(o)(2) of the Act to apply. If DNRC fails to adhere to these terms and conditions, the protective coverage of the section 10(a)(1)(B) permit and section 7(o)(2) may lapse.

I. REPORTING REQUIREMENTS

In accordance with 50 CFR §402.14(i)(3), the DNRC HCP specifies provisions for monitoring and reporting the effects and effectiveness of the mitigation and minimization measures on the covered species and their habitats. DNRC will also submit periodic monitoring reports to the USFWS, according to the monitoring and reporting schedule contained in the HCP.

J. CONFERENCE REPORT

<u>Effect of Take for Unlisted Westslope Cutthroat Trout and Redband Trout</u>

The USFWS expects that the proposed action could result in adverse effects to WCT and RBT and their habitats in the form of harm, harassment, and injury or death due to effects from forest management operations related to road activities that generate sediments in close proximity to Class 1 streams; or from stream crossings that fully or partially obstruct fish passage; or from grazing activities that generate sediment that could enter a Class 1 stream. Because these two unlisted species have, in effect, similar habitat requirements as bull trout (clean, cold, complex, and connected habitats) they would be impacted similarly to bull trout. Therefore, the USFWS anticipates incidental take of WCT and RBT would likely occur during the 50-year Permit term following the same reasoning and basis as determined for bull trout. However, the extent of take is not the same because WCT and RBT occupy different drainages.

Although individual forest and grazing management practices implemented under the DNRC HCP may result in adverse effects to these fish species, the effects are expected to be short term and relatively minor in scope (e.g., periods of temporary increases in sediment levels followed by a long-term beneficial habitat condition) impacting very small amounts of habitat and very few individual fish. The proposed action adequately minimizes effects of forest and grazing management on these fish species to levels that are conducive to the continued conservation, and in our best professional judgment, recovery of these fish species populations.

It is the USFWS's opinion that the DNRC HCP adequately conserves aquatic species habitat, and adequately minimizes or mitigates for adverse effects on WCT and RBT such that the HCP would not cause adverse effects contributing to the listing of either of these species. Furthermore, we do not expect that adverse effects would rise to a level that appreciably reduces the reproduction, numbers, or distribution of any WCT or RBT populations in the action area or impeded their recovery. As stated above in the Conclusion section, after reviewing the current status of WCT and RBT, and the environmental baseline for the action area, the effects of the proposed action, and the cumulative effects, it is the USFWS's conference opinion that the proposed action is not likely to jeopardize the continued existence of these two unlisted fish species.

Assumptions made in this conference opinion will be reassessed upon a listing decision (via re-initiation of formal consultation) for WCT or RBT, or if other indicators change substantively, or if ongoing or future research efforts or other information regarding the impact of DNRC HCP forest management practices on these species suggest serious consequences.

K. CONSERVATION RECOMMENDATIONS

Section 7(a)(1) of the Act directs Federal agencies to utilize their authorities to further the purposes of the Act by carrying out conservation programs for the benefit of endangered and threatened species. Conservation recommendations are discretionary agency activities to minimize or avoid adverse effects of a proposed action on listed species or critical habitat, to help implement recovery plans, or to develop information. The USFWS believes that the following recommendations should be considered for implementation:

1. The USFWS should provide technical assistance to DNRC throughout the term of the ITP.

2. The USFWS should review periodic, scheduled monitoring reports and use that opportunity to provide technical assistance.

L. REINITIATION NOTICE

This concludes formal consultation on the DNRC HCP and its effects HCP fish species. As provided in 50 CFR §402.16, reinitiation of formal consultation is required where discretionary Federal agency involvement or control over the action has been retained (or is authorized by law) and if one or more of following occurs:

1. The amount or extent of incidental take described above is exceeded.

2. New information reveals effects of the agency action that may affect HCP fish species or critical habitat in a manner or to an extent not considered in this opinion.

3. The agency action is subsequently modified in a manner that causes an effect to the HCP fish species or critical habitat not considered in this opinion.

4. A new species is listed or critical habitat designated that may be affected by the action.

The USFWS retains the discretion to determine whether the conditions listed in (1) through (4) have been met and reinitiation of formal consultation is required. In instances where the amount or extent of incidental take is exceeded, any operations causing such take must cease pending reinitiation.

Note that the factors enumerated above could include approved deviations from the proposed DNRC HCP that result from implementation of the adaptive management program under the HCP. Adaptive management changes to benefit covered HCP fish species may have adverse effects to other covered species (or listed species which are not covered by the DNRC HCP). Should such adjustments occur to the extent that covered or listed species, or critical habitat, are adversely affected in a manner or to an extent not considered in Part IV of this BO, consultation would be reinitiated.

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N. APPENDICES

Appendix A: April 20, 2006, Memorandum to Ecological Services Project Leaders - Idaho, Oregon, Washington regarding Jeopardy Determinations under Section 7 of the Endangered Species Act for the Bull Trout

United States Department of the Interior

FISH AND WILDLIFE SERVICE

911 NE 11th Avenue
Portland, Oregon 97232-4181

FWS/R1/AES-TE

Memorandum

APR 20 2006

To: Ecological Services Project Leaders
Idaho, Oregon, Washington

From: Assistant Regional Director-Ecological Services, Region 1
Portland, Oregon

Subject: Jeopardy Determinations under Section 7 of the Endangered Species Act for the Bull Trout

The purpose of this memorandum is to affirm that jeopardy determinations are made at the scale of the listed entity. In the case of the bull trout, the listed entity is the coterminous United States population (64 FR 58910). The preamble to the final listing rule for the bull trout at 64 FR 58930 further discusses application of the jeopardy standard relative to this species:

> Although this rule consolidates the five bull trout DPSs into one listed taxon, based on conformance with the DPS policy for purposes of consultation under section 7 of the Act, we intend to retain recognition of each DPS in light of available scientific information relating to their uniqueness and significance. Under this approach, these DPSs will be treated as interim recovery units with respect to application of the jeopardy standard until an approved recovery plan is developed. Formal establishment of bull trout recovery units will occur during the recovery planning process.

National policy, via the Director's March 6, 2006, memorandum on "Recovery Units and Jeopardy Determinations under Section 7 of the Endangered Species Act" and page 4-38 of the *Endangered Species Consultation Handbook*, establishes that:

> When an action impairs or precludes the capacity of a recovery unit from providing both the survival and recovery function assigned to it, that action may represent jeopardy to the species. When using this type of analysis, include in the biological opinion a description of how the action affects not only the recovery unit's capability, but the relationship of the recovery unit to both the survival and recovery of the listed species as a whole.

Based on the above, use the following analytical framework to make jeopardy determinations for Federal actions affecting the bull trout:

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1. In the *Status of the Species* section acknowledge that the bull trout is listed as threatened in the coterminous United States, cite the final listing rule and include the text quoted above, and concisely discuss the relationship between each of the interim recovery units and the survival and recovery of the coterminous United States population of the bull trout.

2. In the *Environmental Baseline* section concisely discuss the relationship between the action area and the survival and recovery function assigned to the affected interim recovery unit(s). Currently, the draft *Bull Trout Recovery Plan* recognizes the importance of viable bull trout core area populations in the conservation of the bull trout within the interim recovery units.

