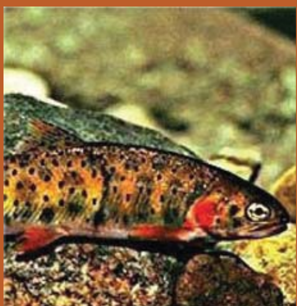
DOI FES 10-46

September 2010



Montana Department of Natural Resources and Conservation

Forested State Trust Lands

Habitat Conservation Plan

Final EIS

Environmental Impact Statement

Volume I

Montana Department of Natural Resources and Conservation

U.S. Department of the Interior
Fish and Wildlife Service

Final Environmental Impact Statement
for the
Montana Department of Natural Resources and Conservation Forested Trust Lands Habitat Conservation Plan

Lead Agencies

U.S. Department of the Interior, U.S. Fish and Wildlife Service

and

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Abstract

The Montana Department of Natural Resources and Conservation (DNRC) has applied for an incidental take permit (Permit) authorizing the take of terrestrial and aquatic species under Section 10 of the Endangered Species Act, relative to forest management activities on forested state trust lands. In compliance with both the National Environmental Policy Act and Montana Environmental Policy Act, this Final Environmental Impact Statement (Final EIS) has been prepared to evaluate the environmental effects of the proposed action and three alternatives. The no-action alternative is evaluated based on potential effects of not issuing a Permit and continuing under the state's current forest management program. This Final EIS also evaluates three action alternatives, which represent conservation strategies for the Habitat Conservation Plan (HCP) species. The three action alternatives represent varying levels of conservation commitments and management flexibility under which the USFWS would potentially issue a Permit for incidental take. The Draft EIS was published in June 2009 and made available for review at http://dnrc.mt.gov/HCP. Following a 90-day public comment period on the Draft EIS, the USFWS and DNRC reviewed and responded to comments in writing and modified the EIS and proposed HCP as appropriate. These changes are summarized in the Preface included as part of this Final EIS. Public comments on the Draft EIS and responses to those comments are provided in Appendix G. This Final EIS is being published for additional public review. DNRC will then prepare a Record of Decision formally documenting the conservation strategies it will implement for covered species, while the USFWS will prepare a Record of Decision formally documenting its decision on whether to issue a Permit.

Preface

Introduction

In June 2009, the United States Fish and Wildlife Service (USFWS) and Montana Department of Natural Resources and Conservation (DNRC) published their Draft Forested Trust Lands Habitat Conservation Plan (HCP) Environmental Impact Statement (EIS). This Draft EIS/HCP was distributed to more than 100 agencies, tribal governments, organizations, businesses, and individuals. An electronic copy of the Draft EIS/HCP was also made available on the project website (http://dnrc.mt.gov/HCP/).

The 90-day Draft EIS/HCP review period began June 26, 2009, and was extended to October 9, 2009. Nearly 170 unique comment letters and emails were received, containing over 700 individual comments. Of the unique letters, two were form letters submitted by multiple individuals. Appendix G of this Final EIS summarizes the letters and comments received, and it provides responses to substantive comments.

After review of the comments received on the Draft EIS/HCP, the USFWS and DNRC have prepared this Final EIS/HCP, which includes modifications to the Draft EIS/HCP and responses to public comments on the Draft EIS/HCP. Modifications to the EIS/HCP include (1) substantive modifications made to the proposed HCP (preferred alternative), as well as any associated modifications to the EIS analysis, and (2) minor editorial modifications to the EIS/HCP.

In the Final EIS/HCP, substantive modifications from the Draft EIS/HCP are shown as gray-shaded text (for new text) and ~~strikethrough~~ (for deleted text). However, some of the modifications to the HCP commitments (described below) resulted in changes to the EIS/HCP that are global in nature. The following changes are not shown in grayshade/strikethrough:

1. EIS and HCP
    a. changes from Tier 1 to Class 1 streams and lakes (for Alternatives 1 and 2) and to Class 1 streams supporting HCP fish species (for Alternatives 3 and 4)
    b. changes from Tier 2 to Class 1 streams and lakes supporting non-HCP fish species
    c. changes from Tier 3 to Class 2 and 3 streams and lakes
2. EIS Alternative 2 and HCP – changes in the no-harvest buffer width from 25 to 50 feet
3. EIS and HCP – changes in numbering of the lynx habitat commitments (LY-HB)
4. EIS and HCP – changes in numbering of the riparian timber harvest commitments (AQ-RM)
5. EIS and HCP – changes in the riparian management zone (RMZ) width from one site potential tree height (SPTH) to one 100-year site index tree height

6. EIS and HCP – changes to the maximum height of a 100-year site index tree from 100 to 120 feet.

Additionally, for updated numerical tables in the EIS and HCP, only new numbers are shown. Deleted numbers are not shown to preserve the format and readability of the updated tables.

Minor editorial modifications from the Draft EIS/HCP are not identified. These modifications include editorial corrections and clarifications in the EIS/HCP that did not alter the context or content of the HCP commitments or EIS analysis.

Summary of Substantive Modifications to the EIS/HCP

Substantive modifications to the proposed HCP (preferred alternative), as well as any associated modifications to the EIS, were made based on (1) public comments on the Draft EIS/HCP; (2) discussions with Canada lynx researcher John Squires (U.S. Forest Service), whose ongoing research was deemed relevant to finalizing the EIS/HCP; (3) recent legal rulings and litigation; (4) clarification of information presented in the Draft EIS; and (5) recent guidance from the Council on Environmental Quality (CEQ) at the federal level and suggestions from the USFWS regarding how to address climate change in federal National Environmental Policy Act (NEPA) documents. Substantive modifications are those where new information is provided or new or different conclusions are reached. These modifications are summarized in this section.

Changes to the Proposed HCP (Preferred Alternative)

GRIZZLY BEAR CONSERVATION STRATEGY

Draft HCP Section 2.1.1 (Grizzly Bear Conservation Strategy) was revised to include two new commitments addressing helicopter use for forest management activities (GB-PR8 and GB-CY5).

1. **GB-PR8.** DNRC added this program-wide commitment to limit low-altitude helicopter use and flight paths over known seasonally important areas in grizzly bear recovery zones or non-recovery occupied habitat (NROH), scattered parcels in rest in recovery zones, grizzly bear subzones in rest in recovery zones, and/or federally designated security core areas in recovery zones.

   Reason for the change: Like other motorized activities, helicopter use can affect bears. To address this gap in the HCP commitments, DNRC added a new commitment to minimize and potentially avoid effects of helicopter use on bears.

2. **GB-CY5.** DNRC added this Cabinet-Yaak Ecosystem (CYE) commitment to avoid effects on bears from low-altitude helicopter use by avoiding use in and flight paths over scattered parcels in rest or federally designated security core areas.

   Reason for the change: Like other motorized activities, helicopter use can affect bears. To address this gap in the HCP commitments and avoid the potential for incidental take in the CYE, DNRC added a new commitment to avoid effects from helicopter use on bears in the CYE.

LYNX CONSERVATION STRATEGY

Several changes were made to Draft HCP Section 2.1.2 (Lynx Conservation Strategy). These changes were made based on comments from Montana Fish, Wildlife and Parks (MFWP), which were received during the public comment period and raised concerns about (1) the exclusion of big game winter range from consideration as suitable lynx habitat and (2) recent findings by local research biologist Dr. John Squires on lynx use of foraging habitats.

1. **LY-HB1.** DNRC changed the lynx habitat mapping protocols to include areas classified as big game winter range. This change added 58,000 acres to the amount of potential lynx habitat where HCP commitments would apply.

   Reason for the change: This change came about as a result of comments from MFWP and discussions between DNRC and the USFWS about the assumptions behind the mapping protocol. The original mapping protocol excluded big game winter range areas because densities of competing predators (e.g., mountain lions and coyotes) were deemed likely high in these areas such that the area would be poorly suited for appreciable use by lynx. However, upon further review, the USFWS and DNRC determined there was little evidence in the literature substantiating competition between coyotes and lynx. Recent research also indicates that the two species' winter food habits are highly segregated on HCP project area lands (Kolbe et al. 2007). Mountain lions are the lynx's primary natural predator, but this predation almost always occurs during the snow-free months when ungulates (and their predators) are dispersed on their summer ranges (Squires, personal communication, as cited in MFWP's comment letter on the Draft EIS/HCP dated October 7, 2009).

2. **LY-HB2.** DNRC removed the commitment to retain a minimum of two natural or manmade piles of woody debris per square mile as potential lynx den sites. As a result of this change, Draft HCP commitments LY-HB3 through LY-HB7 were renumbered as LY-HB2 through LY-HB6 in the Final HCP. Also, Draft HCP commitment LY-HB2 item (2) regarding retention of blowdown salvage was incorporated into the commitment to maintain coarse woody debris (CWD) (Final HCP commitment LY-HB2).

   Reason for the change: In prior communications and at a December 22, 2009, meeting with the HCP planning team, Dr. Squires indicated that the Draft HCP commitment LY-HB2 – Den Site Attributes, to retain 2 slash piles per square mile as potential future den sites would likely provide little in the way of meeting habitat needs for lynx because the availability of den site structures at the landscape scale are not particularly limited in abundance or limiting for lynx. Rather, DNRC will monitor timber sales to ensure that the application of the CWD commitments do in fact provide sufficient den sites for lynx. DNRC anticipates the commitments related to CWD would ensure that the raw materials needed for lynx den sites would be available on HCP project area lands within lynx habitat. By implementing Final HCP commitment LY-HB2 for CWD and retention of blowdown salvage, as well as the Administrative Rules of Montana (ARMs) 36.11.411 for snags and snag recruits, DNRC would continue to provide assurances that woody structure needed by lynx at broad scales would not become limiting in the future. DNRC anticipates these commitments would result in the retention of two future den sites per square mile as discussed in Draft HCP commitment LY-HB2 such that this commitment is no longer necessary.

3. **LY-LM3.** DNRC changed the foraging habitat commitment to maintain 20 percent winter foraging habitat within lynx management areas (LMAs) instead of 20 percent of winter and summer foraging habitat in any combination within LMAs. Additionally, DNRC added a pre-commercial thinning requirement. Within pre-commercial thinning projects that target saplings in lynx habitat in LMAs, DNRC will be required to identify and retain unthinned 20 percent of each thinning project area.

   Reason for the change: Between development of the Draft and Final HCPs, DNRC and the USFWS identified two potential gaps in the current lynx strategy related to pre-commercial thinning and lynx habitat use in summer. Based on additional information provided by Squires (2009, personal communication), both agencies were concerned that DNRC's young foraging and winter foraging habitat definitions in the Draft HCP would not adequately capture the structural stand conditions lynx prefer to use in summer.

   Also, Squires (2009, personal communication) re-iterated (based on Griffin 2004) that pre-commercial thinning is detrimental to snowshoe hares, and depending on where it happens on the landscape, it can affect lynx. Therefore, DNRC added the commitment described above. By ensuring that 20 percent of sapling stands would be retained until they reach the DNRC sawtimber size class, both potential gaps would be addressed. This commitment would provide greater assurances that dense sapling stands important for hares, and slightly more mature summer habitat used by lynx (provided over time as dense sapling stands age and grow), would be prevalent on HCP project area lands within landscapes known to be important for lynx (i.e., LMAs). Considering a range of likely growth estimates and sapling sizes at the time of thinning within retention patches, the retained portions would likely provide dense habitat conditions favorable for hares and lynx for about 10 to 30 years beyond the time the remainder of the stand was pre-commercially thinned (assuming an average radial growth range of 0.125 to 0.375 inch per year). This commitment would also promote a diversity of dense patches and thinned patches, which is consistent with the philosophy of the State Forest Land Management Plan (SFLMP) and with natural disturbance patterns. Under this approach, DNRC has developed a summer habitat definition using improved parameters from Squires et al. (2010 in press) for the purpose of tracking and reporting lynx habitat under the HCP.

Aquatic Conservation Strategies

Several changes were made to Draft HCP Section 2.2 (Aquatic Conservation Strategies).

1. **AQ-RM1.** In the Final HCP, this commitment in the riparian timber harvest conservation strategy applies to all Class 1 streams and lakes, rather than just HCP fish-bearing streams. This extends the RMZ commitment developed in the HCP to non-HCP fish-bearing streams and perennial streams connected to all fish-bearing streams. As originally proposed, the commitments for non-HCP fish-bearing Class 1 streams (Draft HCP commitment AQ-RM2) would have been the same as under the current ARMs for Forest Management. Additionally, DNRC extended the no-harvest buffer within the HCP RMZ from 25 to

50 feet. As a result of including all Class 1 streams and lakes in commitment AQ-RM1, commitment AQ-RM2 was removed, and commitment AQ-RM3 was re-numbered to AQ-RM2 in the Final HCP.

Reason for the change: Expanding the commitment to all Class 1 streams simplifies the application of the overall RMZ strategy for DNRC's field practitioners and eliminates the need for a new classification system (what was referred to as the "tier" system in the Draft HCP). Extending coverage to all Class 1 streams encompasses perennial streams that discharge to HCP fish-bearing streams. Enhancing streamside shade and opportunities for large woody debris (LWD) recruitment in upstream tributaries would help maintain the temperature and LWD regimes of the HCP fish-bearing streams into which these streams discharge. Extending the no-harvest buffer helps ensure minimization of long-term risks to critical riparian functions (shade, LWD, channel form and function, temperature) and increases the certainty that these functions would be provided comprehensively when considering the environmental variation that exists in riparian areas in the HCP project area. In doing so, DNRC anticipates it will meet with more certainty the Endangered Species Act (ESA) Section 10 standard of "minimizing and mitigating the impacts of take to the maximum extent practicable." While the science is not yet clear how a no-harvest buffer would make a difference in terms of climate change, doubling the width of the no-harvest buffer is also a proactive approach to help insulate streams in harvest units against potential effects of climate change.

2. **AQ-SD2 item (6).** DNRC changed this commitment to restrict or reclaim, rather than restrict or abandon, roads that are non-essential to near-term future management needs.

   Reason for the change: This change was made to better address potential long-term future management needs of such roads because abandoned roads retain drainage structures that may become maintenance issues in the future. When roads are reclaimed, all drainage structures are removed, thereby avoiding future maintenance needs.

3. **AQ-SD2 item (9).** For addressing roads with shared ownership, DNRC expanded this commitment to include road segments with a moderate risk of sediment delivery, rather than just road segments with a high risk of sediment delivery.

   Reason for the change: This change was made to establish consistency in DNRC actions where they own the road (commitment AQ-SD2 item (8)), versus where they are cooperators (commitment AQ-SD2 item (9)).

Commitment Allowances

In response to comments on the Draft EIS/HCP, the USFWS and DNRC reviewed the allowances included in several of the conservation strategy commitments. In the Final EIS, these commitments were clarified to identify instances when a commitment simply cannot be met due to impracticability versus instances where DNRC may elect to not implement a commitment through an allowance. In a few cases, DNRC may simply not be able to implement a commitment through no fault of its own. Those commitments that include instances of impracticability require disclosure in DNRC Montana Environmental Policy Act (MEPA) documentation and 5-year summaries reported to the USFWS. In the Final HCP, all allowances now include a limit on their use (see Final HCP Chapter 2, Conservation Strategies) and/or require annual reporting to the USFWS so that both agencies can avert any chances that an allowance may be exceeded (see Final HCP Chapter 4, Monitoring and Adaptive Management).

Transition Lands Strategy

In the Final HCP, DNRC updated the discussion of lands that may be considered for addition to the HCP project area and revised the limits on the amount of lands that may be removed from the HCP project area (HCP Chapter 3, Transition Lands Strategy). When this strategy was originally developed in 2005, DNRC did not anticipate (1) the potential acquisition of large amounts of former Plum Creek Timber Company lands, and, as a result, (2) the expectation that DNRC would dispose of a commensurate amount of lands, some of which could be in the HCP project area (see Draft HCP Chapter 3, Transition Lands Strategy). In general, the Montana State Legislature, the Montana Board of Land Commissioners, and the public support DNRC's buying, selling, and exchanging of state trust lands to configure the land base for increased public access and management efficiency. However, there is an expectation that DNRC will generally maintain a consistent amount of state-owned lands over time. This means that some sale of lands must occur to balance out the potential large acquisitions. Therefore, DNRC may need additional flexibility to sell of some parcels currently included in the HCP project area. To address this need in the Final HCP, the cap on the removal of lands outside grizzly bear recovery zones, NROH in the CYE, LMAs, and bull trout core areas has been modified so that it can be increased from 10 percent to 15 percent if, and only if, DNRC adds 15,000 acres or more to the HCP project area.

Monitoring and Adaptive Management

The following changes were made to Draft HCP Chapter 4 (Monitoring and Adaptive Management).

1. **Table 4-2, Summary of Grizzly Bear HCP Implementation Monitoring, and Table 4-4, Summary of Lynx HCP Implementation Monitoring:** These tables were revised to clarify the role of both parties when management responses are required.

   Reasons for the change: For the most part, the changes require the collaborative development of corrective actions. When the appropriate corrective action is known, the specific measures were included in the table. Both agencies feel these changes better clarify roles and expectations in the monitoring process.

2. **Section 4.6.1, Riparian Timber Harvest Monitoring and Adaptive Management, subsection Temperature Monitoring Approach:** The stream temperature monitoring approach was revised in the Final HCP to ensure protection of native fish species from increased stream temperatures by including criteria for determining the maximum increases attributable to harvest. These changes include a new table (Table 4-8) that summarizes the tiered exceedance criteria for non-temperature-sensitive stream reaches.

   Reason for the change: These changes were made based on comments received on the Draft HCP and through subsequent conversations between DNRC and the Montana

Department of Environmental Quality (MDEQ). These changes ensure compliance with MDEQ standards and ensure that no degradation of aquatic habitat conditions would occur.

HCP Implementation

The following changes were made to Draft HCP Chapter 8 (HCP Implementation).

1. The HCP implementation costs have been updated in Section 8.1.1 (Estimated Costs of the HCP) to reflect the changes between the Draft and Final HCP.
2. Section 8.1.3 (How DNRC Will Fund the HCP) has been updated to
   a. Reflect the recent legislative approval of increased funding for HCP implementation
   b. Describe potential funding sources for implementation costs associated with changed circumstances
   c. Clarify how projects in progress at the time of Permit issuance would be handled by DNRC.
3. Table 8.2 has been revised to reflect the changes in HCP commitments and numbering.

Changes to the EIS

Alternatives Considered but Eliminated from Detailed Analysis

In the Final EIS, the discussion of alternatives considered but eliminated from detailed analysis (Section 3.5) was revised to include a discussion of a no-take strategy as an alternative that provides a different approach to ESA compliance. Additionally, in response to comments on the Draft EIS, the USFWS and DNRC considered but eliminated from detailed analysis an alternative that would require less road building. This discussion was added as a new section (Section 3.5.5, Alternatives Considered between the Draft EIS and Final EIS) to the Final EIS.

Climate Change

Several modifications were made in the Final EIS to address concerns raised in public comments about climate change and to ensure consistency with federal NEPA guidance on considering climate change for federal projects and in NEPA documents. These modifications include the following.

1. A new resource section (Section 4.1, Climate) was added to the Final EIS. The affected environment portion of this section includes the description of climate presented in Draft EIS Section 4.1 (Introduction), as well as a discussion of what climate change is; why it is happening; what is known (or not known) about the types of and direction and magnitude of trends globally, regionally, and locally; and responses to climate change at the global, national, state, and local levels. The environmental consequences discussion provides an analysis of the potential contribution to the production of greenhouse gases from road building and timber harvest projected under each alternative.