3. In the *Effects of the Action* section concisely discuss the significance of adverse and beneficial effects in relation to the role of the action area in the conservation of the bull trout at the interim recovery unit scale.

4. In the *Cumulative Effects* section concisely discuss the significance of adverse and beneficial effects in relation to the role of the action area in the conservation of the bull trout at the interim recovery unit scale.

5. In the *Conclusion* section concisely discuss how the effects of the action, taking into account any cumulative effects, are likely to influence the survival and recovery function assigned to the affected interim recovery unit(s) as the basis for determining if the proposed action is likely to appreciably reduce both the survival and recovery of the coterminous United States population of the bull trout in the wild.

If you have any questions regarding this guidance, please contact Larry Salata at (503) 231-2350.

cc: ARD-ES, CNO
ARD-ES, Region 6

Appendix B: Director's Memorandum on Application of the Destruction of Adverse Modification Standard under Section 7 (a)(2) of the Endangered Species Act (12-9-04)

United States Department of the Interior

FISH AND WILDLIFE SERVICE
Washington, D.C. 20240

In Reply Refer To:
FWS/AES/DCHRS/019634

December 9, 2004

Memorandum

To: Regional Directors, Regions 1, 2, 3, 4, 5, 6, and 7
Manager, California-Nevada Operations Office

From: Acting Director

Subject: Application of the "Destruction or Adverse Modification" Standard under Section 7(a)(2) of the Endangered Species Act

Recent litigation has focused on the regulatory standard for determining whether proposed Federal agency actions are likely to result in the "destruction or adverse modification" of designated critical habitat under Section 7(a)(2) of the Endangered Species Act (ESA). On August 6, 2004, the Ninth Circuit Court of Appeals rendered a decision in *Gifford Pinchot Task Force v. U.S. Fish and Wildlife Service*, No. 03-35279, finding that the Service's regulatory definition of "destruction or adverse modification" of critical habitat, at 50 C.F.R. § 402.02, is contrary to law. Previous Federal court rulings have reached similar conclusions (see *Sierra Club v. U.S. Fish and Wildlife Service*, 245 F.3d 434 (5th Cir. 2001) (held regulation to be facially invalid); *American Motorcycle Ass'n District 37 v. Norton*, Civ. No. C03-0209-S.I. (N.D. Cal., Aug. 3, 2004) (California Desert Conservation Area case)). Due to the strategic importance of the 9th Circuit ruling, the potential effects of the ruling on recent and prospective biological opinions, and the need for interim measures to be in place while the Department proceeds with a proposed rulemaking early next year that addresses this ruling, the following guidance is provided to Service biologists conducting Section 7 consultations pending the adoption of any new regulatory definition of "destruction or adverse modification."

Destruction or adverse modification determinations will be made using the analytical framework described below. First, however, I (along with our counsel in the Solicitor's Office) want to emphasize that when we conduct a Section 7 consultation that involves the evaluation of whether a Federal agency action is likely to destroy or adversely modify designated critical habitat, we do **not** cite to or use the regulatory definition of "destruction or adverse modification" at any point in the consultation process. In fact, our biological opinion should state explicitly that we do not rely on this regulatory definition, using this language:

> "This biological opinion does not rely on the regulatory definition of "destruction or adverse modification" of critical habitat at 50 C.F.R. 402.02. Instead, we have relied upon the statutory provisions of the ESA to complete the following analysis with respect to critical habitat."

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Analytical Framework for Adverse Modification Determinations

Until we have promulgated a new regulatory definition of "destruction or adverse modification," our evaluation of effects to proposed or designated critical habitat should consider the statutory concepts embodied in Sections 3 (the definitions of "critical habitat" and "conservation"), 4 (the procedures for delineating and adjusting areas included in a designation), and 7 (the substantive standard in paragraph (a)(2) and the procedures in paragraph (b)). The analytical framework described here will guide Service biologists in applying these considerations in Section 7(a)(2) consultations on Federal actions that may affect designated critical habitat, and to Section 7(a)(4) conferences on proposed critical habitat, when conference is requested by the Federal action agency. The following framework is intended to be applied as a whole since the individual parts have no meaning outside of the context of this guidance.

1. In the "Status of the Species/Critical Habitat" analysis in the biological opinion, discuss the entire designated critical habitat area in terms of the biological and physical features that are essential to the conservation (discussion of "survival" in this and other sections of the adverse modification analysis is not appropriate) of the species. This analysis should identify and discuss the primary constituent elements of the critical habitat (as described in the final rule) and, very importantly, the current condition, the factors responsible for that condition, and the conservation role of individual critical habitat units.

   Many critical habitat designations pre-date the requirement for identification of primary constituent elements that are essential for the conservation of the listed species. In consultations on actions that involve this type of critical habitat, the best available scientific and commercial data should be used to determine and document these elements or habitat qualities.

2. In the "Environmental Baseline" analysis, discuss the current condition of the critical habitat unit(s) in the action area, the factors responsible for that condition, and the conservation roles of the unit(s), with appropriate supporting documentation. In particular, discuss the relationship of the affected unit(s) in the action area to the entire designated or proposed critical habitat with respect to the conservation of the listed species, unless the proposed or final rule designating critical habitat has already clearly done so.

   Based on the results of this analysis, we will have a clear and credible basis for determining the significance of any adverse or beneficial effects of the action (and cumulative effects) on the function and conservation role of the affected unit(s).

3. In the "Effects of the Action" analysis, characterize the direct and indirect effects of the action and those of interrelated and interdependent actions on the proposed or designated critical habitat. Describe how the primary constituent elements or habitat qualities essential to the conservation of the species are likely to be affected and, in turn, how that will influence the function and conservation role of the affected critical habitat unit(s). This part of the analysis should focus exclusively on the effects to critical habitat. Conservation activities (e.g., management, mitigation, etc.) outside of critical habitat should not be

considered when evaluating effects to critical habitat. Based on the analyses under (1) and (2) above, discuss the significance of anticipated effects to critical habitat.

4. In the "Cumulative Effects" analysis, characterize the effects of future, non-Federal actions reasonably certain to occur in the action area in terms of how the primary constituent elements or habitat qualities essential to the conservation of the species are likely to be affected and, in turn, how that will influence the function and conservation role of the affected critical habitat unit(s). Based on the analyses under (1) and (2) above, discuss the significance of these anticipated effects to critical habitat.

5. In the "Conclusion" section, following the standard text, present the reasons why we reached our 7(a)(2) conclusion. Discuss whether, with implementation of the proposed Federal action, critical habitat would remain functional (or retain the current ability for the primary constituent elements to be functionally established) to serve the intended conservation role for the species, based on the analyses under (1) **through** (4) above.