2. For each resource area (Section 4.2, Forest Vegetation, through Section 4.13, Socioeconomics), effects of and trends in climate change on that resource are discussed in the affected environment section. In the environmental consequences section, climate trends are factored into the analysis of potential effects of the alternatives.

3. Much of the text discussing climate change in Draft EIS Section 4.9.6 (Effects of the Changed Circumstances Process) and the section discussing climate change in Draft EIS Chapter 5 (Cumulative Effects) were deleted.

Annual Sustainable Yield

The annual sustainable yield for the proposed HCP (Alternative 2) was recalculated due to (1) changes to the lynx conservation strategy commitments (described above) and (2) a wider no-harvest buffer applied to more streams in the riparian timber harvest conservation strategy. The re-calculated annual sustainable yield is presented in the Final EIS, and the analyses of resource effects based on this yield were revised accordingly.

Affected Environment and Environmental Consequences

In addition to the resource-specific changes mentioned above for climate change, the analysis of effects for each resource in Final EIS Chapter 4 (Affected Environment and Environmental Consequences) was revised to reflect the changes made to the proposed HCP (Alternative 2). For bull trout and gray wolf, recent legal developments were also included. Specific changes made in Final EIS Sections 4.8 (Fish and Fish Habitat) and 4.9 (Wildlife and Wildlife Habitat) are discussed below.

Fish and Fish Habitat

The analysis of potential effects on aquatic resources in Final EIS Section 4.8 (Fish and Fish Habitat) was revised to capture the expected effects on and benefits to riparian functions from changes to the riparian timber harvest conservation strategy (described above).

The discussion of bull trout critical habitat in Final EIS Section 4.8 (Fish and Fish Habitat) was updated to reflect the revised designation proposed by the USFWS and issued for public comment in January 2010 (75 Federal Register 2270-2431). Table 4.8-17 was revised to show miles of bull trout critical habitat based on this revised designation.

Wildlife and Wildlife Habitat

The analysis of potential effects on grizzly bears was revised in Final EIS Section 4.9.3 (Grizzly Bears) to capture the expected effects on and benefits to bears from the addition of HCP commitments GB-PR8 and GB-CY5, which address low-altitude helicopter use for forest management activities.

The analysis of potential effects on lynx was revised in Final EIS Section 4.9.4 (Canada Lynx) to capture the expected effects on and benefits to lynx from modifications to the lynx denning and foraging habitat commitments (described above). Tables 4.9-18 through 4.9-21 were also updated to reflect the additional acres that would be subject to the lynx commitments and changes to lynx habitat categories (i.e., young forage is now summer forage). Additionally, a map of lynx critical habitat was added to the Final EIS (Figure D-20 in Appendix D, EIS Figures), and Draft EIS Figures D-20 through D-22 were renumbered in the Final EIS to Figures D-21 through D-23.

The analysis of effects of the transition lands strategy on both terrestrial and aquatic HCP species (Final EIS Section 4.9.5) was revised to include more detailed information regarding potential near-term land acquisitions by DNRC and how HCP species occurring on those lands may be affected by HCP implementation if the lands are added to the HCP project area.

Final EIS Section 4.9.7 (Other Wildlife Species) was updated to reflect more current information regarding population status and legal harvest in Montana, as well as the August 2010 decision by the U.S. District Court that set aside the USFWS' May 2009 de-listing of the gray wolf in Montana and Idaho.

Executive Summary

Introduction

The Montana Department of Natural Resources and Conservation (DNRC) has prepared a habitat conservation plan (HCP) for forest management activities on Montana's forested state trust lands (forested trust lands). These lands are managed by DNRC's Trust Land Management Division (TLMD). The mission of the TLMD is to manage trust land resources to produce revenues for the trust beneficiaries while considering environmental factors and protecting the future income-generating capacity of the land. Under its forest management program, the TLMD generates revenues for trust beneficiaries through timber harvest on classified forest trust lands. The lands are managed in accordance with the State Forest Land Management Plan (SFLMP) (DNRC 1996) and the Administrative Rules of Montana (ARMs) for Forest Management Title 36, Chapter 11, Subchapter 4 (ARMs 36.11.401 through 456) (Forest Management ARMs). Montana's forested trust lands also support federally listed threatened species. ARM 36.11.428 directs DNRC to confer with the United States Fish and Wildlife Service (USFWS) to develop habitat mitigation measures to address the needs of listed species. This proposed HCP is a programmatic plan that identifies DNRC's proposal for managing federally listed species on forested trust lands in accordance with the direction contained in the SFLMP and Forest Management ARMs.

An HCP is a long-term management plan prepared under the Endangered Species Act (ESA) to conserve threatened and endangered species (16 United States Code [USC] 1531 et seq.). Section 10 of the ESA authorizes a landowner to develop a conservation plan to minimize and mitigate, to the maximum extent practicable, the~~any~~ impacts of incidental take of~~to~~ threatened and endangered species while conducting lawful activities such as harvesting timber on state trust lands. The HCP is part of the application for obtaining an incidental take permit (Permit) from the USFWS in accordance with Section 10(a)(1)(B) of the ESA. The Permit would authorize ~~the Permit holder (~~DNRC~~)~~ to take federally listed species that are covered under the HCP. ~~The DNRC HCP covers forest management activities on forested trust lands that provide habitat for species currently listed or having the potential to be listed under the ESA (HCP species).~~

Issuance of the Permit ~~in this circumstance~~ by the USFWS is considered a major federal action that may affect the quality of the human environment, thus requiring preparation of an environmental impact statement (EIS) under the National Environmental Policy Act (NEPA) (Section 101 [42 USC 4331]). The decision by DNRC, as the applicant, to develop and implement the HCP is considered a major state action that may affect the quality of the human environment, thus requiring preparation of an EIS under the Montana Environmental Policy Act (MEPA) (Montana Code Annotated [MCA] 75-1-201 (1)(b)(iv)). This EIS has been prepared to comply with both NEPA and MEPA, with the USFWS as the lead agency for the NEPA component and DNRC as the lead agency for the MEPA component. This EIS describes the potential effects of the proposed action (implementation of the HCP and issuance of the Permit) by evaluating the effects resulting from implementation of the HCP and other action alternatives over the Permit term.

HCP Species

Five HCP species are included in the proposed HCP. Three of these species are listed as threatened under the ESA:

- Grizzly bear (*Ursus arctos horribilis*)
- Canada lynx (*Lynx canadensis*)
- Bull trout (*Salvelinus confluentus*).

Two additional aquatic species are included as HCP species should these species become listed during the Permit term:

- Westslope cutthroat trout (*Oncorhynchus clarkii lewisi*)
- ~~Columbia~~Interior redband trout (*Oncorhynchus mykiss gairdneri*).

The Interior redband trout is also commonly known as the Columbia River redband trout, Columbia redband trout, redband trout, and Columbia River interior redband trout and is herein referred to as the Columbia redband trout.

Permit Term

DNRC has proposed that the Permit be issued by the USFWS for a period of 50 years. DNRC views the HCP as a long-term program for addressing and improving habitat needs across the landscape. This Permit term was selected by DNRC to ensure that it would have sufficient time and funding to implement the conservation strategies and make adjustments through adaptive management where needed. This period also helps ensure that the cost and effort of obtaining the Permit would be offset by the long-term advantage of ensuring that ESA regulatory requirements were met for those HCP species listed or likely to be listed over the next 50 years. ESA regulatory certainty will help DNRC plan forest management activities without concern that those activities might be subject to additional ESA regulatory restrictions due to the presence of a listed HCP species.

As part of its review of the Permit application, the USFWS will evaluate the proposed Permit term ~~to ensure that it is an adequate timeframe in which to fully mitigate for the expected incidental take of listed species~~while considering the four factors outline in the 5 Points Policy (USFWS and NMFS 2000) for determining the Permit term: (1) the duration of the applicant's proposed activities and expected positive or negative effects on the HCP species, (2) the extent of information underlying the HCP, (3) the length of time necessary to implement and achieve the benefits of the operating conservation program, and (4) the extent to which the program incorporates adaptive management strategies.

HCP Project Area

DNRC evaluated which trust lands to cover in the HCP by assessing where lands within the distribution of the HCP species overlapped with trust lands containing appreciable amounts of manageable forest acreage. This approach was adopted to meld the geographic area where risk to those species was deemed greatest with the lands where DNRC forest management activities are most likely to occur in the foreseeable future.

The HCP project area includes 548,500 acres of trust lands within three DNRC land offices (Figure ES-1), the Northwestern Land Office (NWLO), Southwestern Land Office (SWLO), and Central Land Office (CLO). The HCP project area includes primarily forested trust lands (446,100 acres), but it contains other non-forested trust lands (102,400 acres) that are portions of, or are needed to access, forested parcels included in the HCP project area.

The HCP project area occurs on both blocked and scattered parcels across the three land offices. Blocked lands refer to the two large, mostly contiguous blocks of DNRC ownership, specifically identified as the Stillwater and Coal Creek State Forests (the Stillwater Block) and the Swan River State Forest. Scattered parcels refer to all other HCP project area lands outside of blocked lands (Figure ES-1).

Covered Activities

The DNRC HCP would cover forest management activities on forested trust lands that provide habitat for the HCP species and include the following:

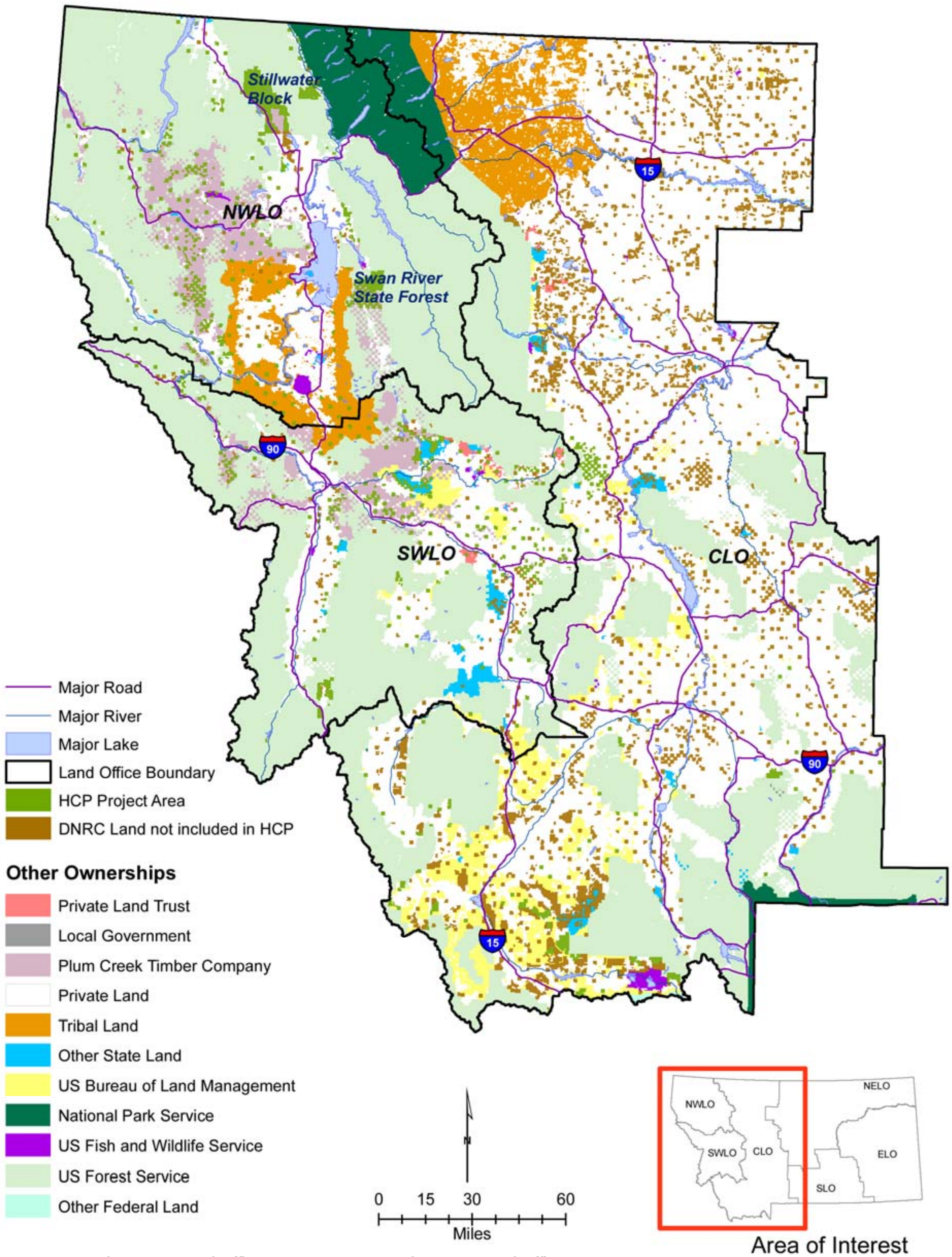
- **Timber harvest.** Includes commercial timber, salvage harvest, and silvicultural treatments such as thinning.
- **Other forest management activities.** Includes slash disposal, prescribed burning, site preparation, reforestation, fertilization, forest inventory, and access to forested lands for weed control.
- **Roads.** Includes forest management road construction, reconstruction, maintenance, use, and associated gravel quarrying for forest road surface materials, as well as installation, removal, and replacement of stream crossing structures.
- **Grazing.** Includes grazing licenses on classified forest trust lands.

EIS Planning Area

The EIS planning area encompasses the geographic area potentially influenced by implementation of the HCP. The planning area consists of the HCP project area and all other lands in the NWLO, SWLO, and CLO, including lands owned by DNRC but not included in the HCP project area and lands owned by others. The planning area demonstrates DNRC's landownership stake in the overall habitat of the HCP species in western Montana and is also used as the cumulative effects analysis boundary for many of the resources analyzed in this EIS.

Purpose and Need for Action

Since this EIS has been prepared to comply with both NEPA (USFWS) and MEPA (DNRC), each agency has identified its own purpose and need for action.



NWLO = Northwestern Land Office
SWLO = Southwester Land Office
CLO = Central Land Office
NELO = Northeastern Land Office
SLO = Southern Land Office
ELO = Eastern Land Office

FIGURE ES-1. LOCATION OF THE PLANNING AREA AND HCP PROJECT AREA

USFWS Purpose and Need for Action

The purpose for which this EIS is being prepared is to

- Respond to DNRC's application for a Permit, which contains a proposed HCP for forest management activities on 548,500 acres of forested trust lands for 50 years. Issuance of the Permit would authorize incidental take, including modification of habitat, for three listed species (grizzly bear, Canada lynx, bull trout) and two non-listed species (westslope cutthroat trout and Columbia redband trout), and would require implementation of the HCP to minimize and mitigate the effects of take of these HCP species to the maximum extent practicable. The Permit application will be evaluated pursuant to ESA Section 10(a)(1)(B) and its implementing regulations and policies.
- Protect, conserve, and enhance the covered species and their habitat for the continuing benefit of the people of the United States.
- Provide a means and take steps to conserve the ecosystems upon which the HCP species depend.
- Ensure the long-term survival of the covered species through protection and management of the species and their habitat.
- Ensure compliance with the ESA, NEPA, and other applicable federal laws and regulations.

The USFWS' need for action is based on the potential that activities proposed by DNRC on covered state trust lands could result in the take of covered species; thus the need for an incidental take permit.

DNRC Purpose and Need for Action

Under the HCP, project area lands would be managed in compliance with the conservation strategies contained in the HCP. The HCP would minimize take and conserve federally listed fish and wildlife species while providing long-term regulatory certainty and flexibility for DNRC's forest management practices on its HCP project area lands. The HCP and associated Implementing Agreement demonstrate how DNRC would minimize and mitigate impacts on the HCP species resulting from otherwise lawful activities DNRC conducts while managing these trust lands. The HCP would provide a significant contribution to the conservation of HCP species and would allow for, or not preclude, the recovery of listed HCP species. If either of the non-listed HCP species becomes listed during the Permit term, the HCP conservation commitments would be sufficient and provide adequate protection under the ESA. The Permit would thus provide long-term regulatory certainty for DNRC for the HCP species.

Forest management activities can alter habitats essential to species listed under the ESA. Significant alteration of essential habitat might constitute take of listed species, which would be prohibited under Section 9 of the ESA, unless otherwise exempted through a Permit. Section 10(a)(1)(B) of the ESA provides non-federal entities, including state agencies, with a legal mechanism to receive authorization to take listed species by obtaining a Permit from the USFWS. In addition, non-listed species can be covered under the Permit if their conservation needs are adequately addressed in the HCP. The federally listed species that currently occur on state lands (grizzly bear, Canada lynx, and bull trout), as well as the two other non-listed HCP species (westslope cutthroat trout and Columbia redband trout), pose regulatory uncertainty for DNRC as the agency conducts forest management activities. This uncertainty could result in significant curtailment of timber harvest or could otherwise decrease management flexibility, which may reduce economic viability on trust lands and DNRC's ability to meet its trust mandate. By obtaining a Permit and managing under the HCP, DNRC seeks to benefit the forest management program by increasing regulatory certainty and ensuring greater economic viability and management flexibility.

Alternatives

DNRC and the Land Board are required by state law to secure the largest measure of legitimate and reasonable advantage and to provide for the long-term financial support of education when managing trust lands (MCA 77-1-202 (a) and (b)). DNRC is bound by this mandate in determining what is practicable when implementing conservation and forest management actions. Those actions that allow DNRC the management flexibility to best sustain its entrusted mandate at reasonable costs while meeting the needs and requirements of its conservation efforts are typically seen as the most practicable. All four alternatives analyzed in detail in the EIS were designed to be viable based on these requirements. These four alternatives are summarized below, and detailed information is provided in Chapter 3 (Alternatives).

Alternative 1 (No Action)

Alternative 1, the no-action alternative, reflects continued implementation of existing rules and regulations (Forest Management ARMs, Montana Forestry Best Management Practices [BMPs], and other conservation measures) pertaining to the five HCP species, and avoidance of take. Under this alternative, the USFWS would not issue a Permit covering DNRC's forest management and related activities. Although it is recognized that the ARMs and other conservation measures may be modified over the next 50 years, it is unknown what changes would occur to existing policies and regulations. Thus, given that future changes in the ARMs, BMPs, and other conservation measures are unknown, the comparison of the action alternatives to Alternative 1 are based on the existing rules and regulations. Alternative 1 includes conservation measures, monitoring, and adaptive management programs captured in the existing rules and regulations pertinent to the five HCP species.

Within the Stillwater State Forest, DNRC currently maintains grizzly bear security core area, which is referred to as the Stillwater Core. Within in this area of about 39,600 acres, all administrative or commercial activities are restricted to the denning period, and there are no salvage harvest allowances unless activities are conducted during the denning period or through helicopter harvest. Road closures are examined and repaired as needed in this area as well.

Alternative 2 (Proposed HCP)

DNRC's proposed HCP consists of individual conservation strategies for grizzly bears, Canada lynx, and three aquatic species. The strategies are a series of commitments regulating DNRC forest management activities on forested trust lands that would be covered by the HCP. The strategies were developed to help conserve the HCP species and the habitats on which they depend. The conservation strategies were developed using background information compiled in the HCP species accounts and through collaborative agreement between the USFWS and DNRC on biological goals and objectives for HCP species. Conservation commitments were then developed that were supported by scientific data and rationale. These commitments address both known scientific information and uncertainties in scientific knowledge, as well as existing data gaps. The individual conservation commitments comprising the conservation strategies are presented in HCP Chapter 2 (Conservation Strategies) in Appendix A (HCP).