Reevaluation of Existing Biological Opinions

Over the next few months Federal action agencies are likely to examine, in the context of the 9th Circuit ruling in *Gifford Pinchot*, consultations that have been completed on a variety of Federal actions. The Solicitor's Office has advised us that this review should not be premised on the theory that the ruling has necessarily invalidated all existing opinions. We recognize, however, that these reviews may result in a number of requests for reinitiation of formal consultation to examine more closely "no destruction or adverse modification" conclusions. This analytical framework should be used in any reinitiated consultations. Please work with the action agencies to give the appropriate priority to any reinitiated consultations, in light of other consultations with these agencies and your available resources.

This guidance is provided to enhance national consistency in the conduct of Section 7 consultations (and conferences) where effects to designated (and proposed) critical habitat are being evaluated, in light of recent Court decisions; it does not set forth binding legal interpretations. This guidance will be in effect until a new regulation has been adopted or revised guidance issued. Please contact Patrick Leonard, Chief, Division of Consultation, Habitat Conservation Planning, Recovery, and State Grants, at (703) 358-2171 if you have any questions.

Appendix C: 2010 Crosswalk Between the Bull Trout Matrix of Pathways and Indicators (MPI) and Primary Constituent Elements (PCEs) of Proposed Critical Habitat

Crosswalk between the Bull Trout Matrix of Pathways and Indicators (MPI) and Primary Constituent Elements (PCEs) of Proposed Critical Habitat

The Matrix of Pathway Indicators (MPI) for bull trout is used to evaluate and document baseline conditions and to aid in determining whether a project is likely to adversely affect or result in the incidental take of bull trout.

The MPI analysis incorporates 4 population indicators and 19 physical habitat indicators. Analysis of the habitat indicators can provide a thorough evaluation of the existing baseline condition and potential project impacts to the PCEs of proposed critical habitat for bull trout. Table 1 shows the relationship between the PCEs for bull trout critical habitat and the MPI habitat indicators.

The following paragraphs describe how the MPI indicators are related to evaluating the function of each PCE for proposed bull trout critical habitat.

1. ***Springs, seeps, groundwater sources, and subsurface water connectivity (hyporehic flows) to contribute to water quality and quantity and provide thermal refugia.***
   The analysis of *floodplain connectivity* considers the hydrologic linkage of off-channel areas with the main channel and overbank-flow maintenance of wetland function and riparian vegetation and succession. Floodplain and riparian areas provide hydrologic connectivity for springs, seeps, groundwater upwelling and wetlands and contribute to the maintenance of the water table. The analysis of *changes in peak/base flows* addresses subsurface water connectivity and *substrate embeddedness* addresses inter-gravel flows. *Increase in drainage network* and *road density and location* address potential changes to groundwater sources and subsurface water connectivity. *Streambank condition, floodplain connectivity* and *riparian conservation areas* address groundwater influence. C*hemical contamination/nutrients* addresses concerns regarding groundwater water quality.

2. ***Migratory habitats with minimal physical, biological, or water quality impediments between spawning, rearing, overwintering, and freshwater and marine foraging habitats, including but not limited to permanent, partial, intermittent, or seasonal barriers***.
   Physical, biological or chemical barriers to migration are addressed directly through water quality habitat indicators, including *temperature, sediment, chemical contamination/nutrients* and *physical barriers*. The analysis of these indicators assess whether barriers have been created due to impacts such as high temperatures or high concentrations of turbidity or contaminants. Analysis of *change in peak/base flows* and *average wetted width/maximum depth ratio* assess whether changes in flow might create a seasonal barrier to migration. An analysis of *refugia* considers the habitat's ability to support strong, well distributed, and connected populations for all life stages and forms of bull trout.

3. ***An abundant food base, including terrestrial organisms of riparian origin, aquatic macroinvertebrates, and forage fish.***

Floodplain connectivity and *riparian conservation areas* provide habitat to aquatic invertebrates, which in turn provide a forage base for bull trout. *Pool frequency and quality* and *substrate embeddedness* contributes to the variety and density of aquatic invertebrates and other fish species. Changes in *temperature, sediment*, and *chemical contaminants and nutrients* affect aquatic invertebrate production.floodplain and riparian areas provide habitat to aquatic invertebrates, which in turn provide a forage base for bull trout. The combined analyses of all the Matrix habitat indicators and the other seven PCEs provide information to assess whether there is an abundant food base in the analysis area. Therefore, any impairment to the food base will be addressed by way of summarizing the biological and habitat indicators.

4. Complex river, stream, lake, reservoir, and marine shoreline aquatic environments and processes with features such as large wood, side channels, pools, undercut banks and substrates, to provide a variety of depths, gradients, velocities, and structure.

Large woody debris increases channel complexity and creates pools and undercut banks, so the analysis of the current amounts and sources of *large woody debris* available for recruitment is pertinent to this PCE. *Pool frequency and quality* considers the number of pools per mile as well as the amount of cover and temperature of water in the pools. *Average wetted width/maximum depth ratio* is an indicator of channel shape and pool quality. Low ratios suggest deeper, higher quality pools. *Large pools,* consisting of a wide range of water depths, velocities, substrates and cover, are typical of high quality habitat and are a key component of channel complexity. Analysis of *off-channel habitat* describes side-channels and other off-channel areas. *Streambank condition* analyzes the stability of the banks, including features such as undercut banks. The analysis of both *riparian conservation areas,* and *floodplain connectivity, disturbance history, and disturbance regime* includes the maintenance of habitat and channel complexity, the recruitment of large woody debris, and the connectivity to off-channel habitats or side channels. Complex habitats provide refugia for bull trout and in turn, analysis of *refugia* assesses complex stream channels. All of these habitat indicators consider the numerous characteristics of instream bull trout habitat and quantify critical components that are fundamental to creating and maintaining complex instream habitat over time.

5. Water temperatures ranging from 2 to 15 °C (36 to 59 °F), with adequate thermal refugia available for temperatures at the upper end of this range. Specific temperatures within this range will vary depending on bull trout life-history stage and form; geography; elevation; diurnal and seasonal variation; shade, such as that provided by riparian habitat; and local groundwater influence.

This PCE is addressed directly by the analysis of *temperature*. It is also addressed through consideration of *refugia,* which by definition is high quality habitat of appropriate temperature. Availability of refugia is also considered in analysis of *pool frequency and quality* and *large pools*. *Average wetted width/maximum depth ratio* is an indication of water volume, which indirectly indicates water temperature, i.e., low ratios indicate deeper water, which in turn indicates possible refugia. This indicator in conjunction with *change in peak/base flows* is an indicator of potential temperature and

refugia concerns particularly during low flow periods. *Streambank condition, floodplain connectivity,* r*oad density and location* and *riparian conservation areas* address the components of shade and groundwater influence, both of which are important factors of water temperature. Stable streambanks and intact riparian areas, which include part of the floodplain, typically support adequate vegetation to maintain thermal cover to streams during low flow periods. *Road density and location* addresses the potential contributions of warm water discharges from stormwater ponds.