The proposed HCP also includes a transition lands strategy that addresses how lands would be moved into or out of the HCP project area~~,~~ and caps the amount of land that could be moved out of the HCP project area. The HCP's ~~as well as a~~ changed circumstances process ~~to~~ addresses natural and administrative events that can reasonably be anticipated by DNRC and the USFWS during the Permit term. These are also included as part of the HCP for Alternatives 3 and 4.

For grizzly bears, DNRC would expand its existing grizzly bear conservation commitments to cover more geographic area and to more fully permeate its program (i.e., rather than just applying commitments at the project level, commitments would also be required in contracts and for agency staff working in the field). DNRC would tier its conservation commitments across a wider geographic area than is covered under the existing program. Some commitments would apply across the entire geographic area comprising the HCP project area, and others would apply within a specific subset of geographic areas. The geographic areas include program-wide, non-recovery occupied habitat (NROH), recovery zones (including the Stillwater Block, the Swan River State Forest, and scattered parcels in recovery zones), the Stillwater Block, the Swan River State Forest, scattered parcels within recovery zones, and the Cabinet-Yaak Ecosystem (CYE).

The overall biological goal of the lynx conservation strategy is to support federal Canada lynx conservation efforts by managing for habitat elements important for lynx and their prey that contribute to the landscape-scale occurrence of lynx, particularly in key locations for resident populations. Similar to the grizzly bear, the lynx conservation strategy would have a tiered approach, where the degree of conservation commitments varies by geographic area, and is based on existing lynx range and habitat, need for conservation, and land ownership patterns. For this alternative, the geographic areas for specific lynx conservation commitments include lynx habitat in the HCP project area and designated lynx management areas (LMAs) in the HCP project area.

For the aquatic conservation strategies, the overall biological goal is to protect bull trout, westslope cutthroat trout, and Columbia redband trout populations and their habitat and to contribute to habitat restoration~~, as appropriate~~. Five aquatic strategies were developed as part of the proposed HCP: (1) riparian timber harvest, (2) sediment delivery reduction, (3) fish connectivity, (4) grazing, and (5) cumulative watershed effects. Most of the commitments would implement existing ARMs, as well as additional commitments developed under this alternative.

Under Alternative 2, the USFWS would be provided assurances that DNRC will implement appropriate minimization and mitigation measures that conserve and support the recovery of HCP species. DNRC has determined that it can implement Alternative 2 and meet its trust mandate, as well as secure the funding necessary to implement the commitments and achieve the timelines identified in this HCP. This level of commitment further provides the USFWS assurances that the conservation strategies can be successfully implemented and monitored and thus conserve and support the recovery of HCP species. DNRC is provided assurances that future management activities can be sustained over time on lands where management activities might affect HCP species. DNRC is also provided assurances that it can maximize the legitimate return to the trust beneficiaries while still responsibly managing the habitats of HCP species.

Under Alternative 2, active forest management would increase in the Stillwater Core~~ would be opened up to active forest management activities~~. DNRC would divide a subset of the area into subzones, which would then be individually rotated between active management and rest to provide grizzly bears with relatively quiet areas free from commercial activity after a period of active management. These areas would also be subject to restrictions on new roads, salvage harvest, and gravel pits.

Alternative 3 (Increased Conservation HCP)

Alternative 3 includes additional mitigation measures beyond those proposed under Alternative 2. Differences from Alternative 2 are summarized below.

Compared to Alternatives 2, increased conservation commitments for grizzly bear under Alternative 3 would include implementation of DNRC-wide food storage and sanitation rules for all departmental activities (not just forest management); more restrictions on motorized activities during the spring period in spring habitat within NROH; more restrictions on motorized activities in or near denning habitat during the spring period within NROH; shorter timeframe for repairing ineffective road closures within recovery zones; similar management as Alternative 1 for designated security core areas within the Stillwater Block; participation in collaborative Section 7 planning for coordination of access management and activities in the Swan River State Forest; no net increase in baseline total road densities for forest management projects at the administrative unit level for scattered parcels in recovery zones; and restrictions on numbers of vehicle trips instead of management days, as well as more spring management restrictions, within the CYE.

For lynx, increased conservation commitments under Alternative 3 would include more restrictions on retention of denning habitat and sites; more restrictions on use of motorized forest management activities and burning near denning habitat within LMAs containing less than 10 percent denning habitat; increased limitations on contiguous occurrences of temporary non-suitable habitat within scattered parcels outside LMAs; requirements for breaks between harvest units of 100 yards of suitable habitat were possible within scattered parcels outside LMAs; and increased levels of potential lynx habitat maintained within LMAs and scattered parcels outside LMAs.

Several increased conservation commitments would also be included for aquatics species under Alternative 3, including more restrictions on harvest within riparian management zones (RMZs) for Class 1 streams and lakes supporting HCP species; shorter timeframes to complete road inventories on all HCP project area watersheds; shorter timeframes to complete corrective actions for all high-risk segments in HCP project area watersheds containing HCP fish species; shorter timeframes to complete connectivity improvements for streams supporting HCP fish species; shorter review cycle for grazing licenses; identification of measurable targets for desired future conditions as grazing license inspection criteria; and requirement of Level 3 watershed analysis whenever an estimated clearcut area on an HCP watershed exceeds 25 percent.

For Alternative 3, the Stillwater Core would be managed as discussed above for Alternative 1.

Alternative 4 (Increased Management Flexibility HCP)

Alternative 4 would increase DNRC's management flexibility to implement its program, as well as the conservation commitments, when compared to Alternative 2. Increased management flexibility for grizzly bear would include fewer restrictions on motorized activities in spring habitat during the spring period within NROH, less restrictive visual screening requirements (same as Alternative 1) in recovery zones, and longer inspection cycle for road closures on scattered parcels, as well as longer timeframe to repair ineffective closures, on scattered lands within recovery zones. Lynx management would include less restrictive retention requirements for lynx habitat, decreased levels of potential lynx habitat maintained within LMAs and scattered parcels outside LMAs, and higher limits on conversion of lynx habitat to temporary non-suitable habitat within LMAs. For aquatic species, increased management flexibility would include decreased harvest restrictions within RMZs, less frequent monitoring of grazing effects, longer timeframe for correcting fish connectivity issues (same as Alternative 1), and longer timeframe for correcting sediment erosion from existing roads. As for Alternative 2, ~~the~~active management would increase in the Stillwater Core~~ would be opened up to active forest management activities~~.

Anticipated Effects

The anticipated environmental effects associated with the alternatives analyzed for this EIS are summarized below by resource. They are also described in detail in Chapter 4 (Affected Environment and Environmental Consequences).

Summary of Effects by Resource

Climate

Timber harvest, new road construction, and existing road improvement, maintenance, and upgrades under each of the alternatives would contribute to atmospheric concentrations of carbon dioxide (CO_2), as well as other greenhouse gases (GHGs). While a portion of sequestered carbon would remain in the wood products generated, much of this would slowly be released over time. After harvest, the ability of those forest stands to sequester carbon would be reduced, with the level dependent on the intensity of harvest. However, as harvested areas regenerate, their ability to sequester more carbon would increase. At the landscape scale, there would be no appreciable differences in net CO_2 emissions due to changes in forest management activities from the four alternatives. By maintaining a consistent harvest rotation and forest productivity historically and throughout the Permit term, losses of carbon from newly harvested stands would be expected to be offset by increased carbon intake from regenerating stands harvested in previous years, resulting in little or no net change in CO_2 emissions.

Forest Vegetation

The effects on forest stand attributes would be similar and in most cases differences are not discernable among alternatives regarding individual stand attributes. Under all alternatives, progress toward desired future conditions (DFCs) would continue, with seral forest types increasing and late-successional forest types decreasing compared to current levels. Across the project area, the acreage in the seedling/sapling size class would increase compared to current conditions, and poletimber, young sawtimber, and mature sawtimber classes would decrease under each alternative. Changes in age class under each alternative would follow trends for size class: the amount of young stands would increase, and the amount of older stands would decrease. There are no discernable differences at the landscape scale in the potential effects on wildfire or insects and diseases among alternatives.

For Alternative 3, additional constraints associated with the conservation strategies reduce the sustainable yield under that alternative compared to Alternative 1 (Table ES-1). The greatest vegetation-related difference between alternatives would result from changes in how the Stillwater Core is managed. Under Alternatives 2 and 4, DNRC would move to an approach that incorporates a long-term transportation plan with various annual and seasonal road restrictions, and the area now identified as the Stillwater Core would be more available for management. The extra acres available for management in the Stillwater Core would increase the sustainable yield of timber in Alternatives 2 and 4, and increased management may reduce the chances of wildfire or insect or disease spread in managed stands.

TABLE ES-1. SUSTAINABLE YIELD OF TIMBER FOR EACH ALTERNATIVE (MILLION BOARD FEET PER YEAR)

Alternative 1 (No Action)	Alternative 2 (Proposed HCP)	Alternative 3 (Increased Conservation HCP)	Alternative 4 (Increased Management Flexibility HCP)
53.2	57.6	50.6	58.0

Air Quality

At the landscape scale, there would be no appreciable differences in terms of effects on air quality due to changes in forest management activities among the four alternatives.

Transportation

By the end of the Permit term, all four alternatives would result in more roads on trust lands within the HCP project area. At the land office scale, as well as for scattered parcels, new road miles would be highest under Alternative 1 and lowest under Alternative 3, although differences are relatively small (ranging between 1,322 and 1,408 miles of newtotal road miles on the landscape and between 1,035 and 1,121 miles of new road construction at the end of the 50-year Permit term).

In the Stillwater Block, Alternatives 2 and 4 would result in slightly (or a few) more new road miles than Alternatives 1 and 3, reflecting an increase in roads to support forest management activities in the Stillwater Core. Under a 50-year transportation plan, Alternatives 2 and 4 would result in a decrease in roads open year-round and roads restricted year-round, while miles of road restricted seasonally would increase. Public access to roads, at least on a seasonal basis, would increase under Alternatives 2 and 4.

If the Swan Valley Grizzly Bear Conservation Agreement (Swan Agreement) remains in effect for the entire Permit term, there would be no differences in road miles and classifications between the four alternatives for the Swan River State Forest. Should the agreement terminate, road management for these blocked lands under Alternatives 2, 3, and 4 would be subject to a 50-year transportation management plan. Up to 23 miles of road could be converted from restricted year-round to open year-round or seasonally restricted, depending on ~~DNRC's ability to negotiate reciprocal access agreements after land ownership changes or~~the land ownership pattern at the time of termination of the Swan Agreement.

On scattered parcels in the HCP project area, most new roads under all four alternatives would be classified as restricted year-round. The largest increases in roads open to the public, at least on a seasonal basis, would occur under Alternative 1, while miles of open roads would be the same between Alternatives 2, 3, and 4. Miles of road restricted year-round would be the same for Alternatives 1, 2, and 4, and lower for Alternative 3.

Geology and Soils

By implementing existing BMPs and complying with the existing regulatory framework, all four alternatives would minimize the risk of effects on soil productivity and provide adequate protection from erosion effects. The existing Streamside Management Zone (SMZ) Law, Forest Management ARMs, Montana Forestry BMPs, and DNRC forest management policies are generally effective at minimizing soil disturbance activities. However, additional conservation commitments specified by the action alternatives would decrease risks associated with specific activities (e.g., harvest, grazing) and locations (e.g., riparian areas) and require some level of identifying, prioritizing, and correcting road and stream crossing problems to reduced sediment delivery to streams. Alternative 3 would result in the least potential for adverse effects from forest management activities and provide the greatest benefit in terms of reducing ongoing sediment delivery to streams. Alternatives 2, 4, and 1 would have increasingly higher potential for adverse effects and decreasing benefits for reducing sediment delivery to streams.

Water Resources

DNRC has achieved a high level of success with protection and mitigation efforts under its current forest management program, resulting in 97 to 98 percent application and effectiveness of BMPs to limit sediment delivery to streams. DNRC's existing program would continue under Alternative 1, so this level of success would be expected to continue during the Permit term. However, compared to the action alternatives, Alternative 1 would not provide any additional protection of streamside buffers, additional commitments for road and harvest area practices that protect water quality, more formal documentation of cumulative watershed effects thresholds and mitigation requirements, or enhanced coarse-filter reviews of grazing effects. All three action alternatives would provide some level of these additional commitments, with Alternative 3 providing the most protective measures and least risk of adverse effects on water quality, followed by Alternative 2, then Alternative 4.

Changes in water quantity effects would generally be similar among all alternatives. Potential to measurably change water quantity would be highest under Alternatives 2 and 4 because these alternatives have the highest levels of planned timber harvest and include opening the Stillwater Core to active forest management. However, differences among alternatives would have the potential to result in measurable changes in water quantity only where more timber harvest is concentrated in small watersheds, particularly within the rain-on-snow elevation zone.

Plant Species of Concern, Noxious Weeds, and Wetlands

All alternatives would implement current practices (ARMs and MCA) that address identified plant species of concern (SOC), noxious weeds, and wetlands. However, under the action alternatives, some conservation commitments would potentially result in greater protection of potential plant SOC habitat (where unknown populations may exist), reduced spread of noxious weeds, and enhanced wetland protection over Alternative 1. All action alternatives offer some increase level of benefit over the no-action alternative, with Alternative 3 providing slightly higher levels of protection due to more restrictive commitments related to forest management activities and shorter timeframes for identifying and correcting problems.

Fish and Fish Habitat

Overall, all of the alternatives would generally be effective at maintaining the key habitat components (sediment delivery, stream temperature, in-stream habitat complexity, and connectivity among sub-populations of fish species) at a level that provides for healthy fish populations, including the HCP fish species. However, there are some substantial differences between the alternatives. In most cases, Alternative 1 provides the smallest degree of improvement in the individual habitat components during the Permit term. In some cases, such as stream temperature and shading, Alternative 1 could lead to some negative short-term effects on fish populations, although the magnitude of any such effect would be relatively small. In addition, any risk of effects from Alternative 1 would apply equally to all fish species, including HCP fish species, because the existing policies, procedures, and corrective actions are not prioritized for any particular species. However, Alternative 1 would still maintain or slightly improve habitat conditions that would support native cold-water and warm-water fish populations.

All of the action alternatives have a greater potential to improve aquatic habitat conditions, based either on overall scale or rate of change. In addition, the action alternatives have some specific mechanisms for monitoring and adaptive management to help to ensure proper implementation and effectiveness of the various conservation strategies. The risk of adverse effects to HCP fish species is reduced with the action alternatives, compared to Alternative 1.

The action alternatives would all benefit aquatic species, including the HCP fish species. Alternative 3 would provide the greatest potential benefits, followed by Alternatives 2 and 4. This is generally due to an increased rate of conservation commitment implementation under Alternative 3. In the case of those habitat components affected by riparian buffer width (stream temperature and large woody debris [LWD] frequencies), Alternative 3 is roughly equivalent to a "no management" alternative in areas adjacent to HCP fish species habitat. This alternative would provide for the maximum levels of LWD recruitment and shade within the riparian areas of the HCP fish-bearing streams in the HCP project area~~, unless LWD frequency was increased through the active placement of LWD through tree falling or manual installation~~. However, Alternative 2 would provide increased LWD frequencies and shade protection over a substantially larger portion of the HCP project area than would either of the other action alternatives (Alternatives 3 and 4).

Wildlife and Wildlife Habitat

None of the alternatives is expected to result in substantial changes in the distribution or amount of wildlife habitat in the HCP project area. Compared to the no-action alternative, increased restrictions on new road construction, ~~and~~ access easements, and helicopter use under the action alternatives, along with restrictions on activities in spring habitat, post-denning habitat, and near den sites, would reduce the risk of effects on grizzly bears due to the presence of roads and human activity in key habitat areas. Canada lynx would be expected to benefit from HCP conservation commitments to maintain suitable habitat and foraging habitat in key areas of known importance for the species in western Montana.

Recreation

Under all four alternatives, increases in the amount of roads open to non-motorized public access would result in expanded opportunities for hiking, mountain biking, berry picking, and other such activities throughout the HCP project area. Under Alternatives 2 and 4, implementation of a transportation plan in the Stillwater Block would result in increased opportunities for motorized public access as compared to Alternatives 1 and 3 due to greater access to the Stillwater Core. In the Swan River State Forest, access would remain the same for all alternatives if the Swan Agreement remains in effect; otherwise, opportunities for motorized public access could increase under the action alternatives. As a result of timber harvest under all alternatives, opportunities for hunting, berry picking, and other activities in young, open-canopy forest would likely increase. On the other hand, opportunities for recreation in unmanaged areas would be reduced, and the quality of the recreational experience for some users may decrease due to the increased visibility of managed stands. Under the action alternatives, increases in the amount of roads available for motorized public access would likely reduce the amount of wild, backcountry areas available for recreation, particularly in the Stillwater Block.

Visual Resources

Under all four alternatives, increases in the amount of roaded areas and forest in the non-stocked and seedling/sapling size classes would result in decreases in the amount of natural-appearing forested landscape. Such changes would be visible from roads (including scenic drives), trails, recreation areas, and viewpoints in the planning area. Under Alternatives 2 and 4, increased access in the Stillwater Core would result in more timber management (largely even-aged harvest), resulting in greater visual impacts than under Alternatives 1 or 3. Compared to Alternative 1, all three action alternatives would result in slightly smaller increases in total road length at the end of the Permit term, with the smallest increases expected to occur under Alternative 3. In all parts of the HCP project area, the visual impacts of roads would not be expected to differ substantially among the alternatives.

Archaeological, Historical, Cultural, and Trust Resources

Within DNRC's existing forest management program, activities associated with timber harvest and road construction are the primary sources of potential adverse effects on non-renewable cultural and paleontological resources and traditional cultural properties (TCPs) or cultural use areas on trust lands. For the four alternatives, annual timber harvest would range from just under 51 to 58 million board feet per year, and there would be between 1,322 and 1,408 miles of new road constructed on HCP project area lands. The one indirect benefit to cultural and paleontological resources and TCPs under all the alternatives would be the large amounts of road with restricted motorized public access year-round.

Alternative 3 would result in the least amount of annual timber harvest, the lowest amount of new roads at the end of the Permit term, the widest buffers for stream systems supporting HCP fish species, and retention of the Stillwater Core. Thus, this alternative would be expected to have the lowest likelihood of adversely affecting cultural and paleontological resources and TCPs or cultural use areas. Alternative 1 would be expected to have a lower likelihood of adverse effects resulting from timber harvest as compared to Alternatives 2 and 4. Conversely, Alternatives 2 and 4 would be expected to have a lower likelihood of adverse effects from road construction than Alternative 1 and lower likelihood of adverse effects from timber harvest along streams supporting HCP fish species due to the 50-foot and 25-foot no-harvest buffer, respectively, that would be implemented for those alternatives. However, within the Stillwater Block, Alternatives 2 and 4 would result in a higher likelihood of adverse effects to cultural and paleontological resources and TCPs or cultural use areas because there would be increased ~~flexibility to manage~~active forest management in the Stillwater Core. Additional harvest activities, as well as increased public access to the Stillwater Core, would increase risks to existing resources in the area.

Socioeconomics

Alternatives 2 and 4 would result in more forestry sector jobs and associated wages than Alternatives 1 and 3. Other jobs that support the forest industry or workers would be expected to follow the same pattern. Similarly, net revenues generated for trust beneficiaries would be highest for Alternative 4 and slightly less for Alternative 2 due to higher costs associated with more restrictive HCP commitments. Alternative 3 would likely generate the lowest net revenues.

Revenues from recreational licenses would likely be higher for Alternatives 2 and 4 due to increased access to the Stillwater Core after it is opened up for active management. Similarly, increases in forest-related recreation jobs would also likely be higher for these two alternatives.

Natural amenities and non-use values would likely be least affected under Alternative 3 because it provides protection to sensitive areas and species. Opening the Stillwater Core under Alternatives 2 and 4 would affect the natural amenities and non-use values in that area versus what they currently are and would be during the Permit term under Alternatives 1 and 3.

DNRC's current program does not disproportionately affect minority or low-income populations. There would be differences among the alternatives regarding changes to the availability of salmonid species or other recreational, subsistence, or ceremonial plant or wildlife species; access to TCPs; or numbers of forestry jobs and associated income. However, these effects are not expected to fall disproportionately on minority or low-income populations for any of the alternatives.

Preferred Alternative

Since this EIS has been prepared to comply with both NEPA (USFWS) and MEPA (DNRC) requirements, each agency has identified its own preferred alternative.

USFWS Preferred Alternative

While development of the HCP was driven by DNRC, USFWS personnel provided guidance and technical assistance throughout the process. Therefore, the USFWS supports ~~the selection of~~ the proposed action (Alternative 2) as its preferred alternative and does not anticipate Permit conditions beyond those already included in the proposed action. Prior to finalizing its selection of ~~the~~a preferred alternative, USFWS will review the HCP relative to the requirements of Sections 7 and 10 of the ESA and NEPA.

DNRC Preferred Alternative

The proposed action (Alternative 2) is DNRC's preferred alternative. This alternative provides the best balance between providing for HCP species conservation and allowing for DNRC management flexibility to fulfill its trust mandate. DNRC believes that Alternative 2 ~~best represents the methods and processes~~meets the intent of the ESA Section 10 process for avoiding, minimizing, and mitigating the impacts of take resulting from its forest management activities ~~on HCP species~~ to the maximum extent practicable.

Environmentally Preferred Alternative

Alternative 3, the Increased Conservation HCP, is the environmentally preferred alternative. This alternative includes more protective measures than those required under the current forest management program or proposed under the other two action alternatives. This alternative would also retain the grizzly bear secure habitat within the Stillwater Core and not increase the level of active forest management in that area. The more protective measures under Alternative 3 include greater restrictions on forest management activities in habitats and during seasons important to HCP species. This alternative would also require shorter timeframes to identify the need for and implement correcting actions, resulting in the fastest rate of habitat improvement over existing conditions versus the other alternatives.

Table of Contents

TABLE OF CONTENTS (continued)

TABLE OF CONTENTS (continued)

TABLE OF CONTENTS (continued)

LIST OF TABLES

TABLE OF CONTENTS (continued)

TABLE OF CONTENTS (continued)

TABLE OF CONTENTS (continued)

TABLE OF CONTENTS (continued)

TABLE OF CONTENTS (continued)

TABLE OF CONTENTS (continued)

TABLE OF CONTENTS (continued)

TABLE OF CONTENTS (continued)

TABLE OF CONTENTS (continued)

TABLE OF CONTENTS (continued)

LIST OF FIGURES

TABLE OF CONTENTS (continued)

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Acronyms and Abbreviations

° C	degrees Celsius
° F	degrees Fahrenheit
AAU	aquatic analysis unit
ACHP	Advisory Council on Historic Preservation
ACOE	United States Army Corps of Engineers
AFS	American Fisheries Society
AIRFA	American Indian Religious Freedom Act
AITESA	American Indian Tribes and the Endangered Species Act
ARMs	Administrative Rules of Montana
ARPA	Archaeological Resources Protection Act
ATV	all-terrain vehicle
AUM	animal unit month
BCR	Bird Conservation Region
BE	Bitterroot Ecosystem
BIA	Bureau of Indian Affairs
BLM	United States Bureau of Land Management
BMP	best management practice
BMU	bear management unit
BOCC	Birds of Conservation Concern
BOR	Bureau of Reclamation
BP	before present
CAA	Clean Air Act
CCAC	Climate Change Advisory Committee
CEQ	Council on Environmental Quality
CFR	Code of Federal Regulations
CLO	Central Land Office
CMP	corrugated metal pipe

ACRONYMS AND ABBREVIATIONS (continued)

CMR	cooperative management response
CMZ	channel migration zone
CO	carbon monoxide
CO_2	carbon dioxide
CSC	Climate Science Center
CWA	Clean Water Act
CWD	coarse woody debris
CWE	cumulative watershed effects
CYE	Cabinet-Yaak Ecosystem
dbh	diameter at breast height
DDT	dichloro-diphenyl-trichloroethane
DFC	desired future condition
DNA	deoxyribonucleic acid
DNRC	Montana Department of Natural Resources and Conservation
DOD	Department of Defense
DOI	Department of the Interior
DOT	United States Department of Transportation
DOW	Defenders of Wildlife
DPS	distinct population segment
EA	environmental assessment
ECA	equivalent clearcut area
EIS	environmental impact statement
EPA	United States Environmental Protection Agency
EQC	Environmental Quality Council (Montana Legislature)
ESA	Endangered Species Act
FMB	Forest Management Bureau (DNRC)
Forest Management ARMs	Administrative Rules of Montana for Forest Management
forested trust lands	forested state trust lands
FR	Federal Register
FVS	Forest Vegetation Simulator
GHG	greenhouse gas

ACRONYMS AND ABBREVIATIONS (continued)

GIS	geographic information system
GYE	Greater Yellowstone Ecosystem
HCP	habitat conservation plan
HUC	hydrologic unit code
ID	interdisciplinary
IGBC	Interagency Grizzly Bear Committee
INFISH	Inland Native Fish Strategy
IPCC	Intergovernmental Panel on Climate Change
kg-C/m^3	kilograms of carbon per cubic meter
Land Board	State Board of Land Commissioners
LAU	lynx analysis unit
LCAS	Lynx Conservation Assessment and Strategy
LCC	Landscape Conservation Cooperative
LMA	lynx management area
LWD	large woody debris
MAAQS	Montana Ambient Air Quality Standards
MAPA	Montana Administrative Procedure Act
mbf	thousand board feet
MB&G	Mason, Bruce & Girard
MBTRT	Montana Bull Trout Restoration Team
MCA	Montana Codes Annotated
MDEQ	Montana Department of Environmental Quality
MEIC	Montana Environmental Information Center
MEPA	Montana Environmental Policy Act
MEQC	Montana Environmental Quality Council
MFWP	Montana Fish, Wildlife and Parks
mg/L	milligrams per liter
mi/mi^2	miles of road per square mile of land area
MNHP	Montana Natural Heritage Program
MSAA	Montana State Antiquities Act
MDEQ	Montana Department of Environmental Quality

ACRONYMS AND ABBREVIATIONS (continued)

MPIF	Montana Partners in Flight
MWMT	mean weekly maximum temperature
NAAQS	National Ambient Air Quality Standards
NAGPRA	Native American Graves Protection and Repatriation Act
NCCWSC	National Climate Change and Wildlife Science Center
NCDE	Northern Continental Divide Ecosystem
NELO	Northeastern Land Office
NEPA	National Environmental Policy Act
NHPA	National Historic Preservation Act
NMFS	National Marine Fisheries Service
NO_2	nitrogen dioxide
NOI	Notice of Intent
NPS	National Park Service
NRDC	Natural Resources Defense Council
NRHP	National Register of Historic Places
NRIS	Natural Resource Information System
NRLMD	Northern Rockies Lynx Management Direction
NRM	Northern Rocky Mountain
NROH	non-recovery occupied habitat
NTU	nephelometric turbidity unit
NWI	National Wetlands Inventory
NWLO	Northwestern Land Office
OHWM	ordinary high water mark
ORD	open road density
PA	Programmatic Agreement
PCE	primary constituent element
Permit	incidental take permit
Plum Creek	Plum Creek Timber Company
PM_{10}	particulate matter less than 10 micrometers in diameter
$PM_{2.5}$	particulate matter less than 2.5 micrometers in diameter
PNV	present net value

ACRONYMS AND ABBREVIATIONS (continued)

RAIS	riparian aquatic interaction simulator
RMO	riparian management objective
RMZ	riparian management zone
ROD	Record of Decision
SFLMP	State Forest Land Management Plan
SHPO	State Historic Preservation Officer
SLI	stand level inventory
SMZ	streamside management zone
SMZ Law	Montana Streamside Management Zone Law
SO_2	sulfur dioxide
SOC	species of concern
SPTH	site potential tree height
Swan Agreement	Swan Valley Grizzly Bear Conservation Agreement
SWLO	Southwestern Land Office
SYC	sustainable yield calculation
TCP	traditional cultural property
THPO	Tribal Historic Preservation Officer
TLMD	Trust Land Management Division (DNRC)
TMDL	total maximum daily load
TNC	The Nature Conservancy
TRD	total road density
TSS	total suspended solids
UNFCCC	United Nations Framework Convention on Climate Change
USC	United States Code
USDA	United States Department of Agriculture
USFS	United States Department of Agriculture, Forest Service
USFWS	United States Fish and Wildlife Service
USGCRP	United States Global Change Research Program
USGS	United States Geological Survey
WADNR	Washington Department of Natural Resources
WCI	Western Climate Initiative

ACRONYMS AND ABBREVIATIONS (continued)

WEPP	Water Erosion Prediction Project
WMU	wolf management unit
WMZ	wetland management zone

Chapter

Purpose and Need for Action

1 Purpose and Need for Action

This chapter describes the proposed action for which this environmental impact statement (EIS) has been prepared and identifies where to find the various elements of the EIS within this document. It also describes the purpose and need for the action as well as the relationship of the EIS to other regulations and laws.

1.1 Introduction

The Montana Department of Natural Resources and Conservation (DNRC) has prepared a proposed habitat conservation plan (HCP) for forest management activities on its forested state trust lands (forested trust lands) managed by the Trust Land Management Division (TLMD). The mission of the TLMD is to manage trust land resources to produce revenues for the trust beneficiaries while considering environmental factors and protecting the future income-generating capacity of the land. Under its forest management program, the TLMD generates revenues for trust beneficiaries through timber harvest on forested trust lands. DNRC manages its forested trust lands in accordance with the Administrative Rules of Montana (ARMs) for Forest Management, Title 36, Chapter 11, Subchapter 4 (ARMs 36.11.401 through 456) (Forest Management ARMs) and the scientific principles articulated in the State Forest Land Management Plan (SFLMP) (DNRC 1996)~~ and the Administrative Rules of Montana (ARMs) for Forest Management Title 36, Chapter 11, Subchapter 4 (ARMs 36.11.401 through 456) (Forest Management ARMs)~~. DNRC's forested trust lands also support federally listed threatened species. The ARMs direct DNRC to confer with the United States Fish and Wildlife Service (USFWS) to develop habitat mitigation measures to address the needs of listed species. The proposed HCP is a programmatic plan that identifies DNRC's proposal for managing federally listed species on forested trust lands.

The Forest Management Bureau (FMB) within the TLMD would be responsible for administering the HCP. An HCP is a long-term management plan authorized under the Endangered Species Act (ESA) to conserve threatened and endangered species (16 United States Code [USC] 1531 et seq.). Section 10 of the ESA authorizes a landowner to develop a conservation plan to minimize and mitigate, to the maximum extent practicable, any impact to threatened and endangered species while conducting lawful activities such as harvesting timber on state trust lands.

The HCP is part of the application for obtaining an incidental take permit (Permit) from the USFWS in accordance with Section 10(a)(1)(B) of the ESA. The Permit would authorize the Permit holder (DNRC) to take federally listed species that are covered under the HCP. The DNRC HCP covers forest management activities on forested trust lands that provide habitat for the three species currently listed and two species with the potential to be listed under the ESA (HCP species). The three ESA-listed species proposed for coverage in the HCP are

1. Grizzly bear (*Ursus arctos horribilis*)
2. Canada lynx (*Lynx canadensis*)
3. Bull trout (*Salvelinus confluentus*).

The HCP also addresses two additional aquatic species should these species become listed during the 50-year Permit term.

1. Westslope cutthroat trout (*Oncorhynchus clarkii lewisi*)
2. ~~Columbia~~Interior redband trout (*Oncorhynchus mykiss gairdneri*).

The interior redband trout is also commonly known as the Columbia River redband trout, Columbia redband trout, redband trout, and Columbia River interior redband trout and is herein referred to as the Columbia redband trout.

Issuance of the Permit in this instance by the USFWS is considered a major federal action that may affect the quality of the human environment, thus requiring preparation of an EIS under the National Environmental Policy Act (NEPA) (Section 101 [42 USC 4331]). The decision by DNRC, as the applicant, to develop and implement the HCP is considered a major state action that may affect the quality of the human environment under the Montana Environmental Policy Act (MEPA) (Montana Code Annotated [MCA] 75-1-201 (1)(b)(iv)), and therefore requires a MEPA EIS.

This EIS has been prepared to comply with both NEPA and MEPA. The USFWS is the lead agency for the NEPA component of this EIS, and DNRC is the lead agency for the MEPA component of this EIS. There are no other state, federal, or local agencies that have overlapping or additional jurisdiction or responsibility for the proposed action. Both agencies will use this EIS to meet federal NEPA and state MEPA requirements, respectively, recognizing that the EIS purpose and need, use of the environmental impact analyses, and regulatory requirements of the two agencies may differ.

1.2 Document Overview

This document includes both the EIS (main body) and the HCP (Appendix A). These contents are presented here under a single cover to provide the public with an easier opportunity to review, understand, and comment on the HCP and EIS. The EIS organization is described below to help the reader understand the document contents and EIS organization.

Chapter 1 (**Purpose and Need for Action).** This chapter introduces the proposed action (proposed HCP). The chapter also describes the purpose and need, the decisions to be made, and the regulations and laws pertaining to the NEPA and MEPA analysis.

Chapter 2 (**Environmental and Procedural Setting).** Chapter 2 describes the environmental and procedural setting under which DNRC implements its programs on forested trust lands that would be covered under the HCP. This chapter describes the organization of the DNRC and TLMD, and describes the legal framework under which the forest management program is conducted. As the primary activity conducted on forested trust lands and the primary source of revenue for forested trust lands in Montana, the forest product sales program (or the timber sales process) is also described.

Chapter 3 (Alternatives). Chapter 3 describes the no-action alternative (Alternative 1), the proposed HCP (Alternative 2), and two other HCP action alternatives (Alternatives 3 and 4). Conservation commitments associated with each alternative are described, including measures to minimize and mitigate impacts on HCP species. Chapter 3 also describes alternatives that were considered but not selected for detailed analysis. A summary comparing the effects of the alternatives analyzed in detail by resource is provided at the end of Chapter 3.

Chapter 4 (Affected Environment and Environmental Consequences). Chapter 4 describes existing conditions and environmental consequences for those resources that could potentially be affected by implementation of the alternatives. The chapter presents technical background information and a description of the regulatory requirements and affected environment for the potentially affected resources. Chapter 4 also includes an analysis of the potential impacts on those resources under the proposed action and identifies the anticipated effects on the HCP species.

Chapter 5 (Cumulative Effects). Chapter 5 describes the cumulative effects of the alternatives. NEPA defines cumulative effects as "the impact on the environment which results from the incremental impact of the action when added to other past, present, and reasonably foreseeable future actions, regardless of what agency (federal or non-federal) or person undertakes such other actions" (40 Code of Federal Regulations [CFR] 1508.7).

Chapter 6 (Scoping and Public Involvement). This chapter describes the public scoping and involvement process undertaken for this project to date, as well as future plans for public involvement on the Final EIS. This chapter also includes the Distribution List and List of Preparers of the EIS.

Chapter 7 (References). References for the EIS are contained in this chapter.

Chapter 8 (Glossary). This chapter provides a glossary of terms used in the EIS.

Appendices. The HCP is included as Appendix A, and other supplemental information, including maps and tables, is contained in the remaining appendices.

1.3 Proposed Action and Decisions to be Made

This section describes the context of the proposed action, identifies the EIS planning area, describes the elements of the proposed action, and states the decisions to be made by the USFWS and DNRC.

1.3.1 CONTEXT OF THE ACTION

In 1982, Congress amended Section 10(a) of the ESA to authorize the issuance of a permit allowing "incidental taking" of listed species by non-federal entities if the permit applicant submitted a conservation plan satisfying the ESA's requirements. Under this provision, the USFWS is authorized to permit the taking of federally listed fish and wildlife if such taking is "incidental to, and not the purpose of, the carrying out of an otherwise lawful activity." Section 10(a)(2)(A) of the ESA requires any applicant applying for a Permit to submit a "conservation plan" that specifies, among other things, the impacts that are likely to result from the taking, and steps that will be undertaken to minimize and mitigate such impacts.

The USFWS would issue a Permit to DNRC if the HCP adequately provides conservation for species covered by the Permit according to issuance criteria as described in Section 10(a)(1)(B) of the ESA (see Section 1.3.4, Decisions to be Made, below). Under Section 7(a)(2) of the ESA, issuance of a Permit by the USFWS is a federal action subject to Section 7 compliance. Therefore, a USFWS internal Section 7 consultation must also be conducted to ensure that issuance of the Permit will not jeopardize the continued existence of listed HCP species.

1.3.2 EIS PLANNING AREA

The EIS planning area encompasses the geographic area potentially influenced by implementation of the HCP. The planning area consists of the HCP project area (described below under Section 1.3.3.1, HCP Project Area) and all other lands in DNRC's Northwestern Land Office (NWLO), Southwestern Land Office (SWLO), and Central Land Office (CLO), including lands owned by DNRC but not included in the HCP project area and lands owned by others (Table 1-1 and Figure 1-1; see also Figure D-1 in Appendix D, EIS Figures). The planning area demonstrates DNRC's landownership stake in the overall habitat of the HCP species in western Montana and is also used as the cumulative effects analysis boundary for many of the resources analyzed in Chapter 4 (Affected Environment and Environmental Consequences).