6. ***Substrates of sufficient amount, size, and composition to ensure success of egg and embryo overwinter survival, fry emergence, and young-of-the-year and juvenile survival. A minimal amount (e.g., less than 12 percent) of fine substrate less than 0.85 mm (0.03 in.) in diameter and minimal embeddedness of these fines in larger substrates are characteristic of these conditions.***

The analyses for *sediment* and *substrate embeddedness* assess substrate composition and stability in relation to the various life stages of the bull trout as well as the sediment transportation and deposition. *Large woody debris* and *pool frequency and quality* affect sediment transport and redistribution within a stream and assessment of these indicators will clarify substrate composition and amounts. Analysis of *streambank condition* will provide insight into the amount of fine sediment contribution.

7. ***A natural hydrograph, including peak, high, low, and base flows within historic and seasonal ranges or, if flows are controlled, they minimize departures from a natural hydrograph***.

The analysis of *change in peak/base flows* considers changes in hydrograph amplitude or timing with respect to watershed size, geology, and geography. Analyses of *floodplain connectivity, increase in drainage network, road density and location, disturbance history,* and *riparian conservation areas* provides further information regarding possible interruptions in the natural stream hydrology. *Floodplain connectivity* considers the hydrologic linkage of off-channel areas with the main channel. Roads and vegetation management both have effects strongly linked to a stream's hydrograph. *Disturbance regime* ties this information together to consider how a watershed reacts to disturbance and the time required to recover back to pre-disturbance conditions.

8. ***Sufficient water quality and quantity such that normal reproduction, growth, and survival are not inhibited.***

The quantity of permanent water will be considered in the analyses for PCE 4 natural hydrograph and PCE 5 springs, seeps, and groundwater, which include *floodplain connectivity, changes in peak/base flows, drainage network increase, disturbance history,* and *disturbance regime*. Analysis of *temperature, sediment, and chemical contaminates and nutrients* consider the quality of permanent water. Current listing under 303(d) and 305(d) status should be considered, as well as the causes for that listing. Analysis pertinent to sediment should address turbidity.

9. ***Few or no nonnative predatory (e.g., lake trout, walleye, northern pike, smallmouth bass; inbreeding (e.g., brook trout); or competitive (e.g., brown trout) species present.***

This PCE is not well covered by existing MPI analyses. Some information may be available from analyses of population indicators, particularly the "persistence and genetic integrity" indicator.

Table 1. MPI indicators relevant to each of the Primary Constituent Elements of proposed bull trout critical habitat (2010 version).

Diagnostic Pathway/Indicator	*PCE 1 - Springs, seeps, groundwater	PCE 2 - Migratory Habitats	PCE 3 - Abundant food base	PCE 4 - Complex habitats	PCE 5 - Water Temperature	PCE 6 - Substrate features	PCE 7 - Natural Hydrograph	PCE 8 - Water quality and quantity	PCE 9 - Predators and competitors
Water Quality									
Temperature		x	x		x			x	
Sediment		x	x			x		x	
Chemical Contaminants and Nutrients	x	x	x					x	
Habitat Access									
Physical Barriers	x	x	x						x
Habitat Elements									
Substrate Embeddedness	x		x			x			
Large Woody Debris				x		x			
Pool Frequency and Quality			x	x		x			
Large Pools				x	x				
Off-Channel Habitat				x					
Refugia		x			x				x
Channel Conditions and Dynamics									
Wetted Width/Maximum Depth Ratio		x		x	x				
Streambank Condition	x			x	x	x			
Floodplain Connectivity	x		x	x	x		x	x	
Flow/Hydrology									
Changes in Peak/Base Flows	x	x			x		x	x	
Drainage Network Increase	x						x	x	
Watershed Conditions									
Road Density and Location	x				x		x		
Disturbance History				x			x	x	x
Riparian Conservation Areas	x		x	x	x		x		
Disturbance Regime				x			x	x	
*Updated for 2010 proposed rule Khalupka 2-24-10									

Appendix D: Riparian Function

Riparian Function

Background information

To assess the adequacy of riparian conservation proposals, the Service considers a suite of component riparian functions that includes stream bank stability, shade, litterfall and nutrient input, large woody debris recruitment, floodplain function, sediment/bedload transport, and microclimate factors that can affect both aquatic conditions and the short and long-term function of the riparian forest ecosystem. Because these ecological elements interact in complex ways, the adequacy of riparian conservation measures is based on a synthesis of judgments of the relative levels of individual function based on published and regional literature. For example, judgments about large woody debris function will be based on the riparian buffer widths, the probability of (functionally-sized) tree fall in relation to distance from the stream, and site-tree heights of dominant and subdominant species in a mature riparian forest

The adequacy of the riparian conservation measures in the proposed DNRC HCP were judged at several spatial scales and with consideration of the management frameworks already in place or likely to be implemented in the near future. One scale is the stream reach scale. However, larger policy and acceptable risk considerations should consider the forested landscape in Montana that supports HCP fish species, such as bull trout, and the baseline conditions within those component watersheds or core areas for HCP fish species. To that end an analysis was done to estimate the condition of riparian forest stands, the type of representative streams they support, and the area and distribution of riparian management zones that might occur with assumed applications of the proposed HCP. The habitat complexity conservation strategy under the HCP addresses the riparian functions that support the habitat components important for the HCP fish species. In addition, the sediment reduction strategy also addresses these functions as well. The individual measures of these strategies would be applied programmatically.

The value of the riparian conservation measures in the DNRC HCP proposal should accrue over time as riparian and instream conditions improve through passive (conservation) and active (restoration) activities. Conversely, short-term risks that are expected to become apparent may be accepted in order to achieve the overall conservation goals and desired future conditions. Temporal factors that were taken into account in the consideration of the HCP proposal were the following (although not limited to): 1) the rate of timber harvest (and other forest and grazing management activities), road management actions (inventories, construction, reclamation, etc.) grazing management (license inspections/renewals, vegetation surveys, corrective actions), conservation and restoration actions, transportation planning, and MEPA processes on HCP project lands; and 2) the term length of the Permit as influenced by the proposed time to successfully fulfill the full complement of minimization and mitigation measures developed in the HCP.

The rate of riparian timber harvest by DNRC on HCP project lands was an important consideration in determining the effects on riparian functions as it relates to effects on HCP fish species. For example, historical rates may be different than present annual rates because of variable wood products market and other factors. In addition, conversion of timber lands,

especially on adjacent private lands, to other uses has occurred at high rates and continues to increase at a substantial rate as population growth expands in such areas as the upper Flathead Valley, Bitterroot Valley, and the Swan Valley (although a slower rate in the Swan). There are obviously many ecological benefits to maintaining riparian areas within forest management rather than developed areas. DNRC acknowledged this issue and developed the transitions lands strategy for the HCP in order to keep intact over the long-term the riparian conservation values in major river valley corridors within the HCP project area.

Riparian forest conditions are thought to vary with site productivity, dominant species, successional pathways, and the stand age proposed to represent mature riparian forest conditions. Generally, mature forest conditions that begin to be manifested at about 80 years in conifer stands reflect the natural vegetative succession from a single-age class to a stand with multiple age classes and diverse structure (Bilby and Ward 1991). Since conifer stands begin to differentiate by about age 80, and may be considered fully mature by about age 200, the mid-point, or age 140 could be considered as the juncture at which defines the structure and stand condition that will result in the future condition for any particular site. The DNRC HCP considered stand age at maturity in development of the habitat complexity conservation strategy.