TABLE 1-1. ACRES OF ALL OWNERSHIPS, ALL DNRC LANDS, AND HCP PROJECT AREA LANDS IN THE EIS PLANNING AREA BY DNRC LAND OFFICE

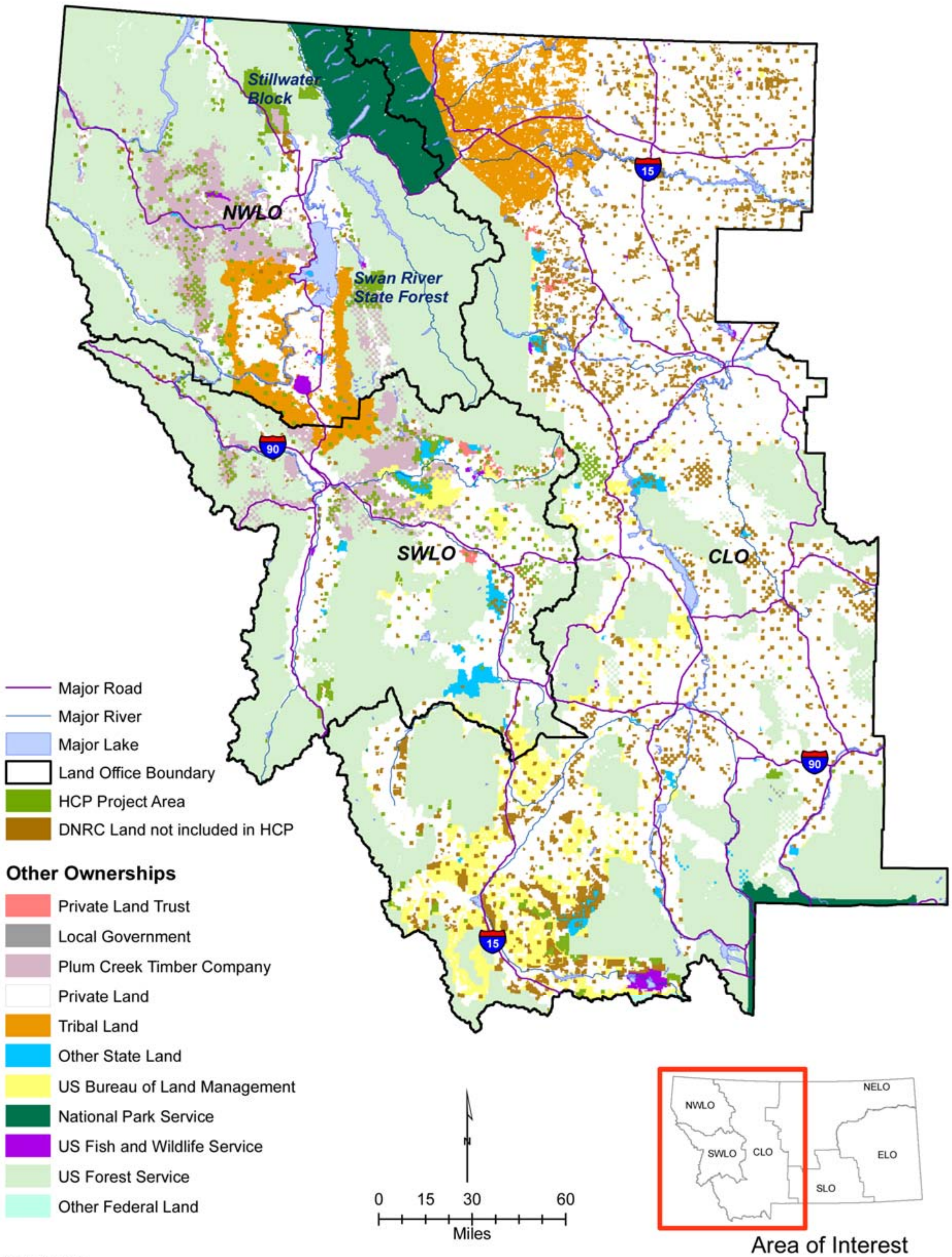
DNRC Land Office	EIS Planning Area (All Ownerships)	DNRC Lands (Acres)	HCP Project Area (Acres)	Percent of HCP Project Area in Land Office	Percent of Total HCP Project Area
NWLO					
Stillwater Block[1]	90,800	90,800	90,700	100	17
Swan River State Forest	39,800	39,800	39,700	100	7
Scattered Parcels[2]	8,936,300	185,600	143,000	77	26
SWLO	7,432,200	234,700	161,900	69	30
CLO	22,894,800	1,262,500	113,200	9	21
Total	**39,393,900**	**1,813,400**	**548,500**	**30**	**100**

[1] Stillwater and Coal Creek State Forests.
[2] DNRC lands not included in a state forest.
Source: DNRC (2008a), rounded to the nearest 100 acres.

1.3.3 PROPOSED ACTION - HABITAT CONSERVATION PLAN

The proposed action being addressed in this EIS is DNRC's implementation of the HCP and the USFWS' evaluation of the application and potential issuance of the Permit under the ESA that would authorize the incidental take of up to five HCP species. Each of the action alternatives represents an HCP alternative, with DNRC's preferred alternative represented by Alternative 2. The EIS describes the potential effects of the proposed action (implementation of the HCP and issuance of the Permit) by evaluating the effects resulting from implementation of the HCP and other action alternatives over the Permit term.

DNRC's proposed HCP (Appendix A) consists of individual conservation strategies for grizzly bears, Canada lynx, and three aquatic species. The strategies are a series of commitments regulating DNRC forest management activities on forested trust lands that would be covered by the HCP. The strategies were developed to help conserve the HCP species and the habitats on which they depend. HCP Chapter 1, Introduction, describes the process used to develop the strategies. Briefly, the conservation strategies were developed using background information compiled in the HCP species accounts and through collaborative agreement between the USFWS and DNRC on biological goals and objectives for HCP species. Conservation commitments were then developed that were supported by scientific data and rationale. These commitments address both known scientific information and uncertainties in scientific knowledge, as well as existing data gaps.



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NWLO = Northwestern Land Office
SWLO = Southwester Land Office
CLO = Central Land Office

NELO = Northeastern Land Office
SLO = Southern Land Office
ELO = Eastern Land Office

FIGURE 1-1. LOCATION OF THE PLANNING AREA AND HCP PROJECT AREA

HCP Chapter 2 (Conservation Strategies) includes a detailed description of the commitments for the two terrestrial species and three aquatic species. The commitments were designed to minimize and mitigate the potential for take to the maximum extent practicable, to provide a conservation benefit for the HCP species, and to ensure that future timber harvest levels continue to offer a predictable and long-term flow of income to trust beneficiaries. The strategies consist of goals and objectives, detailed descriptions of the commitments, and applicable field data forms to be used during implementation. The strategy for moving lands into and out of the HCP project area is described in HCP Chapter 3 (Transition Lands Strategy). Monitoring and adaptive management of the HCP components are described in HCP Chapter 4 (Monitoring and Adaptive Management).

Several basic elements of the HCP include, but are not limited to (1) definition of the project area, (2) the covered activities, (3) the HCP species, and (4) the term of the Permit. These elements are described below.

1.3.3.1 HCP Project Area

DNRC evaluated which lands to cover in the HCP by assessing where lands within the distribution of the species of interest overlapped with lands containing appreciable amounts of manageable forest acreage. This approach identified the geographic area where risk to those species was deemed greatest over the Permit term.

The HCP project area includes 548,500 acres of trust lands within three DNRC land offices (Figure 1-1), the NWLO, SWLO, and CLO. The HCP project area includes primarily forested trust lands (446,100 acres), but it contains other non-forested trust lands (102,400 acres) that are portions of, or are needed to access, forested parcels included in the HCP project area.

The HCP project area occurs on both blocked and scattered parcels across the three land offices (Table 1-1). Blocked lands refer to the two large, mostly contiguous blocks of DNRC ownership, specifically identified as the Stillwater and Coal Creek State Forests (the Stillwater Block) and the Swan River State Forest. Scattered parcels refer to all other HCP project area lands outside of blocked lands (Figure 1-1).

1.3.3.2 Covered Activities

The DNRC management activities that are covered in the HCP and associated Permit application are described in detail in HCP Chapter 1 (Introduction) in Appendix A (HCP), and include the following:

- **Timber harvest.** Includes commercial timber, salvage harvest, and silvicultural treatments such as thinning.
- **Other forest management activities.** Includes slash disposal, prescribed burning, site preparation, reforestation, fertilization, forest inventory, and access to forested lands for weed control.
- **Roads.** Includes forest management road construction, reconstruction, maintenance, use, and associated gravel quarrying for forest road surface materials, as well as installation, removal, and replacement of stream crossing structures.
- **Grazing**. Includes grazing licenses on classified forest trust lands.

1.3.3.3 HCP Species

The proposed HCP addresses three species listed as threatened under the ESA: grizzly bear, Canada lynx, and bull trout. The HCP also addresses two aquatic species should these species become listed during the Permit term: westslope cutthroat trout and Columbia redband trout. The status of these species is provided in Chapter 4: Section 4.8.3.1 (HCP Fish Species) for the aquatic species and Sections 4.9.3 (Grizzly Bears) and 4.9.4 (Canada Lynx) for the terrestrial species.

1.3.3.4 Permit Term

DNRC views the HCP as a long-term program for addressing and improving habitat needs across the landscape. DNRC has proposed that the Permit be issued by the USFWS for a period of 50 years in order to realize both the biological and economic benefits of the HCP. This Permit term was selected by DNRC to ensure that it would have sufficient time and funding to implement the conservation strategies and make adjustments through adaptive management where needed. Securing an adequate amount of time to implement the HCP is expected to maximize the HCP's contribution to the recovery of the HCP species.

This period also helps ensure that the cost and effort of obtaining the Permit would be offset by the long-term advantage of ensuring that ESA regulatory requirements were met for those HCP species listed or likely to be listed over the next 50 years. ESA regulatory certainty will help DNRC plan forest management activities with the reassurance that those activities will not be subject to additional ESA regulatory restrictions due to the presence of a listed HCP species.

As part of its review of the Permit application, the USFWS will evaluate the proposed Permit term ~~to ensure that it is an adequate timeframe in which to fully mitigate for the expected incidental take of listed species~~while considering the four factors outlined in the 5 Points Policy (USFWS and NMFS 2000) for determining the Permit term: (1) the duration of the applicant's proposed activities and expected positive or negative effects on the HCP species, (2) the extent of information underlying the HCP, (3) the length of time necessary to implement and achieve the benefits of the operating conservation program, and (4) the extent to which the program incorporates adaptive management strategies.

1.3.4 Decisions to be Made

In compliance with NEPA and MEPA, both agencies will use this EIS to identify and evaluate the potential impacts of the proposed action, including the direct, indirect, and cumulative effects of issuance of the Permit and implementation of the HCP~~, and the effects of the proposed incidental take~~. Theis Final EIS ~~will be used by each agency to select~~incorporates responses to public comments on the Draft EIS and changes to the Draft EIS analysis, as described in the Preface~~ a preferred alternative~~. Based on this Final EIS, e~~E~~ach agency will prepare its own Record of Decision (ROD), which will ~~include reasons for its decisions and~~identify the alternative selected, provide the rationale for the decision, and outline the process for implementing the ~~selected~~ alternative. ~~However, t~~The two agencies ~~will need to agree on~~must select the same alternative ~~for each~~in their respective RODs in order for the USFWS to issue the Permit and for~~ so the~~ DNRC ~~will be able ~~to then implement ~~conservation strategies for ~~the HCP~~ species~~.

1.3.4.1 USFWS Decisions

Before issuing the Permit, the USFWS must ensure that all requirements of Section 10(a)(1)(B) of the ESA (the issuance criteria) and the implementing regulations are met. The following six questions must be answered affirmatively for the USFWS to grant a Permit:

1. Is the proposed take incidental to an otherwise lawful activity?
2. Are the impacts of the proposed take minimized and mitigated to the maximum extent practicable?
3. Has the applicant ensured that adequate funding will be provided to implement the measures proposed in the HCP?
4. Is the proposed take such that it will not appreciably reduce the likelihood of survival and recovery of the species in the wild?
5. Will other required measures, if any, be met by the HCP?
6. Has the USFWS received any other assurances that the plan will be implemented?

The decision by the USFWS is made in light of the anticipated duration and geographic scope of the applicant's planned activities, including the amount of listed species habitat involved and the degree to which listed species and their habitats are affected. After evaluating the requirements, the USFWS may deny the Permit, issue a Permit based on implementation of the HCP as received, or issue Permit conditions with other measures specified by the USFWS.

The USFWS must also comply with NEPA, which requires federal agencies to evaluate the effects of the proposed action on the human environment in an environmental document that addresses

- Impacts of the proposed action
- Reasonable alternatives to the proposed action
- Whether any unavoidable adverse impacts would result from the proposed action
- The relationship between short-term uses of the human environment versus maintenance and enhancement of long-term productivity
- Any irreversible and irretrievable commitment of resources that would be involved if the proposed action is implemented.

1.3.4.2 DNRC Decisions

The Forest Management ARMs provide programmatic guidance on forest management activities on forested trust lands. The ARMs direct DNRC to confer with the USFWS to develop habitat mitigation measures to address the needs of listed species. The proposed HCP is a programmatic plan that identifies procedures for managing HCP project area lands. The HCP does not address site-specific issues or make specific land use allocations. The HCP does contain specific DNRC management procedures for HCP species that occur on HCP project area lands.

DNRC's overall decisions will be

- Does selecting an action alternative (obtaining the Permit and managing HCP project area lands under an HCP) provide long-term ESA regulatory certainty?
- Does the DNRC have, or can it obtain, the resources needed to fund the implementation of the HCP?

- Does implementation of the HCP support and/or enhance DNRC's ability to meet its trust mandate, which is to maximize revenues to the trust beneficiaries?

DNRC must also comply with MEPA, which requires state agencies to evaluate the effects of the proposed action on the human environment in an environmental document that addresses

- Impacts of the proposed action
- Reasonable alternatives to the proposed action
- The relationship between short-term uses of the human environment versus maintenance and enhancement of long-term productivity
- Any irreversible and irretrievable commitment of state resources that would be involved if the proposed action is implemented.

1.4 Purpose and Need

This section describes the purpose of the action and need for the action for the USFWS as well as DNRC.

1.4.1 Purpose of the Action

1.4.1.1 USFWS Purpose

The purpose for which this EIS is being prepared is to

- Respond to DNRC's application for the Permit, which contains a proposed HCP for forest management activities on 548,500 acres of forested trust lands for 50 years. Issuance of the Permit would authorize incidental take, including modification of habitat, for three listed species (grizzly bear, Canada lynx, bull trout) and two non-listed species (westslope cutthroat trout and Columbia redband trout), and would require implementation of the HCP to minimize and mitigate the take of these HCP species to the maximum extent practicable. The Permit application will be evaluated pursuant to ESA Section 10(a)(1)(B) and its implementing regulations and policies.
- Protect, conserve, and enhance the HCP species and their habitat for the continuing benefit of the people of the United States.
- Provide a means and take steps to conserve the ecosystems upon which the HCP species depend.
- Ensure the long-term survival of the covered species through protection and management of the species and their habitat.
- Ensure compliance with the ESA, NEPA, and other applicable federal laws and regulations.

1.4.1.2 DNRC Purpose

Under the HCP, project area lands would be managed in compliance with the conservation strategies contained in the HCP. The HCP would minimize take and conserve fish and wildlife species listed under the ESA while providing long-term regulatory certainty and flexibility for DNRC's forest management practices on its HCP project area lands. The HCP and associated

Implementing Agreement (Appendix F) demonstrate how DNRC would minimize and mitigate impacts on the HCP species resulting from otherwise lawful activities DNRC conducts while managing these lands. The HCP would provide a significant contribution to the conservation of HCP species and would allow for, or not preclude, the recovery of listed HCP species. If either of the non-listed HCP species (westslope cutthroat trout and/or Columbia redband trout) becomes listed during the term of the Permit, the HCP conservation commitments would be sufficient and provide adequate protection under the ESA. The Permit would thus provide long-term regulatory certainty for DNRC for the HCP species.

1.4.2 Need for Action

1.4.2.1 USFWS Need for Action

The USFWS' need for action is based on the potential that activities proposed by DNRC on HCP project area lands could result in the take of HCP species; thus the need for a Permit.

1.4.2.2 DNRC Need for Action

Forest management activities can alter habitats essential to species listed under the ESA. Significant alteration of essential habitat might constitute take of listed species, which would be prohibited under Section 9 of the ESA, unless otherwise exempted through a Permit. Section 10(a)(1)(B) of the ESA provides non-federal entities, including state agencies, with a legal mechanism to receive authorization to take listed species by obtaining a Permit from the USFWS. In addition, non-listed species can be covered under the Permit if their conservation needs are adequately addressed in the HCP.

The listed federal species that currently occur on state lands (grizzly bear, Canada lynx, and bull trout), as well as two other non-listed HCP species (westslope cutthroat trout and Columbia redband trout), pose regulatory uncertainty for DNRC as the agency conducts forest management activities. This uncertainty could result in significant curtailment of timber harvest or could otherwise decrease management flexibility, which may reduce economic viability on trust lands and DNRC's ability to meet its trust mandate. By obtaining a Permit and managing under the HCP, DNRC seeks to benefit the forest management program by increasing regulatory certainty and ensuring greater economic viability and management flexibility.

1.5 Relationship to Other Plans, Regulations, and Laws

Federal and state actions are subject to numerous regulations and other applicable guidelines. Those regulations and guidelines applicable to this EIS, the HCP, and issuance of the Permit are described below.

1.5.1 Federal Laws and Regulations

Development of this HCP and EIS is regulated by two primary pieces of federal legislation, the ESA and NEPA. These laws are described below, as are additional federal regulations governing resources potentially affected by the HCP and analyzed in this EIS.

1.5.1.1 Endangered Species Act

The federal ESA (16 USC 1531 et seq.) protects threatened and endangered species and their habitats. The purpose of the ESA is to conserve threatened and endangered plant and animal species and their ecosystems. The ESA defines an endangered species as one that is "…in danger of extinction throughout all or a significant portion of its range," and a threatened species as one that "is likely to become an endangered species within the foreseeable future throughout all or a significant portion of its range."

In addition to designating and listing a species as endangered or threatened, the USFWS is required to identify critical habitat if considered essential for the conservation of that species. Critical habitat includes areas containing essential habitat features, regardless of whether those areas are currently occupied by the listed species. The USFWS may also designate areas requiring special management or protection as critical habitat.

The sections of the ESA most relevant to the HCP process and this EIS are Sections 7, 9, and 10. These sections are described further below.

Section 7 – Consultation and Conference Responsibilities

Under Section 7, federal agencies must consult with the USFWS (and/or National Marine Fisheries Service [NMFS] depending on the species reviewed) to ensure that their actions (including issuances of permits) are not likely to jeopardize the continued existence of endangered and threatened species or destroy or adversely modify critical habitat for endangered and threatened species. The issuance of a Permit by the USFWS constitutes a federal action subject to Section 7. Therefore, prior to issuing the Permit, the USFWS will conduct a Section 7 consultation to determine if the project would jeopardize the continued existence of a listed species or result in the adverse modification of critical habitat. The analysis conducted under Section 7 will also support the evaluation of the Permit issuance criteria and the decision whether to issue the Permit.

Section 9 – Prohibition Against Take

Section 9 prohibits take of any threatened or endangered species without a Permit, unless otherwise authorized. The term "take" is defined under the ESA to mean "to harass, harm, pursue, hunt, shoot, wound, kill, trap, capture, collect, or to attempt to engage in any such conduct." "Harass," according to the definition of take in the ESA, 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" means "an act which actually kills or injures wildlife. Such acts 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).

Section 10(a)(1)(B) – Incidental Take Provision

Section 10 of the ESA was revised in 1982 to provide a clear regulatory mechanism to permit the incidental take of federally listed fish and wildlife species by private interests and non-federal government agencies during lawful activities. Congress intended this process to reduce conflicts between listed species and economic development activities and to provide a framework that would encourage creative partnerships between federal agencies and private, state, and municipal land managers in the interests of endangered and threatened species and habitat conservation.

Section 10 authorizes the USFWS to issue permits allowing incidental take of listed species if the Permit applicant has submitted (among other things) an HCP that satisfies ESA requirements. To receive a Permit, the HCP, among other requirements, must demonstrate that the permitted activities will not appreciably reduce the likelihood of survival and recovery of the species in the wild. Under this provision, the USFWS is authorized to permit the taking of federally listed fish and wildlife if such taking is "incidental to, and not the purpose of, the carrying out of an otherwise lawful activity."

The requirements of Section 10 and the HCP are contained in Sections 10(a)(2)A and 10(a)(2)B of the ESA and 50 CFR 17.22 and 17.32. Additional guidance on the contents of an HCP is provided in the HCP Handbook (USFWS and NMFS 1996) and 5 Points Policy (65 Federal Register [FR] 35242-35257, June 1, 2000).

1.5.1.2 National Environmental Policy Act

Issuance of a Permit, as is being considered under the proposed action, is a federal action subject to NEPA compliance (42 USC 4321 et seq., 40 CFR 1502 et seq., 43 CFR Part 46). The purpose of NEPA is to promote analysis and disclosure of the environmental issues surrounding a proposed federal action. Such analysis provides the information for decision-making that reflects the NEPA mandate to strive for harmony between human activity and the natural world. Although Section 10 of the ESA and NEPA requirements overlap considerably, the scope of NEPA goes beyond that of the ESA by considering the impacts of a federal action on wildlife not included in the HCP and other environmental resources (such as water quality, air quality, and cultural resources).

Analysis under NEPA must also consider the potential effects of reasonable alternatives to the proposed action. Under NEPA, an EIS is required when a proposed action would constitute a major federal action significantly affecting the quality of the human environment, as is the case for the proposed covered activities under the DNRC HCP.

For this EIS and HCP, the NEPA process has three goals:

1. Foster a complete disclosure of the environmental issues surrounding the proposed federal action (that is, issuance of the Permit).

2. Encourage public involvement in planning, identifying, and assessing a range of reasonable alternatives.

3. Explore all practicable means for enhancing the quality of the human environment while avoiding or minimizing adverse environmental impacts that may result from Permit issuance.

1.5.1.3 Other Applicable Federal Laws

Other federal laws governing environmental resources that may be affected by issuance of the Permit and implementation of the proposed HCP are summarized in Table 1-2. Compliance with these regulations is described in Chapter 4 (Affected Environment and Environmental Consequences) by applicable resource.

TABLE 1-2. FEDERAL ENVIRONMENTAL REGULATIONS PERTINENT TO THIS EIS

Regulation	Resource	Location Reviewed in This EIS
Endangered Species Act	Plants, Fish, Wildlife	Sections 4.7 through 4.9
Clean Water Act	Water, Plants (wetlands)	Sections 4.6 and 4.7
Executive Order 11990 (Wetland Protection)	Wetlands	Section 4.7
Executive Order 11988 (Floodplain Management)	Water	Section 4.6
Clean Air Act	Air	Section 4.3
National Historic Preservation Act	Cultural Resources	Section 4.12
Archaeological Resources Protection Act	Cultural Resources	Section 4.12
Native American Graves Protection and Reparation Act	Cultural Resources	Section 4.12
Executive Order 11593 (Protection and Enhancement of the Cultural Environment)	Cultural Resources	Section 4.12
Secretarial Order 3206 (American Indian Tribal Rights, Federal-Tribal Trust Responsibilities, and the Endangered Species Act)	Cultural Resources	Section 4.12
Executive Order 12898 (Environmental Justice)	Socioeconomics	Section 4.13
Executive Order 13175 (Consultation and Coordination with Indian Tribal Governments)	Tribal Coordination	Chapter 6.4
Migratory Bird Treaty Act	Wildlife	Section 4.9
Bald Eagle and Golden Eagle Protection Act	Wildlife	Section 4.9

1.5.2 State Laws and Regulations

The decision by DNRC, as the applicant, to implement the HCP is a major state action that may affect the quality of the human environment under MEPA (MCA 75-1-201 (1)(b)(iv)), and therefore requires an EIS. The requirements of MEPA are described below. The Forest Management ARMs are the specific legal resource management standards under which DNRC operates its forest management program. Under the HCP, the ARMs would be revised to incorporate the HCP conservation commitments. The ARMs pertaining to the HCP species and the ARMs revision process are described below. Additional state laws governing resources potentially affected by the HCP and analyzed in this EIS are also identified below.

1.5.2.1 Montana Environmental Policy Act

MEPA (MCA 75-1-101 through 75-1-324) and its DNRC implementing rules (ARMs 36.2.521 through 543) provide a public process at the state level to assure Montana's citizens that a deliberate effort is made to identify impacts before the state government permits or implements an activity that could have significant impacts on the environment. MEPA declares that it is the policy of the State of Montana to create and maintain conditions in which people can exist in productive harmony with nature, and it recognizes each person's entitlement to a healthful environment. Montana state agencies are directed to obtain the input of others concerning the potential environmental impacts of a significant state action.

DNRC's activities in the management of trust lands are subject to the planning and environmental assessment requirements of MEPA. Similar to NEPA, MEPA requires agencies to prepare a written environmental review that is available to the public. This review may be a simple checklist, a more comprehensive environmental assessment (EA), or a more detailed EIS. As the significance of a project's potential or identified environmental impacts increases, MEPA requires an increasing level of analysis and degree of public involvement. For projects for which an EIS is prepared, MEPA requires the agency to explain why it made a particular decision, what voluntary or enforceable mitigation efforts have been included in the decision, and what unavoidable environmental impacts may occur as a result of the decision. The analysis and public review requirements of NEPA and MEPA are nearly identical. In many cases, including that of the DNRC HCP, a single EIS can fulfill the requirements of both statutes.

Although MEPA was patterned after NEPA, there are some differences between the two statutes. A difference that pertains to the preparation of this EIS/HCP is the alternative analysis. MEPA requires a review of the beneficial aspects and the economic advantages and disadvantages of a proposed project, as well as a discussion of the beneficial and adverse environmental, social, and economic impacts of a project's non-completion. MEPA also states that the statute may not be used to withhold, deny, or impose conditions on a permit or other authority to act without the concurrence of the project sponsor. MEPA imposes specific timeframes for completion of environmental reviews, whereas NEPA does not impose time limits but states that agencies should adopt rules that establish timeframes for various elements of the environmental review process. The additional MEPA requirements pertinent to this project are included in this EIS analysis.

Although NEPA and MEPA are almost identical in their mandates, the implementation of each act is a separate and distinct federal and state function. Federal and state agencies are required to coordinate and cooperate with each other in the preparation of a single environmental review (consistent with 40 CFR 1500.4(n)) that is legally sufficient for both NEPA and MEPA, which is the intent of this EIS.

1.5.2.2 State Forest Land Management Plan

The SFLMP provides the philosophical basis and technical rationale for DNRC's forest management program. This section describes the relationship of this EIS/HCP to the SFLMP.

Would Implementation of the HCP Change the SFLMP?

Implementation of the HCP would not change the SFLMP. In fact, the SFLMP recommended DNRC conduct this type of planning for threatened and endangered species:

> "The department shall participate in recovery efforts of threatened and endangered plant and animal species. The department shall confer in its sole discretion with the United States Fish and Wildlife Service (USFWS) to develop habitat mitigation measures."

In 2003, DNRC adopted administrative rules for threatened and endangered species (bull trout, grizzly bear, gray wolf, and bald eagle) that provide specific legal directives for the scientific findings embodied in the SFLMP. The HCP would be a continuation of the approach for threatened and endangered species management that DNRC currently follows under the Forest Management ARMs.

How Do the Effects Described in the SFLMP EIS Differ from those Described in this EIS/HCP?

This EIS describes the effects of implementing the HCP alternatives. It includes analyses of the resources that were analyzed originally in the SFLMP EIS. This EIS was prepared to ensure that if any effects due to implementing the HCP would be different than originally described in the SFLMP EIS, those effects are appropriately considered and described. Table 1-3 displays the relationship between the analyses in the original SFLMP EIS and this EIS/HCP.

TABLE 1-3. RELATIONSHIP OF KEY ELEMENTS OF THE SFLMP EIS AND EIS/HCP

Element of Analysis	SFLMP EIS (The Selected "Omega" Alternative)	EIS/HCP
Overall management philosophy for the forest management program on state trust lands	Produce long-term trust income by managing intensively for healthy and diverse forests.	No change.
Overall management philosophy for managing wildlife and fish habitats	Combined coarse-filter and fine-filter approach: Coarse filter - manage for a variety of forest structures and compositions to support diverse wildlife habitats. Fine filter – focus on single species habitat requirements to ensure that the full range of biodiversity is addressed.	No change for general fish and wildlife. Specific measures described for ESA-listed species (grizzly bear, Canada lynx, and bull trout) and two sensitive species (westslope cutthroat trout and Columbia redband trout).
Sustainable yield of timber	Predicted yields ranged from 30 to 50 million board feet. Subsequently, the sustainable yield was calculated twice: 1996 - 42.2 million board feet 2004 - 53.2 million board feet	Used the 2004 modeling process to predict changes to the sustainable yield due to implementation of the HCP alternatives. Alternatives range from 50.6 to 58.0 million board feet.
Terrestrial wildlife analysis	Analysis based on predicted changes in forest successional stages.	Analysis based on predicted changes in forest successional stages and implementation of the conservation strategies, including transportation plans on blocked lands.
Fisheries analysis	Analysis of three impact components: sediment and nutrient loading, large organic debris, and water temperature.	Detailed programmatic analysis of impacts from sediment loading, population connectivity, cumulative watershed effects, grazing, and riparian habitat conditions.
Roads	Programmatic analysis mostly qualitative. Specific planning and analysis mostly deferred to landscape (i.e., administrative unit or watershed) and project levels.	Analysis based on implementation of the conservation strategies pertaining to roads, including transportation plans on blocked lands and road building estimates for scattered parcels.

1.5.2.3 Forest Management Administrative Rules

The Forest Management ARMs are the specific legal resource management standards under which DNRC operates its forest management program. The ARMs were adopted in March 2003. They provide the legal framework for DNRC project-level decisions and provide field personnel with consistent policy and direction for managing forested trust lands. The ARMs direct the way forest management activities are implemented and the way forest vegetation is shaped on the ground. For each resource area, the relevant ARMs are identified under the Regulatory Framework section for that resource in Chapter 4 (Affected Environment and Environmental Consequences).

<u>What is the Relationship between the HCP and the Forest Management ARMs?</u>

Implementation of the HCP would require adoption of the HCP conservation commitments as Forest Management ARMs through the Montana Administrative Procedure Act (MAPA) process (MCA Title 2, Chapter 4). Concurrent with publishing the Final EIS, DNRC will propose adoption of the HCP by reference through the MAPA rulemaking process. The MAPA process will require approximately ~~6~~3 months from the initial proposal to adoption of the HCP rule. The relationship of this EIS/HCP to the MAPA process is further described below.

Would the Commitments in the HCP Become Administrative Rules?

Yes, DNRC would propose and adopt the ~~commitments in the~~ HCP conservation strategies ~~"~~by reference~~," meaning the entire HCP will be adopted as one rule~~. In accordance with MAPA

- DNRC would propose adoption of the HCP conservation strategies by reference in the Montana Administrative Register.
- DNRC would notify interested persons of the proposal and invite their written or oral input.
- DNRC would schedule a public hearing(s) for interested persons who want to testify about the rule in person.
- The HCP would be made available for review by any persons interested in the rule-making process.
- DNRC would consider all written and verbal comments prior to adopting the HCP conservation strategies as an administrative rule.
- DNRC would respond to comments and testimony and will address opposition to the adoption of the rule.

How Would Adopting the HCP Affect the Existing Rules?

The existing body of rules would be kept in place. Many trust lands parcels are not included in the HCP, and the existing rules would still apply to those parcels.

What Would the HCP Rule Look Like?

The HCP rule would be proposed in the following form:

(Rule X) INCORPORATION BY REFERENCE OF THE DNRC HABITAT CONSERVATION PLAN

(1) The department ~~adopts and incorporates by reference the~~will implement the conservation strategies pursuant to the (~~date~~2010) Montana DNRC Forested State Trust Lands Habitat Conservation Plan (HCP) in accordance with the associated Incidental Take Permit. All forest management projects that are conducted on trust lands parcels listed on the Permit shall ~~comply with the terms~~adhere to the terms of the conservation strategies of the HCP~~, the Permit, and the Implementing Agreement~~.

Is MEPA Required for Rulemaking Under MAPA?

While MAPA does not specifically identify a MEPA requirement, the statutes that govern the administration of state trust lands indicate that MEPA applies to DNRC rule-making. This EIS will serve as the MEPA ~~analysis~~document for the MAPA process of adopting the HCP conservation strategies by reference as an administrative rule.

1.5.2.4 Other Applicable State Laws

Other state laws pertinent to environmental resources that may be affected by issuance of a Permit and subsequent land management under the HCP are identified in Table 1-4. Compliance with these regulations pertinent to the proposed HCP is described in Chapter 4 (Affected Environment and Environmental Consequences) by applicable resource.

TABLE 1-4. STATE ENVIRONMENTAL REGULATIONS PERTINENT TO THIS EIS

Regulation	Resource	Location Reviewed in EIS
Nongame and Endangered Species Conservation Act	Fish, Wildlife	Sections 4.8 and 4.9
Montana Streamside Management Zone Act	Water, Fish	Sections 4.6 and 4.8
Montana Stream Protection Act	Water, Fish	Sections 4.6 and 4.8
Antidegradation Policy	Water	Section 4.6
Montana Water Pollution Control Act	Water	Section 4.6
Clean Air Act of Montana	Air	Section 4.3
Montana Antiquities Act	Cultural Resources	Section 4.12
Montana Noxious Weed Control Act	Weeds	Section 4.7

DNRC's Montana Forestry best management practices (BMPs) consist of forest stewardship practices to manage forestland for protecting water quality and forest soils (DNRC 2004a). The implementation of BMPs by DNRC is required under ARM 36.11.422. Key Montana Forestry BMP elements include streamside management, roads, timber harvesting and site preparation, stream crossings, winter logging, and hazardous substances.

Chapter

Environmental and Procedural Setting

2 Environmental and Procedural Setting

2.1 Introduction

This chapter describes the environmental and procedural setting under which DNRC implements its programs on trust lands. The various agency offices are described, as well as their mission and roles specific to the forest management program, which is the subject of the proposed HCP. Also described are the trust land base, the legal framework for forest management of trust lands, and the programs within the overall forest management program. As the primary activity conducted on forested trust lands, and the primary source of revenue for forested trust lands, the forest product sales program (timber sales process) is also described.

2.2 Department of Natural Resources and Conservation

This section identifies DNRC's mission and summarizes its organizational structure. This section also discusses the legal framework for management of trust lands, and the mission, organizational structure, and programs of the TLMD.

2.2.1 DNRC's Mission and Current Organizational Structure

DNRC's mission is to help ensure Montana's land and water resources provide benefits for present and future generations. DNRC comprises seven divisions: Centralized Services; Conservation and Resource Development; Forestry; Oil and Gas Conservation; Reserved Water Rights Compact Commission; Trust Land Management, and Water Resources. The Reserved Water Rights Compact Commission and Oil and Gas Conservation Divisions are attached to DNRC for administrative purposes, and the remaining five divisions implement DNRC's mission. The proposed HCP is focused on the forest management program in the TLMD.

2.2.2 Trust Land Management Division

Pursuant to the Enabling Act, approved February 22, 1889, the Congress of the United States granted to the State of Montana sections 16 and 36 in every township within the state for support of the common schools. When the State of Montana was admitted into the Union, the original common school grant was 5,188,000 million surface and subsurface acres, with 668,720 acres added for other endowed institutions, for a total of 5,856,720 acres.

The TLMD was established in 1995 through a legislative reorganization of the Montana natural resource agencies and is responsible for the management of trust lands (Figure 2-1). Today, the TLMD manages more than 5.1 million surface acres and more than 6.2 million subsurface acres of trust lands (DNRC 2007a). The total acreage figure fluctuates from year to year due to land sales, exchanges, and acquisitions. Mineral acreage now exceeds surface acreage because the mineral estate has been retained when lands are sold, in accordance with MCA 77-2-304.

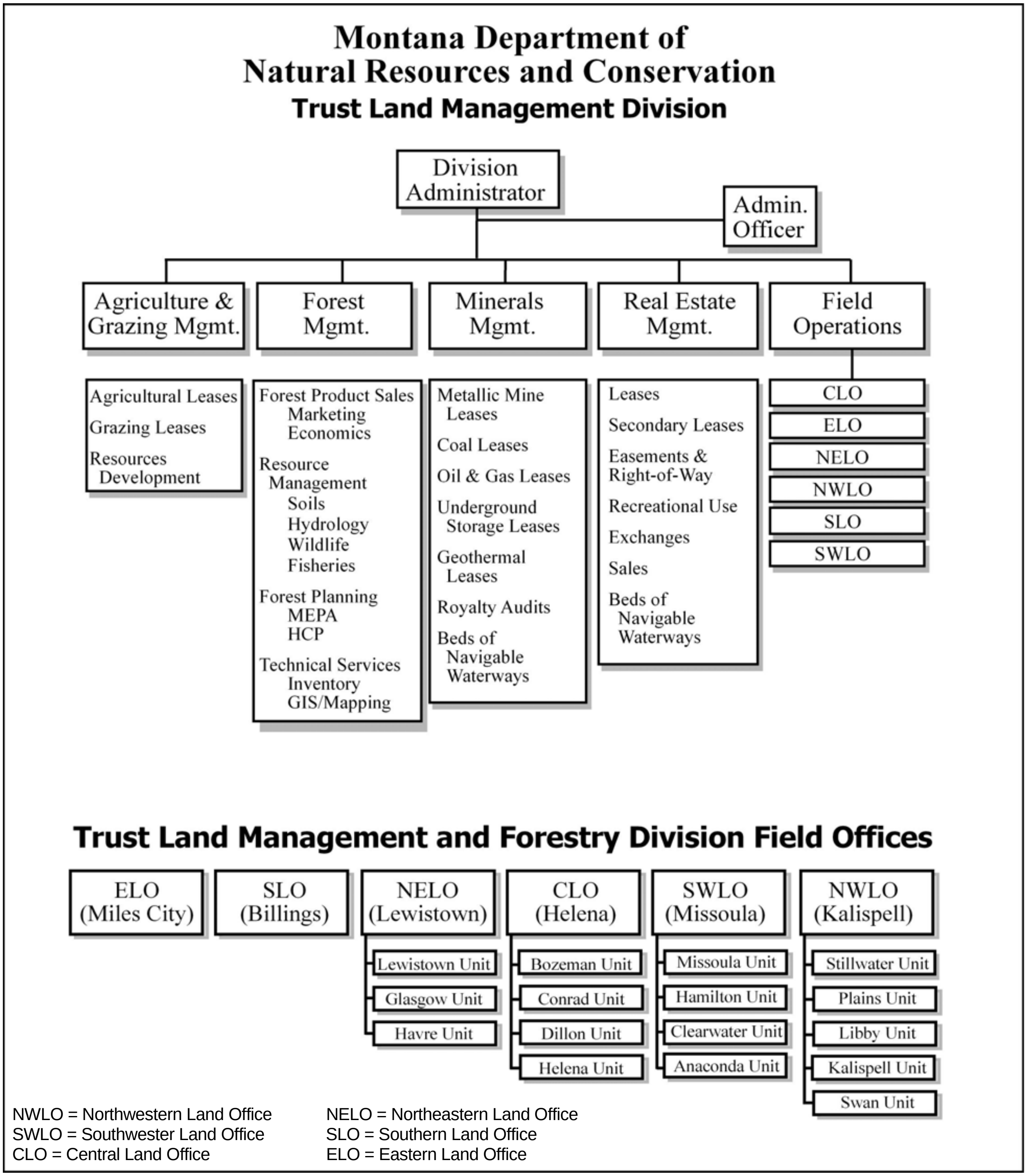

FIGURE 2-1. DNRC TRUST LAND MANAGEMENT DIVISION ORGANIZATION CHART

The mission of the TLMD is to manage trust land resources to produce revenues for the trust beneficiaries while considering environmental factors and protecting the future income-generating capacity of the land. The trust beneficiaries include the following:

- Common schools (K–12 education)
- University of Montana
- Montana State University
- Montana Tech (Butte)
- University of Montana (Western)
- Montana State University (Billings)
- Pine Hills Youth Correctional Facility
- Montana School for the Deaf and Blind
- Montana Veterans' Home.

The TLMD administers and manages the state trust timber, surface, and mineral resources for the trust beneficiaries under the direction of the State Board of Land Commissioners (Land Board). The Land Board consists of Montana's five top elected officials: Governor, Superintendent of Public Instruction, Secretary of State, Attorney General, and State Auditor. While the TLMD's obligation is to obtain the greatest benefit for the state trust, the monetary return must be weighed against the long-term productivity of the land to ensure continued future returns to the various trust beneficiaries. The Land Board is required to ensure that use or sale of trust lands satisfies trust principles and complies with state standards.