Managing for the diversity of riparian forest conditions is a recognized ecological feature of the riparian zone, and was incorporated into the DNRC HCP. Although forest management is generally designed for conifer-dominant stands, some riparian sites were unlikely to have ever been conifer-dominant and other currently mixed conifer-hardwood sites or shrub-dominated sites with low numbers of conifers have been maintained for many decades and provide diversity over the landscape. This DNRC HCP strategy is consistent with an ecological goal to allow disturbance and recovery processes to take place as normally as possible (Bisson et al. 1997). Under the DNRC HCP, management of riparian areas should help to maintain the ranges of conditions produced by natural disturbance regimes, including a frequency distribution of riparian forest successional stages that resembles those in un-managed watersheds over long time periods.

The design of riparian management zones and determination of allowable levels of disturbance therein, should be balanced with the silvicultural treatments of riparian ecosystems (stand growth and succession) to maintain, or accelerate, achievement of riparian functions in the short-term. However, it is recognized that instream conditions may lag behind achievement of desired riparian condition hence longer periods of time may be needed in order to detect the subtle changes that would benefit HCP fish species. Riparian functions can be achieved well before conditions in the channel become optimum because in some cases active management may forgo short-term large woody debris (LWD) input. In other words, instream conditions are often the result of episodic riparian and watershed disturbances that may have occurred over many decades (Sullivan et al. 1987). Instream conditions are generally not tightly linked to riparian management, consequently, conservation measures should be designed to assure that riparian conditions are functional rather than instream conditions. The DNRC HCP was designed to focus on conserving the most important riparian functions that would benefit HCP species, both in the short-term and the long-term.

FEMAT buffer widths

The Forest Ecosystem Management Assessment Team developed a report (FEMAT report) that provides a conceptual framework for understanding the interactions of riparian areas, stream ecology, and fish habitats (USDA et al. 1993). The riparian process effectiveness curves, which are based on tree heights in the FEMAT report, have been used as an interim basis for federal aquatic conservation strategies and proposed by some for use in framing revisions to state forest practice rules. The curves show the effectiveness of riparian processes as a function of distance from stream channel and suggest that riparian processes are 100% effective within a maximum distance from a stream channel, and that additional effectiveness is not achieved beyond that point. Published scientific literature and technical reports support the notion that the patterns are asymptotic. The FEMAT curves also suggest that the effectiveness of the processes decreases rapidly and non-linearly with increasing distance from the streambank and is supported in the scientific and technical literature.

Riparian forests exhibit a wide range of variation of tree growth (e.g., stand productivity) according to such factors as elevation, riparian land form (floodplain, low terrace, high terrace, or slope), herbivory, temperature, and topographic moisture (Gregory et al 1991). The more productive sites would play a greater role in meeting riparian function than less productive sites. More productive sites would have taller trees that grow faster in diameter (in addition to more understory shrubs) and would therefore be expected to better provide litter-fall, shade, and LWD than similarly aged riparian forests on less productive sites. A common metric to determine the productivity of a riparian site (and ultimately how fast and tall a tree would grow) is the "site index." The site index is a measure of forest productivity expressed as the height of the dominant trees in a stand at an index age – in other words, the height of which a tree will grow under forest conditions in 100 years for most old-growth species.

USDA et al. (1993) in the FEMAT report recommended to federal agencies (BLM, Forest Service) that riparian buffer widths be based on "site potential tree height," which is the distance represented by the approximate mid-point of site classes (i.e., site conditions) projected to a stand age of 100 years for example. Site potential tree height, as defined by FEMAT, is a "tree that has attained the average maximum height possible given the site conditions where it occurs." As indicated above, more productive sites would be expected to better provide various riparian functions than similarly aged riparian forests on less productive sites. Calculation of riparian stand requirements by productivity site class (site class is determined based on groupings of the site index) using existing yield tables (usually reported by the USDA Natural Resource Conservation Service, or U.S. Forest Service) is often an approach that gives landowners a simple way to manage and conserve riparian forests with a high assurance of attaining or conserving appropriate riparian functions.

The FEMAT report (USDA et al. 1993) established a generalized set of curves based on tree height (distance from channel) as the basis for establishing riparian buffer widths for Federal land management agencies (BLM, Forest Service). Federal agencies have utilized site potential tree height distance for the determination of riparian reserve widths in order to address management of aquatic species that are threatened and endangered. The set of generalized

curves indicate the riparian forest effect on streams as a function of buffer width for four principle ecological functions, which are root strength, litter fall, shade, and coarse woody debris (USDA at al. 1993). The curves (commonly known as the FEMAT curves) suggest that a buffer width of one site potential tree height (on both sides of the stream channel) provides close to 100 percent shading effectiveness and similarly provides for maximum availability of coarse woody debris in the stream. A buffer width of one-half the height of site potential tree height provides close to maximum litter-fall and for maximum effectiveness for root strength (i.e., streambank stability).

Federal programs like INFISH (USFS 1995) originally adopted interim riparian buffer widths of two site potential tree heights (300 feet) on both sides of fish-bearing streams until watershed analysis is performed, presumably to develop better site-specific prescriptions and practices (O'Laughlin and Belt 1995). The rationale for doubling of the site potential tree heights was not clear, but may have to do with responding to declining stocks of fish (Nehlson et al. 1991) and riparian dependent wildlife (USDA et al. 1993). No functional explanation was provided in any of the federal documents, but some have suggested that it may have to do with recruiting large woody debris (LWD) into the buffer zone (for an unstated purpose) (O'Laughlin and Belt 1995). However, it may be due to studies that suggest non-channelized sediment flow rarely travels more than 300 feet and that 200-300 foot riparian "filter strips" are generally effective at protecting streams from sediment than from non-channelized flow (USFS 1995, Packer 1967, Swift 1986, Burroughs and King 1989 and 1985). Still others have suggested that the large buffer widths are a conservative approach during the 18-month interim period (1998 - 2000) until watershed analyses can be performed and that the main purpose of this approach is to streamline Section 7 consultations under the Act (O'Laughlin and Belt 1995).

The Federal agency buffer widths based on the FEMAT curves has been criticized as not science-based, to restrictive for management, one-size fits all; based on upland forest data, too subjective, and lacking new scientific information about riparian process relationships (Oregon Forest Industries Council 1999). The conservative approach of applying two site potential tree heights may be due to the larger federal mandates and regulations that federal management strategies have to apply over broad geographic areas that occur throughout the Pacific Northwest (Light et al. 1999). INFISH is a more risk-averse strategy because of the requirement by federal agencies to promote recovery of listed species under the Act, whereas, non-federal entities are required only to allow for, or not preclude recovery. Moreover, federal lands comprise a much greater proportion of habitat for HCP fish species than the HCP project area lands, which warrants even more conservative approach to riparian management as often occurs under INFISH.

The Service is not aware of evidence that HCP fish species including the most sensitive, bull trout, require 300-foot buffers. However, the scientific literature contains many studies that document risks of ground disturbing and harvest activities within one site-potential tree height. As expressed above, functions such as bank stability, nutrient input, and shading generally occur near the stream. Large woody debris recruitment generally approaches its maximum within a site potential tree height or less. Any further distance beyond a site potential tree height clearly shows diminishing returns. The DNRC HCP riparian timber harvest conservation strategy was

developed with the understanding that the majority of stream and riparian functions are addressed within a site-potential tree height of the stream. For most of the HCP project area, a site-potential tree height for various riparian stand types is expected to range from 80 to 120 feet.

DNRC HCP's Use of Site Potential Tree Height for Establishing Riparian Buffer Width

An existing forest management rule (ARM 36.11.425) requires DNRC to establish an RMZ on fish-bearing streams equal to the average site potential tree height (SPTH) at stand age 100 years. Tree height at 100 years is determined using site index curves developed by the USFS Rocky Mountain and Intermountain Research Stations (USFS 1980). The site index of a stand is determined by measuring tree height and age directly from suitable index trees located within the SMZ portion (first 50 feet from the edge of the stream channel) of the RMZ. Under the HCP, all Class 1 streams would receive an RMZ buffer width based on a 100-year site index tree height. DNRC anticipates conducting approximately 32 to 64 acres of RMZ harvest adjacent to Class 1 streams on an annual basis within the HCP project area.

Site index tree height at age 100 years for a given site was selected by DNRC as the most practical and effective indicator for identifying the area where forest practices are most likely to affect riparian functions and biological objectives addressed under this strategy. The site index tree height at age 100 years in most DNRC streamside riparian stands generally ranges from approximately 80 to 120 feet. The actual site index is largely dependent on the soil and climate of the landscape and other factors affecting the specific productivity of an individual site, but it is measurable at each site.

DNRC, with assistance from the Service, designed the riparian timber harvest conservation strategy to ensure that post-harvest riparian stand conditions are adequate to maintain the riparian functions most important to HCP fish species habitat. DNRC based the strategy on scientific research on riparian buffer widths required to maintain adequate levels of buffer function, including LWD recruitment potential, retaining adequate levels of shade, and maintaining streambank stability necessary to provide habitat suitable for supporting HCP fish species (Brown and Krygier 1971; Martin et al. 1985; USDA et al. 1993; Davies and Nelson 1994; Gomi et al. 2003; Sugden and Steiner 2003). This strategy was intended to focus on those critical riparian functions most likely to be affected by timber harvest and, at the same time, the most influential on the habitat of the HCP fish species. Riparian functions specifically addressed in this strategy are LWD recruitment, stream shading (used as a surrogate for stream temperature), and streambank stability. However, the riparian harvest conservation strategy is expected to meet or contribute to Montana DNRC HCP management objectives for sediment and microclimate functions as well. The values reported in the literature for shade retention, LWD recruitment, bank stability, nutrient loading and chemical filtering are all well within the range of 100-year site index tree heights occurring adjacent to streams supporting HCP fish species on forested trust lands.

The HCP riparian timber harvest strategy will result in the retention of all trees and shrubs within 50 feet of a stream, and nearly all shrubs, sub-merchantable trees, and at least 50 percent of the trees greater than or equal to 8 inches dbh from within the remaining RMZ. Therefore, it is expected that on average, approximately 80 percent of the basal area will be retained within the

RMZ following this prescription. In addition, DNRC has indicated that it is likely that a majority of timber harvests in the RMZ will retain a higher concentration of trees adjacent to the no-harvest buffer, which in turn would reduce or eliminate effects to microclimate (Final EIS/HCP, HCP, Chapter 2, 2010).

Riparian functions, SPTH, and the HCP Riparian Timber Harvest Conservation Strategy

The potential recruitment of LWD to stream channels from adjacent forest stands is generally limited to an area located within a width equal to or less than the 100-year site index tree height as measured from the edge of the stream channel. This conclusion is well documented in the literature and is commonly used to delineate the width of SMZs or RMZs. In a study of streams in southeast Alaska, Murphy and Koski (1989) found that almost all (99 percent) identified sources of woody debris in streams were within 100 feet of the stream bank. Nearly half of the woody debris came from trees located on the lower bank (less than 3 feet away) and 95 percent was from trees within 66 feet of the stream. McGreer (1994) reported a study by Andrus and Froehlich in the Oregon Coast Range in 1992 in which 70 to 90 percent of all LWD recruitment was found to occur within 100 feet of streams. McDade et al. (1990) reported that 85 to 90 percent of LWD recruitment comes from within 100 feet of stream channels in western Oregon. Robison and Beschta (1990) concluded that the probability of recruitment was primarily a function of tree distance from the stream and that part of the tree height that would provide woody debris of a minimum diameter to a stream.

The effectiveness of various widths of riparian forest in providing shade to streams is also closely tied to 100-year site index tree heights. Studies have shown that approximately 80 percent of shade effectiveness occurs within 0.5 SPTH, and 90 percent effectiveness occurs within 0.7 SPTH (Oregon Forest Industries Council 1999). A review of the available literature by Castelle and Johnson (2000) concluded that maximum shade produced in forest stands located adjacent to a stream was achieved within 56 to 98 feet of the stream channel. Steinblums et al. (1984) evaluated the effectiveness of 40 different streamside buffer widths in western Oregon and concluded that 90 percent of maximum angular canopy density (a measure of the density of canopy actually capable of shading the stream) could be obtained within a 56-foot) buffer.

As the bulk of organic nutrients tend to be input from an area within approximately one-half the SPTH (Oregon Forest Industries Council 1999; Castelle and Johnson 2000), the HCP riparian timber harvest strategy should provide an adequate mechanism for the range of nutrient loading rates that would be expected to occur in the different regions of forested western Montana. Furthermore, because most chemical filtering by a riparian zone occurs within a width equal to approximately a 100-year site index tree height, the strategy will help to provide the range of chemical filtering rates that would be expected to occur in the different regions of forested western Montana (Castelle and Johnson 2000).

The DNRC HCP riparian timber harvest conservation strategy addresses the critical riparian functions described most important to HCP fish species. The width of an effective riparian buffer is a commonly used function to measure aquatic habitat integrity. A buffer width of about 0.75 tree height is effective at protecting over 80 percent of the LWD functions. Other ecological

functions (stream shading, root strength, and litter fall) are effective with smaller riparian buffers (USDA et al. 1993). The analysis of the effects of the riparian timber harvest on these riparian functions in the FEIS/HCP (2010) provides a high degree of certainty that the buffer widths and associated RMZ prescriptions will likely avoid or minimize the effects on riparian functions that support the habitat needs of the HCP fish species.

Appendix E Road Density

Road Density

DNRC's current transportation system involves about 2,646 miles of roads in watersheds supporting HCP fish species in the HCP project area. About 700 miles of existing roads on HCP project lands are within 300 feet of a stream and 63 miles of these within known HCP fish species streams. DNRC would construct another 1,100 miles of new roads during the 50-year permit period. Road density overall in the HCP project area is 3.1 miles per square mile and would increase to 4.7 miles per square mile by the end of the Permit term. The majority of roads that occur in the HCP project area watersheds are of geology with parent materials of low to moderate erosion potential where sediment travel distances from forest roads are limited to drainage outfalls at stream crossings or if the road erosion rate is unusually high such as during active hauling during wet periods (Woods et. al 2006).