The TLMD is first and foremost committed to asset management. The TLMD has been returning revenues averaging $39.2 million to the state trusts over each of the past 5 years. Those revenues have been obtained through an average annual expenditure of $6.8 million, yielding a return on investment ratio of approximately 5.8 to 1.

2.2.2.1 Legal Framework for the Management of Trust Lands

Trust lands are managed under Montana's Enabling Act, Constitution, and the statutes and administrative rules found in the MCA and ARMs, respectively. The Enabling Act provides that proceeds from the sale and permanent disposition of any trust lands constitutes permanent funds for the support and maintenance of Montana's public schools and the various state institutions for which the lands were granted. The Montana Constitution provides that these permanent funds shall forever remain inviolate, guaranteed by the State of Montana against loss or diversion.

The Enabling Act further provides that rentals received on leased lands, interest earned on the permanent funds arising from these lands, interest earned on deferred payments on lands sold, and all other actual income shall be available for the maintenance and support of such schools and institutions. While the trust lands are considered state-owned, the lands may only be managed to fulfill the specific purposes for which the trust was created, and the use of trust lands must result in income to the intended trust beneficiary. Montana's Constitution further states that any use or disposition of the trust lands must generate "full market value."

The Constitution also gives the Land Board the authority to manage and control the disposition of the trust lands. The Land Board can take no action contrary to trust principles as applied to one acting in a fiduciary capacity. However, it has broad discretion in applying those principles. That discretion is necessary because DNRC is required to not only satisfy trust principles, but also to comply with the state statutes.

The discretion that DNRC may exercise is alluded to in MCA 77-1-202: "…these lands and funds are held in trust for the support of education and for the attainment of other worthy objects helpful to the well-being of the people of this state as provided in the Enabling Act. The board shall administer this trust to secure the largest measure of legitimate and reasonable advantage to the state."

This discretionary authority of DNRC is exercised pursuant to two principles. The first is the concept of sustainable yield. The Montana Supreme Court has said, "In exercising its constitutional authority the legislature has provided that full market value shall encompass the concept of sustained yield" (*Jerke vs. Department of State Lands*, 182 Mont. 294, 296, 597 P.2d 49, 51 [1979]). Therefore, it is within the discretion of DNRC to receive less income currently, if this action would maintain the long-term productivity of the land and guarantee income to the beneficiaries in the long run. For example, DNRC may prescribe shelterwood timber harvest that generates less immediate return than a clearcut if the shelterwood harvest is expected to provide for regeneration and a better long-term financial return to the trust.

The second important principle is that DNRC's management of trust lands is subject to state and federal laws enacted to protect public health, safety, welfare, and the environment. The Montana Constitution requires that "the state and each person shall maintain and improve a clean and healthful environment in Montana for present and future generations" and directs the legislature to enact laws to this end (1972 Montana Constitution, Article IX, Section 1). Several such laws are identified in Section 1.5 (Relationship to Other Plans, Regulations, and Laws). DNRC's activities in the management of trust lands are also subject to planning and environmental assessment requirements of MEPA and the administrative rules implementing MEPA (ARMs 36.2.501 through 611) and legal requirements and procedures for state land management contained in MCA Title 77 and ARM Title 36. The requirements of MEPA are described in Section 1.5 (Relationship to Other Plans, Regulations, and Laws). MCA Title 77 and ARM Title 36, contain statutes and rules that provide specific legal requirements and procedures for state land management, respectively. The subjects addressed by these laws are briefly outlined below.

Statutes (MCA Title 77)

The provisions contained in the seven MCA Title 77 chapters are described below.

Chapter 1, Administration of State Lands, contains general provisions relating to state lands, including powers and duties of the Land Board and DNRC, multiple-use management, classification, equalization payments, resource development, and ownership records.

Chapter 2, Transfers and Reservation of Property Interests, contains provisions addressing easements, exchanges, and sales of state lands.

Chapter 3, Rock, Mineral, Coal, Oil and Gas Resources, contains provisions addressing prospecting permits and mineral leases handled by DNRC's Minerals Management Bureau.

Chapter 4, Geothermal and Hydroelectric Resources, contains provisions for leasing for development of such resources.

Chapter 5, Timber Resources, contains provisions related to management of state forestlands, including

- Provisions that classify and designate as "state forests" all state-owned lands "which are principally valuable for the timber that is on them or for the growing of timber or for watershed protection" and reserves said lands "for forest production and watershed protection" (MCA 77-5-101)
- Provisions for timber sales (MCA 77-5-201) and timber permits (MCA 77-5-212)
- Provisions for salvage timber sales (MCA 77-5-207) and a provision for the removal of timber in cases of emergency due to fire, insect, fungus, parasite, or blowdown
- Prohibitions from either temporarily or permanently designating, treating, or disposing of any interest in any state forestlands, unless the full market value of the property interest or of the revenue foregone is obtained (MCA 77-5-116)
- Provisions for the determination of annual sustainable yield (MCA 77-5-222).

Chapter 6, Agriculture, Grazing, and Other Surface Leases, contains provisions addressing surface leases of state lands.

Administrative Rules (ARM Title 36)

ARM Title 36 addresses land leasing and surface management, forest management, and streamside management on state land.

State land leasing and surface management rules (ARMs 36.25.101 through 167) contain provisions addressing surface leases and licenses on state land.

State Forest Management ARMs (36.11.401 through 456) are the resource management standards for the management of forested trust lands and apply to all forest management activities on all forested trust lands administered by DNRC.

Streamside management zone rules (ARMs 36.11.301 through 313) contain provisions addressing timber harvest adjacent to streams.

2.2.2.2 TLMD Bureaus and Associated Land Area

The TLMD is divided into four bureaus, which manage various portions of the trust lands (Table 2-1):

- Agriculture (11 percent of trust lands) and Grazing Management (79 percent)
- Minerals Management (less than 1 percent)
- Real Estate Management (less than 1 percent)
- Forest Management (9 percent).

TABLE 2-1. LAND USE CLASSIFICATION OF TRUST LANDS MANAGED BY DNRC STATEWIDE

Land Use Classification	Acres	Managing Bureau for Surface Acres[2]	Percent of Total
Agriculture	547,600	Agriculture and Grazing	11
Grazing	4,101,600	Agriculture and Grazing	79
Forest	481,200	Forest	9
Other[1]	18,500	Real Estate	<1
Unassigned	50,200	Agriculture and Grazing, Forest, or Real Estate	<1
Total	**5,199,100**		**100**

[1] "Other" includes those uses such as administrative sites, cabin sites, commercial leases, and military sites that do not fit into the first three categories.
[2] All subsurface acres are managed by the Minerals Management Bureau.
Source: DNRC (2008a), rounded to the nearest 100 acres.

Trust lands are legally assigned to one of four land use classes. The four classes are grazing, agricultural, forest, and other (Table 2-1). The basis for classification is to ensure that lands are used to best meet the Land Board's trust and multiple-use responsibilities and that no lands are sold, leased, or used under a different classification than the one to which they belong.

The four bureaus within the TLMD guide policy development for their respective programs, which are described below. The bureaus also work in concert with field practitioners to implement projects and prepare project documentation packages for Director and Land Board approval.

Agriculture and Grazing Management. This bureau is responsible for leasing and managing crop and rangeland uses on 4.65 million acres of trust lands statewide through approximately 10,000 separate agreements. This responsibility includes evaluation and assessment of range and cropland condition; administration of archaeological, paleontological, and historical properties on trust land; investigations of lease non-compliance; participation in the Federal Farm Program; and oversight of water developments, water rights, and improvement projects such as range renovations and resource development.

Minerals Management. This bureau is responsible for leasing, permitting, and managing oil and gas, metalliferous and non-metalliferous minerals, coal, and sand and gravel agreements on the 6.2 million mineral acres of trust lands, as well as more than 100,000 acres of other state-owned land throughout Montana.

Real Estate Management. This bureau administers all sales, exchanges, and acquisitions of trust lands, as well as right-of-way requests, commercial developments, and residential leases. The bureau also manages secondary activities on trust lands, such as temporary storage of gravel, construction materials, or equipment; group activities; research, outfitting, and other forms of recreation; and short-term agricultural uses such as grain bins, stockwater reservoirs, or pipelines.

Forest Management. This bureau provides policy and programmatic direction for the forest management program. Bureau staff also provide technical expertise and site-specific reviews as members of interdisciplinary (ID) teams that develop forest management projects. The sections within the FMB are Forest Operations, Technical Services, Resource Management, Forest Product Sales and Marketing, and Forest Planning and Implementation. The FMB will have the primary responsibility for administering the HCP and Permit.

2.2.3 DNRC Land Offices and Administrative Units

DNRC's trust lands are managed through six land offices, which have primary responsibility for on-the-ground management activities (Figure D-2 in Appendix D, EIS Figures). Total trust land area managed by DNRC represents 6 percent of the total lands in Montana (Table 2-2).

TABLE 2-2. ACRES OF ALL LAND OWNERSHIP AND DNRC TRUST LANDS BY LAND OFFICE

Land Office	Total Lands (All Ownerships)	DNRC Trust Lands	Percent of All Ownership in DNRC Trust Land
Northwestern			
Stillwater Block[1]	90,800	90,800	1%
Swan River State Forest	39,800	39,800	0%
Scattered Parcels[2]	8,936,300	185,600	2%
Subtotal	**9,066,900**	**316,200**	**3%**
Southwestern	7,432,200	234,700	3%
Central	22,894,800	1,262,500	6%
Eastern	20,292,900	1,241,500	6%
Northeastern	23,931,800	1,750,800	7%
Southern	10,394,100	393,400	4%
Total	**94,012,700**	**5,199,100**	**6%**

[1] Stillwater and Coal Creek State Forests.
[2] DNRC lands not included in a state forest.
Source: DNRC (2008a), rounded to the nearest 100 acres.

2.3 TLMD Forest Management Program

The FMB, in cooperation with the land offices, implements DNRC's forest management program. This section describes the mission, philosophy, and guidelines of the FMB, and describes the land base upon which forest management activities occur, as well as the adjacent land ownership patterns and their influence on the forest management program. This section also identifies the programs supporting forest management activities on trust lands, and identifies the DNRC land offices and administrative units that carry out the on-the-ground forest management activities.

2.3.1 Forest Management Program Mission, Philosophy, Guidelines, and Direction

The mission of DNRC's forest management program is "to sustainably manage Montana's forested trust lands to maximize long-term revenue while promoting healthy and diverse forests." From this point forward, DNRC and its divisions and bureaus are referred to collectively as DNRC.

DNRC generates revenue for state trust beneficiaries by managing forested trust lands through the harvesting and selling of timber. DNRC's forest management actions are governed by the Forest Management ARMs (36.11.401 through 456), and other applicable rules and laws. The ARMs dictate DNRC's management objectives, regulate how and where timber harvest can take place, and establish DNRC policy for the protection of habitat for terrestrial and aquatic species, while maintaining DNRC's ability to generate revenues for its trust beneficiaries.

At least once every 10 years, DNRC determines the annual sustainable yield of timber to be prepared for sale on forested trust lands. The sustainable yield is the annual timber sale requirement, but it also represents a management level needed to maintain healthy and diverse forests and meet other important ecological goals.

The application of these philosophies, guidelines, and standards ultimately provides the basis for the forest management activities that shape the condition of forested trust lands.

The SFLMP provides the philosophical basis, technical rationale, and analysis for DNRC's forest management program, while the ARMs provide the specific legal mandate with respect to the resource management standards.

2.3.1.1 State Forest Land Management Plan

The SFLMP provides the philosophical basis and technical rationale for DNRC's forest management program. The SFLMP is based on the philosophy that the best way to produce long-term income for the trust is to manage intensively for healthy and biologically diverse forests as summarized in the following excerpt. Therefore, for the foreseeable future, timber management will continue to be the primary source of revenue and primary tool for achieving biodiversity objectives on forested trust lands.

> *"Our premise is that the best way to produce long-term income for the trust is to manage intensively for healthy and biologically diverse forests. Our understanding is that a diverse forest is a stable forest that will produce the most reliable and highest long-term revenue*

stream. Healthy and biologically diverse forests would provide for sustained income from both timber and a variety of other uses. They would also help maintain stable trust income in the face of uncertainty regarding future resource values. In the foreseeable future timber management will continue to be our primary source of revenue and primary tool for achieving biodiversity objectives."

The SFLMP and ARM 36.11.404 take a coarse-filter approach to biodiversity. The coarse-filter approach operates at the landscape scale and focuses on maintaining an appropriate mix of stand structures and compositions on forested trust lands. This approach is based on the understanding that, if DNRC maintains landscape patterns and processes similar to those with which the component species evolved, then the full complement of species will persist and biodiversity will be maintained (Jensen and Everett 1994). Maintaining a diversity of stand structures and compositions (cover types) also provides a range of current and prospective trust revenue opportunities, including a sustainable yield of timber, maintenance of forest health and biodiversity, and other outputs, while reducing risks of catastrophic fires and insect or disease attacks.

Because the coarse-filter approach may not adequately address the full range of needs required to support biodiversity, a fine-filter approach, as provided for in ARM 36.11.406, may be employed to address the needs of threatened, endangered, or sensitive species.

To achieve its biodiversity objectives, DNRC manages large, blocked ownerships for a desired future condition (DFC) characterized by the proportion and distribution of forest cover types and structures (snags, coarse woody debris [CWD], large live trees) historically present on the landscape. Across its ownership, on scattered or smaller parcels, DNRC strives to create and maintain a semblance of historical conditions (cover type and structure) to the extent feasible.

2.3.1.2 Forest Management Administrative Rules

The Forest Management ARMs provide the specific legal mandate with respect to the resource management standards under which DNRC operates its forest management program. The ARMs were adopted in March 2003 and provide the legal mandate for DNRC project-level decisions. They also provide field personnel with consistent policy and direction for managing forested trust lands.

2.3.1.3 Sustainable Yield Calculation

DNRC is required to calculate the annual sustainable yield for forested trust lands at least every 10 years (MCA 77-5-223(2)). The legislature defines the annual sustainable yield calculation (SYC) 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).

The SYC is calculated using a forest management model that considers the acres available for management and capable of growing timber, and projects how timber stands will grow and change over time under different management regimes. The forest model uses a long-term horizon (100 or more years) to find the best set of forest management regimes, given the objectives and constraints facing DNRC land managers.

When the sustainable yield was last calculated in 2004, it incorporated all applicable laws and environmental commitments by DNRC as described in the MCA and ARMs. Biodiversity, forest health, endangered species considerations, and DFCs are important aspects of state forestland management. These factors were modeled in the SYC and were reflected in the various constraints applied to the model. These constraints are identified and described in Section 4.2 (Forest Vegetation). Therefore, the SYC represents more than just an annual volume goal; it also represents the management level needed to maintain healthy and diverse forests and to meet other important ecological goals and commitments. The 2004 analysis resulted in an SYC of 53.2 million board feet.

2.3.2 The Forested Land Base and Land Ownership Patterns

DNRC administers 726,666 acres of forestlands throughout the state. While Table 2-1 indicates that 481,200 acres of trust lands are classified as forest, additional lands within other classifications are partially forested and jointly managed by DNRC under the various TLMD bureaus. Of the 726,666 forested acres of trust lands, 446,100 acres are included in the HCP project area, all of which lie within the planning area consisting of DNRC's NWLO, SWLO, and CLO. The remaining 102,400 acres in the HCP project area are non-forested trust lands that were included in the project area because they provide access to forested lands.

Statewide, DNRC's net amount of forestlands available for timber management is 726,666 acres. Areas of roads, rivers, and lakes are subtracted from the total amount of forested acres to obtain an acreage estimate that is closer to the actual acres managed. DNRC categorizes forestlands as commercial forestland and non-commercial forestland. Of the total forested acres, 51,521 acres are classified as non-commercial forestland because they are incapable of growing at least 20 cubic feet of wood per acre per year, and/or do not produce trees of sufficient commercial value. The majority of these non-commercial acres are found in DNRC's eastern land offices, where productivity is lowest, as shown in Table 2-3.

When calculating the sustainable yield of timber, DNRC defers active timber management on commercial forestlands with extreme topography challenges, where current policy or law requires something other than active timber management, or that are inaccessible over the long term. DNRC has deferred management on 91,755 acres of the forestlands. These acres are relatively evenly distributed across the land offices (Table 2-4).

Non-commercial and deferred acres are not scheduled for active timber management under the current forest management program. These acres were also not included in the acres available for management under the proposed HCP. Tables 2-3 and 2-4 show that across all DNRC land offices, approximately 80 percent of the forestland is available for active management (583,389 acres), and approximately 90 percent of the HCP project area is available for active management (404,062 acres).

TABLE 2-3. COMMERCIAL AND NON-COMMERCIAL FORESTLAND AREA BY LAND OFFICE FOR ALL DNRC FORESTLAND AND FOR THE HCP PROJECT AREA

	CLO		Eastern LOs		NWLO		SWLO		Total	
	All DNRC Forestlands	HCP Project Area	All DNRC Forestlands	HCP Project Area[1]	All DNRC Forestlands	HCP Project Area	All DNRC Forestlands	HCP Project Area	All DNRC Forestlands	HCP Project Area
Commercial Forestland	107,557	54,337	128,798	0	285,181	255,071	153,609	130,657	675,144	440,065
Non-commercial Forestland	9,282	2,320	38,401	0	2,922	2,830	916	880	51,521	6,029
Total Forestland	**116,839**	**56,657**	**167,199**	**0**	**288,103**	**257,901**	**154,525**	**131,537**	**726,666**	**446,095**

[1] The HCP project area does not extend into any of DNRC's eastern land offices.
Source: DNRC (2004b).

TABLE 2-4. FORESTLAND AREA IN ACRES BY MANAGEMENT CLASSIFICATION AND LAND OFFICE FOR ALL DNRC FORESTLAND AND IN THE HCP PROJECT AREA

	CLO		Eastern LOs		NWLO		SWLO		Total	
Management Classification	All DNRC Forestlands	HCP Project Area	All DNRC Forestlands	HCP Project Area[1]	All DNRC Forestlands	HCP Project Area	All DNRC Forestlands	HCP Project Area	All DNRC Forestlands	HCP Project Area
Available for Management	85,942	45,922	95,916	0	262,160	236,155	139,371	121,985	583,389	404,062
Deferred from Management	21,614	8,415	32,882	0	23,021	18,916	14,238	8,673	91,755	36,003
Non-commercial Forestland	9,282	2,320	38,401	0	2,922	2,829	916	880	51,521	6,029
Total Forestland	**116,839**	**56,657**	**167,199**	**0**	**288,103**	**257,900**	**154,525**	**131,537**	**726,666**	**446,095**

[1] The HCP project area does not extend into any of DNRC's eastern land offices.
Source: DNRC (2004b).

The planning area for this HCP consists of all ownerships in the NWLO, SWLO, and CLO as described in Chapter 1 (Purpose and Need for Action) (see also Figure D-1 in Appendix D, EIS Figures). Trust lands occur on the landscape as scattered parcels or as blocks of land. As shown in Table 2-2, blocked lands in the planning area include the Stillwater Block (Stillwater and Coal Creek State Forests) and the Swan River State Forest in the NWLO. All other trust lands in the planning area are considered scattered parcels.

Other federal and state entities that own land within the boundaries of the NWLO, SWLO, and CLO include the federal government; Native American Tribes; Montana Fish, Wildlife and Parks (MFWP); and other state agencies (Table 2-5 and Figure D-3 in Appendix D, EIS Figures). The primary private landowner in western Montana is Plum Creek Timber Company (Plum Creek), which is also operating under an HCP for aquatic species on its forestlands. The federal government and private parties own the majority of land in western Montana, and the United States Department of Agriculture (USDA) Forest Service (USFS) is the primary landowner among the federal agencies.