New roads within some portions of the HCP project would likely change the natural hillslope drainage network and could accelerate erosion processes. These changes could alter or exacerbate the physical processes in nearby streams, leading to changes in streamflow regimes, sediment transport and storage, channel bed and bank configurations, substrate composition, and stability of slopes adjacent to the streams (MBTSG 1998; Furniss et al. 1991). These changes could potentially have significant effects for HCP fish species in the action area, particularly in watersheds where fish may already be stressed due to degraded habitat conditions.

High road densities can contribute to increased peak flows, but to varying degrees, and depending on local conditions. Scientific literature indicates variable responses of peak flows related to road density (peak flows exceeding a two-year recurrence interval) in the Pacific Northwest. While Jones and Grant (1996) identified increases in small peak flows (less than 2-year runoff events), this was not identified for larger peak flows (Thomas and Megahan 1998). In the Rockies, King and Tennyson (1984) studied road construction effects on peak flows in six watersheds and did not find any significant effect on flood flows.

McGreer et al. (1998) suggested that a cause-and-effect relationship of road impacts should not be attributed to road density because the impacts of roads on streams is predominantly dependent upon road location, design, construction, and maintenance practices. Some studies of these factors have shown that a cause-and-effect relationship exists only between road surface drainage characteristics and sediment delivery. Nevertheless, other studies have documented aquatic habitat or fish density changes associated with road density or indices of road density (Trombulak and Frissell 1999). Eaglin and Hubert (1993) showed a positive correlation with numbers of culverts and stream crossings and amount of fine sediment in stream channels, and a negative correlation with fish density and numbers of culverts on the Medicine Bow National Forest, Wyoming. Macro invertebrate diversity has also been demonstrated to be negatively correlated with an index of road density (McGurk and Fong 1995). Lee et al. (1997b) concluded the best indicator of management intensity was predicted road density, and that overlaying road density on the location of key salmonid populations showed that the strongest populations

occurred with areas of lowest road densities.

It seems reasonable to assume that watersheds with higher road densities would have greater potential to deliver sediment to nearby streams. The implication is that high road densities can be detrimental to fish resources in the affected streams. An environmental review published in the monthly newsletter of Environmental Science and Policy (Environmetal Review 11. No. 5 May 2004) asked the question of Dr. Bruce Reiman, who is considered by the scientific community an expert on bull trout because of his extensive research, "How does road density affect bull trout?" The following is his answer:

"*At least in the data sets that we have worked with one of the best predictors of the status for bull trout populations is road density. There are lots of reasons why road density could be a good predictor of the status of the fish. Roads can influence erosion and therefore water quality, they can influence the timing and volume of runoff, they can be vectors for the introduction of nonnative species like brook trout, and roads can bring in fishermen. We don't know exactly what it is about roads, but there is a strong association between the status of bull trout populations and the density of roads in a given system. We've seen that in the broad picture across the Columbia River Basin and we've seen it in the work we've done in the Boise River Basin.*

The implication is that the kinds of things that come with roads can be detrimental to bull trout habitats, but it doesn't mean that if you build a road you're going to see a decline in bull trout. It just means that the probability of a negative effect increases."

Considering sediment impacts only, some research suggests that sediment production from forest roads is highly variable from road segment to road segment and that most road segments produce little sediment (Luce and Black 1999). McGreer et al. (1998) suggested that sources of sediment delivery from certain road segments in the Thompson River watershed in western Montana can be identified and therefore treated individually. For example, they found that nine individual locations delivered 76 percent of the total sediment volume in Boiling Springs Creek. On Goat Creek in the Swan Valley, five stream crossings contributed 70 percent of the total sediment delivered by roads to the watershed. In both the Goat Creek and Piper Creek watersheds, the majority of sediment was determined to come from a minority of stream crossings. Overall for both watersheds, less than 5 percent of road mileage was considered to actually deliver sediment to streams (Watson et al. 1997). This implies that managing sediment production of the few highest risk segments would be most efficient in preventing or reducing risk of sediment delivery to streams.

According to Baxter et al. (1999), in the Swan River sub-basin in Montana changes in bull trout redd densities over time were negatively correlated with road densities, and the protection of critical spawning tributary catchments from additional road building and associated land use disturbance will likely be necessary to maintain viable bull trout populations in the Swan River sub-basin. However, this bull trout core area population remains as one of the population

strongholds throughout its entire range (as it has historically) with about 2000 adults (USFWS 2009). Redd counts are stable despite the existing high road densities. In fact, the major threat to this population is the recent population expansion of nonnative lake trout into the system (USFWS 2009). This indicates that the relationship between road densities and resiliency of bull trout populations is not entirely clear.

DNRC's existing roads network is comprised of roads constructed before establishment of state BMPs, and are probably the single greatest source of sediment input within the HCP project area. The predicted reductions in sediment delivery could result in significant improvement in habitat conditions for HCP fish species. However, the magnitude of improvement may not be sufficient to benefit HCP fish species where baseline conditions are already highly degraded. Even small amounts of fine sediment delivered annually to a highly embedded stream can be enough to maintain degraded baseline conditions, which would not then benefit HCP fish species (Rhodes et al. 1994). In turn, relatively small shifts in fine sediment in spawning habitat can cause major changes in bull trout survival at the egg-fry stages (Weaver and Fraley 1991).

Although substantial reductions in sediment delivery from roads are anticipated, the effect of the DNRC HCP on reduction of sediment in stream channels is unknown, because the response is likely to vary from stream to stream. Where sediment delivery to streams remains well-above the natural background rates, after BMPs are applied, a stream may still not have the capacity to transport the excess sediment out of the system in most years. Consequently, the recovery time could be very long in some cases (Rhodes et al. 1994). In such instances, applying additional sediment reducing measures, as well as not engaging in any sediment producing activities, such as construction of new roads whatsoever, may be the appropriate management action.

It is well established that forested roads generate erosion, and even in the presence of old roads that have been treated with BMPs and closed to traffic, sediment from these roads cannot be turned off all at once. Closing and upgrading existing roads and constructing new roads to higher standards in a damaged watershed may not be adequate in all cases to recover the watershed and associated fish habitat in time to allow a local population of a sensitive species, such as bull trout, to recover. Although some mechanisms of increased road surface erosion and hydrologic change can be minimized by BMPs, some mechanisms are inherent to watershed and site conditions (e.g., slope steepness, stream network density, and geologic instability) and are not readily controllable by BMPs or improved road design (USDA et al.1993; Furniss et al. 1991; Packer 1967). The DNRC HCP attempts to take into account these site-specific conditions in degraded watersheds through the cumulative watershed effects analysis, the result of which would be improvement to the existing baseline by the implementation site-specific measures (in addition to BMPs) as directed by a hydrologist, especially at those sites that are most problematic.

The construction of 1,100 miles of new roads on DNRC HCP project lands could impact HCP fish species habitats in the affected reaches where road segments are constructed in close

proximity to streams or at stream crossings.. These impacts would be localized to the watersheds and local populations where the roads are built. Despite the estimates of increased sediment loads, the exact magnitude of sediment impacts resulting from new road construction under the HCP is difficult to discern and quantify because not all of the locations of new roads are known at this time, nor their design and development. For example, even though the HCP will attempt to minimize stream crossings, new roads will require fill to be used for the construction of additional stream crossings. How much of this fill will enter the stream and what its fate will be in terms of impacts on the aquatic system is difficult to predict. The effects of these added road miles and associated roadside ditches may substantially increase the drainage network on project lands. These roads may further cause compaction of forest soils, resulting in increased surface runoff which may contribute to increase stream peak flows. During normal high flow events, the added stream power may help mobilize coarse bedload, and depending on magnitude and timing, could cause potential physical displacement and/or direct mortality of bull trout and salmon eggs and juveniles.

With respect to the potential risk of impacts of roads under the DNRC HCP, no construction of new forest roads would be the only known way to ensure that no new or additional impacts to HCP fish species would occur, particularly in currently unroaded watersheds or drainage areas. Many adverse effects of roads cannot be fully minimized or successfully mitigated 100 percent (Furniss et al. 1991). Increasing road densities could increase the potential risk of land slides, road crossing failures, fill-slope failures, and debris avalanches, which can cause immediate sediment entry into fish bearing streams, as well as other impacts that result, directly or indirectly. Although roads can have very different effects on water resources depending on location and construction, all else being equal, higher total road densities in a watershed increase the risk for aquatic system functioning and associated fish resources than lower total road densities.

The Service believes that road density is a general indicator of potential watershed problems because road density is correlated with many types of watershed alterations, and it is useful when more specific indicators are not available. However, it is unknown and unproven that road densities *per se* cause fish populations to decline when roads exceed some specific density. Certain portions of road systems create the majority of negative effects associated with roads—those segments built on erodible soils, on steep or unstable slopes, and in close proximity to streams. Because of this, the DNRC HCP road commitments focus on specific problem road segments, road reclamation in locations where roads are not needed, and implementation of immediate corrective actions in high and moderate priority watersheds.

DNRC HCP Effects Related to Road Density

The DNRC HCP includes commitments that would reduce road density, but it does not place a limit on road density. To meet DNRC's unique needs as a state public agency with significant road access requirements such as: 1) accessing forest stands for management and hauling timber to market, 2) providing public access to various recreational resources, 3) providing access to

adjacent land ownerships, and 4) patrolling forested areas for fire suppression. Road access agreements with private, county, and Federal landowners often have specific stipulations that mandate open vehicle access across some HCP lands. Due to these and other constraints, a strategy of managing impacts from roads through a road density threshold was not pursued. Instead, DNRC has committed to managing existing roads and newly constructed roads in ways that will reduce the direct (and indirect) impacts to HCP fish species and their habitat. These include the following:

- Minimize the number of roads to those necessary to meet near- and long-term forest management needs. To meet this requirement DNRC must confine road building to only those roads that are absolutely needed. Because road construction is included in the costs of a timber sale, more roads increase project development costs leading to lower market value of logs and less revenue for the school trusts. Additionally, once built, roads are a capital investment which requires funds for monitoring and maintenance. DNRC has also committed, to the extent practicable, avoiding road construction within riparian zones; and to removing road segments from riparian areas whenever the opportunity and resources allow.

- Reduce potential sediment delivery from existing road sources to streams supporting HCP fish species. To reduce sediment delivery from existing road sources DNRC primarily uses applicable Montana Forestry BMPs. Road inspections and other road inventory activities are the primary mechanism used to identify existing and potential sources of road erosion and sediment delivery to streams. DNRC typically implements actions aimed at reducing or eliminating identified or potential sources of sediment from existing roads at the project level. These actions usually consist of various road improvements, road maintenance activities, and road upgrades that have been identified within the project area and are intended to bring the existing roads up to a standard that complies with BMPs. The HCP commitments include a timeline for completing road inventories in watersheds supporting HCP fish species, a prioritization scheme for implementing corrective actions, and a timeline for identifying and implementing corrective actions.

- Construct, reconstruct, maintain, abandon, reclaim, and use roads with practices and measures that reduce the risk of sediment delivery to streams supporting HCP fish species. DNRC applies the SMZ Law and ARMs and applicable Montana Forestry BMPs.when addressing all road management actions. The SMZ Law and ARMs regulate road-related activities conducted immediately adjacent to streams, lakes, and other bodies of water. One of the primary objectives of the SMZ Law is to provide effective sediment filtration from forest road related activities to maintain high water quality. For example, the SMZ Law prohibits the construction of roads in an SMZ except when necessary to cross a stream and prohibits road fill material from being deposited within an SMZ during road construction, except as necessary to construct a stream crossing. Under the HCP, DNRC would do the following: 1) a DNRC water resource specialist would review proposed road activities potentially affecting HCP fish species habitat to provide direction for appropriate sediment abatement measures, 2) as needed design and implement site-specific mitigation measures above and beyond standard BMPs, and 3) conduct adequate monitoring and adaptive management on both the

implementation and effectiveness of the road management conservation measures in order to improve implementation of the measures or to make adjustments as necessary.

- Conduct timber harvest and associated operations (site preparation, slash treatment, reforestation) with practices and measures that reduce the risk of sediment delivery to streams supporting HCP fish species. DNRC timber harvest, yarding, landing, site preparation, and slash treatment operations are designed to implement all appropriate Montana Forestry BMPs. The proper application of appropriate BMPs has been repeatedly demonstrated to minimize sediment transport and delivery from timber-harvest-related activities. As mentioned above, the SMZ Law and ARMs regulate timber harvest activities conducted immediately adjacent to streams, lakes, and other bodies of water. Provisions of the HCP also include: 1) providing a process for ensuring adequate review by a DNRC water resource specialist of harvest activities potentially affecting HCP fish species habitat, 2) designing and implementing site-specific mitigation measures, and 3) providing adequate feedback using both implementation and effectiveness monitoring.

- Conduct gravel excavation, processing, hauling, and use for DNRC forest management projects with practices and measures that reduce the risk of sediment delivery to streams supporting HCP fish species. DNRC will not develop gravel pits within SMZs and RMZs. DNRC will design and implement site-specific BMPs and other mitigation measures to reduce the risk of sediment delivery to streams affecting HCP fish species from all gravel pits. A DNRC water resource specialist will make recommendations that will be integrated into the development of contract specifications, permits, and Plans of Operation

As described above (and elsewhere in this BO), the DNRC HCP would manage specific impacts of roads by utilizing a suite of measures that would reduce the potential risk of sediment delivery to a stream. These collective actions are expected to adequately minimize and mitigate effects of impacts from roads on HCP fish species and their habitats. The HCP also includes sufficient adaptive management flexibility to ensure that, in those cases where the proposed approach is not as effective as necessary in conserving HCP fish species, management can be modified as necessary.