The checkerboard pattern of land ownership poses several challenges to DNRC's land management. One of the greatest challenges is road access. Where access to DNRC land requires traveling on private roads, DNRC must have or obtain landowner permission to use those roads. In some cases, such permission is not granted by the landowners, and DNRC is unable to conduct management activities. Restoration and similar conservation efforts conducted by DNRC on timber harvest areas can also be nullified by adjacent activities on private lands. For example, stream restoration on DNRC-managed lands may have little value if downstream activities on private lands are creating fish passage barriers and/or erosion and other impacts to stream and riparian habitat. In other cases, management of checkerboard lands has been improved through cooperation with other federal, state, and private landowners.

Where blocks of trust lands occur on the landscape, DNRC can more effectively manage access and on-the-ground activities because there are fewer complications due to the interspersed ownership patterns described above.

2.3.3 Forest Management Programs

This section describes DNRC's forest management programs, which include forest product sales, forest improvement, forest inventory, forest planning and implementation, and resource management. The forest management activities conducted within these programs that would be covered under the HCP are described in HCP Chapter 1 (Introduction) in Appendix A (HCP).

2.3.3.1 Forest Product Sales Program

The forest products sales program incorporates all activities and expenditures required to efficiently grow, harvest, and sell forest products from trust lands. Foresters and resource specialists develop, analyze, and review in the field all timber sales and permits to ensure that sales comply with all applicable laws, policies, and management direction. Activities within this program include design and field layout of timber sales; development of sale prescriptions; MEPA documentation; preparation of sale contracts, prospectuses, and notices; both field and office administration of timber sales; and sale billing and accounting. These responsibilities are shared among DNRC staff at the administrative unit, land office, and bureau levels. Administrative unit offices provide local forestland management for each of the land offices.

TABLE 2-5. LAND OWNERSHIP IN THE PLANNING AREA

Landowner		Acres	Percent of Total for All Lands
Federal Lands			
USFS		15,031,100	38.1
BLM		1,446,300	3.7
NPS		1,142,100	2.9
USFWS		101,600	0.3
BOR		85,600	0.2
Other Federal (ACOE, USDA, DOD)		23,900	0.1
	Total	**17,830,600**	**45.2**
Tribal Lands			
BIA Trust Land and Administration		978,600	2.5
Confederated Salish and Kootenai (Tribal Lands)		674,700	1.7
	Total	**1,653,300**	**4.2**
State Lands			
Trust Lands		1,813,500	4.6
MFWP		250,300	0.6
Other State		60,200	0.2
	Total	**2,124,000**	**5.4**
Other			
Plum Creek (Private)		1,394,000	3.5
Other Private		15,893,700	40.3
Water		434,300	1.1
Environmental Organizations		70,000	0.2
Unknown		6,100	0.0
County and Local Government		1,200	0.0
	Total	**17,799,300**	**45.2**
	Total All Lands	**39,407,200[1]**	**100.0**

[1] Totals between tables may differ due to rounding.
USFS = United States Department of Agriculture, Forest Service.
BLM = United States Bureau of Land Management.
NPS = National Park Service.
USFWS = United States Fish and Wildlife Service.
BOR = Bureau of Reclamation.
ACOE = United States Army Corps of Engineers.
USDA = United States Department of Agriculture.
DOD = Department of Defense.
BIA = Bureau of Indian Affairs.
MFWP = Montana Fish, Wildlife and Parks.
Source: DNRC (2008a).

2.3.3.2 Forest Improvement Program

The forest improvement program uses fees from harvested timber to improve the health, productivity, and value of forested trust lands. Uses of these fees authorized by statute include disposal of logging slash, reforestation, acquisition of access to and maintenance of roads necessary for timber harvest, other treatments necessary to improve the condition and income potential of state forestlands, and compliance with other legal requirements associated with timber harvest. Specific activities include piling of logging slash, prescribed burning, site preparation, seed collection, seedling production, tree planting, thinning, genetic tree improvements, erosion control, and culvert replacement.

Forest improvement program funds are also used to collect and analyze forest resource inventory data, including a comprehensive inventory of all timber resources on forested trust lands. This effort includes the development and maintenance of a geographic information system (GIS) inventory used to support forest management planning, which is coordinated through the Technical Services Section of the FMB.

2.3.3.3 Forest Inventory Program

The forest inventory program is responsible for collecting and analyzing forest resource inventory data to support planning for forest management activities, environmental analyses, and other activities on forested trust lands.

2.3.3.4 Forest Planning and Implementation

The forest planning and implementation program provides technical assistance to field staff in the disciplines of forest planning, regulatory compliance, and MEPA documentation. This assistance is provided through training programs, participation on ID teams, development of guidance documents, and maintenance and monitoring of the SFLMP and ARMs.

2.3.3.5 Resource Management

The resource management program provides technical assistance to field staff in the disciplines of hydrology, soils, geology, fisheries, wildlife, sensitive plants, road engineering, and riparian grazing. This assistance is provided through field reviews, project analysis, MEPA documentation, development of design recommendations and mitigation measures, and monitoring of activities on forested trust lands.

This program also monitors grazing licenses on classified forest trust lands. However, this program does not include grazing leases issued on DNRC classified grazing or classified agricultural lands. Both grazing licenses and leases are administered by the Agriculture and Grazing Management Bureau.

2.4 Timber Sales Program

Timber sales are the primary activity conducted through the forest management program and the primary source of revenue on forested trust lands. This section describes the timber sale planning and preparation process, as well as the administration and monitoring of timber sale contracts.

In addition to timber sales, smaller timber projects (up to 100 thousand board feet [mbf]), or 200 mbf emergency salvage, may be prepared and sold as timber "permits." Permits are not required to be individually approved by the Land Board or to be advertised for sale. The level of involvement of resource specialists for timber permits tends to be less than for larger projects and is determined on a case-by-case basis. Some permits are categorically excluded from the requirement to prepare an EA or EIS (ARM 36.11.447); however, DNRC prepares an environmental assessment checklist for most permits.

Implementation of the HCP would be incorporated into the planning, preparation, administration, and monitoring of all timber sales, including timber permits that are not subject to Land Board approval.

2.4.1 Timber Sale Planning and Preparation Process

This section describes the elements of the timber sale and planning process. This process is outlined in Figure 2-2 and summarized below.

The land offices and administrative unit offices have primary responsibility for implementation of the timber sales program and on-the-ground management activities. With assistance from the FMB, they conduct environmental reviews of proposed management activities, prepare contracts for those activities, and complete necessary field work. The steps DNRC follows to complete the timber sales and planning process are summarized below.

Each DNRC land office maintains a 3-year listing of proposed timber sale projects for each of its administrative unit offices. Administrative unit foresters, referred to as project leaders, are responsible for identifying and nominating projects based on fieldwork, stand-level inventories (SLIs), and personal knowledge of stand treatment needs, as well as salvage needs in response to natural disturbances. Land office and FMB staff conduct preliminary reviews of proposed projects to identify areas of concern, initial analysis needs, or special planning requirements.

DNRC issues an initial project proposal to formally notify potentially affected parties of a possible timber sale project and to initiate the scoping process, as required by MEPA. During public and internal review, issues associated with specific projects are identified so that the appropriate level of MEPA analysis and documentation can be determined.

Field reviews to evaluate the existing conditions of the affected resources are conducted after scoping. At this stage, information is gathered to develop a description of the affected environment, and preliminary analyses are conducted to identify mitigation measures that may be appropriate for the proposed action. Based on scoping and field reviews, DNRC determines the appropriate alternatives for analysis in the MEPA document. Specialists then provide written reports on the existing conditions and predicted effects of the action alternatives for integration into the MEPA document.

The MEPA document is subsequently compiled for internal and public review and comment. For EISs and EAs, DNRC responds to public comments and may revise the project based on public concerns. DNRC then selects the alternative that best meets its mission, as well as the project purpose and need. During timber sale design and layout, the mitigation measures in the MEPA document are integrated into the timber sale contract and implemented in the field through flagging buffers and work zones, modifications to roads, and timber marking. The timber sale contract is prepared and submitted to the Land Board for review and rejection or approval. If approved, the sale is then offered for competitive bid and subsequently awarded to the highest bidder.

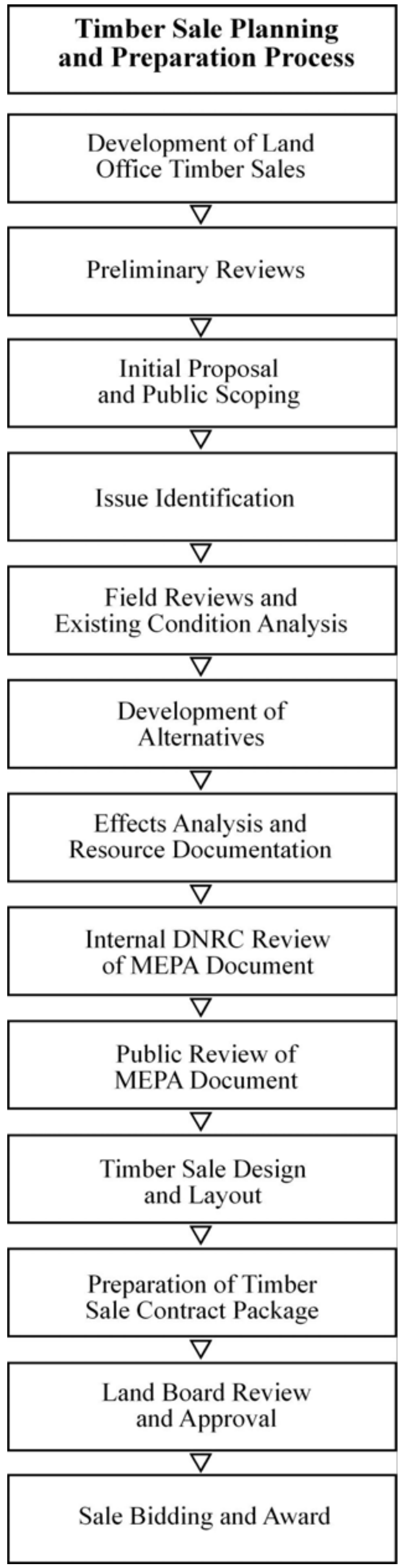

FIGURE 2-2. DNRC'S TIMBER SALE PLANNING AND PREPARATION PROCESS

2.4.2 Timber Sale Administration and Monitoring

This section describes the administration and monitoring of timber sale projects that are conducted by the field staff as well as FMB staff. This process is summarized below and outlined in Figure 2-3.

Following award of a sale, the purchaser and the DNRC forest officer review the sale in a pre-work meeting to address operational conditions, constraints, and special requirements of the contract. Sale administration inspections occur throughout the operational period, and reports are generated to document that resource protection measures are adequate and implemented properly. In addition to the contract compliance and operational inspections, DNRC conducts annual monitoring to determine compliance with the SFLMP and ARMs. The monitoring also ensures special requirements are implemented correctly and meet the goals upon which the rules and the plan were developed. These monitoring efforts include internal BMP audits, statewide BMP audits, timber sale implementation monitoring, pre- and post-harvest monitoring, and watershed monitoring projects.

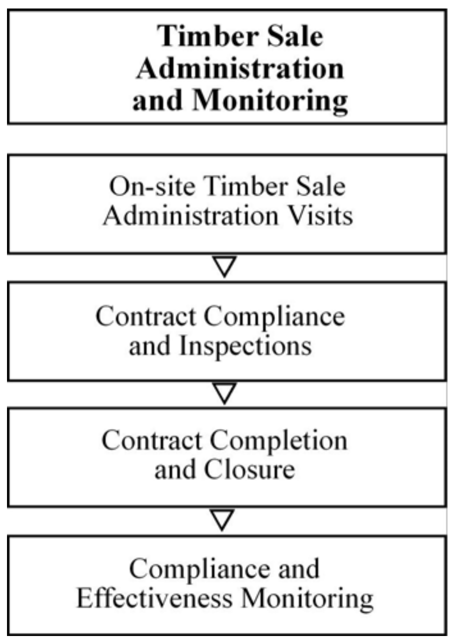

FIGURE 2-3. DNRC'S TIMBER SALE ADMINISTRATION AND MONITORING PROCESS

Chapter

Alternatives

Table of Contents (continued)

3 Alternatives

3.1 Introduction

This chapter describes the conservation strategies comprising each of the alternatives analyzed in this EIS, including the proposed HCP. The first two subsections describe how the EIS alternatives were developed and selected for detailed analysis. The next two subsections describe the alternatives analyzed in detail and alternatives considered but eliminated from detailed analysis. The next two subsections identify the preferred alternative and the environmentally preferred alternative. A comparison of effects of alternatives by key issue is also provided at the end of this chapter (Section 3.8, Comparison of Resource Effects by Alternative).

3.2 How the Alternatives Were Developed

Council on Environmental Quality (CEQ) regulations for implementing NEPA require federal agencies to rigorously explore and objectively evaluate all reasonable alternatives. MEPA also requires that a reasonable range of alternatives be examined, as well as that alternatives be economically feasible. A no-action alternative, which provides a benchmark of existing conditions from which to compare the magnitude of environmental effects of the action alternatives, is also required by CEQ and MEPA.

To develop a reasonable range of alternatives for detailed analysis in this EIS, a full range of alternatives was reviewed to determine which best addressed the project purpose and need, the issues identified by the public and project ID team, CEQ regulations for implementing provisions of NEPA, and MEPA requirements. The project purpose and need is described in Chapter 1 of this EIS. In brief, DNRC's purpose and need is for long-term regulatory certainty in managing its forested trust lands and meeting its trust mandate, while also contributing to the conservation of the five HCP species and their habitats. The USFWS' purpose and need is to authorize the incidental take of the HCP species while gaining assurances that impacts resulting from take will be minimized and mitigated to the maximum extent practicable, and that habitat of the HCP species will be sufficiently conserved to be consistent with long-term survival needs.

The public scoping process is described in Chapter 6 (Scoping and Public Involvement) and in the scoping report (DNRC 2003a), which is posted on the project website (http://dnrc.mt.gov/HCP/). As identified through public scoping and the project ID team, issues for alternatives development include two basic types: (1) ecological issues, and (2) feasibility issues. Ecological issues address management factors that can affect HCP species, such as road management and stream buffer zones. Feasibility issues include management flexibility, legal mandates, and economic viability, such as the ability to produce a sustainable yield of timber. Some issues, such as species for inclusion in the HCP, Permit period, and HCP project area boundaries, are both ecological issues and feasibility issues. The proposed HCP (Alternative 2) represents what is intended to be the optimum balance between providing species protection and the flexibility, legal mandates, and viability of DNRC's forest management program. The other alternatives generally represent variations in the type and degree of species protection and in the degree of flexibility for DNRC's forest management operations.

3.3 How the Alternatives Were Selected for Detailed Analysis

To determine which alternatives would be analyzed in detail for this EIS, screening criteria were developed based on the project purpose and need, as well as other related project goals listed below. A full range of alternatives was then evaluated relative to these screening criteria. Nine screening criteria, grouped into five categories, were used to evaluate the full range of alternatives.

Category #1: Biological/Ecological Soundness

(a) An alternative must be based on biologically and technically sound management aimed at conserving HCP species.

(b) An alternative must support healthy and diverse forests as described by the SFLMP objectives.

Category #2: Economic Feasibility

(a) An alternative must ensure the economic viability and legal mandates of the forest management program, and implementation of the alternative (the conservation commitments) should provide for economically feasible forest management and monitoring activities, as required by MEPA.

Category #3: Operational Practicability

(a) An alternative must be operationally practicable so that it can be implemented at the field level.

Category #4: Compliance with Legal Requirements and Mandates

(a) An alternative must comply with the ESA.

(b) An alternative must comply with state laws, policies, and rules. (However, to implement the HCP, modification of some existing state administrative rules that apply to HCP species may be necessary.)

(c) An alternative must be compatible and consistent with DNRC and other state programs (e.g., statewide wolf recovery plan).

Category #5: Provision of Long-Term Assurances

(a) An alternative should provide for long-term assurances to provide for the conservation of HCP species.

(b) An alternative should provide long-term regulatory assurances for DNRC's compliance with the ESA.

3.4 Alternatives Selected for Detailed Analysis

Four alternatives were selected for detailed EIS analysis, the no-action alternative (Alternative 1) and three action alternatives, which represent conservation strategies for the HCP species with varying levels of conservation commitments and management flexibility. The sections below introduce and compare the alternatives by HCP species. Tables E3-1 through E3-3 in Appendix E (EIS Tables) provide a comparative summary of the conservation commitments for each alternative analyzed in detail. Following the comparison of alternatives by HCP species, this section concludes with a discussion of differences between alternatives for DNRC's land acquisition, development, and disposition program, as well as how DNRC responds to natural events and changes in administrative procedures.

Alternative 1, the no-action alternative, reflects continued implementation of DNRC's existing rules and regulations (ARMs, BMPs, and other standard practices) pertaining to the five HCP species. Although the ARMs, BMPs, and other practices may be modified over the next 50 years, future changes that could occur within these existing policies and regulations are not known. Thus, the description of Alternative 1 used for analysis in this EIS is based on existing rules and regulations. Alternative 1, the no-action alternative, does not meet DNRC's or the USFWS' purpose and need, but (as mentioned above) is carried forward to provide baseline conditions for detailed EIS analysis as required by NEPA and MEPA.

Alternative 2 is the HCP with the conservation commitments and monitoring program developed by DNRC with technical assistance from the USFWS (see HCP Chapters 2, Conservation Strategies, and 4, Monitoring and Adaptive Management, in Appendix A, HCP). The commitments under this alternative are designed to minimize and mitigate the impacts of take of HCP species to the maximum extent practicable and to provide a conservation benefit to the HCP species, as well as to ensure that future timber harvest levels continue to offer a predictable and long-term income to trust beneficiaries. Alternative 3 is an HCP alternative with increased conservation for HCP species relative to Alternative 2. Under Alternative 3, increased conservation for grizzly bears is achieved by retaining the existing secure habitat for grizzly bears in the Stillwater Unit. Increased conservation for lynx is achieved by requiring increased amounts of lynx habitat retention. Increased conservation for aquatic species is primarily achieved by expanding riparian harvest buffers and shortening the timeframes for DNRC to implement certain commitments. Alternative 4 is an HCP alternative with increased management flexibility relative to Alternative 2. Under Alternative 4, increased management flexibility is achieved by requiring smaller amounts of lynx habitat, managing more intensively in the riparian management zone, and expanding the timelines for implementing certain commitments.

3.4.1 Grizzly Bear Conservation Strategy

The following sections provide a summary of the conservation commitments and monitoring requirements for grizzly bears under the no-action and action alternatives. Table E3-1 in Appendix E (EIS Tables) provides a complete comparative summary of the grizzly bear conservation commitments for all alternatives considered in this EIS.

3.4.1.1 Alternative 1 – No-Action, Commitments in the Existing Rules and Regulations

Under its existing program, DNRC's commitments for grizzly bears are included in the ARMs. In addition, as an active participant and cooperator in the Swan Valley Grizzly Bear Conservation Agreement (Swan Agreement), DNRC complies with the measures contained in that agreement as they apply to the Swan River State Forest.

Currently, conservation commitments for grizzly bears are applied on trust lands within grizzly bear recovery zones as identified in the *Grizzly Bear Recovery Plan* (USFWS 1993). Within the project area, these lands include the Stillwater Block, the Swan River State Forest, and scattered parcels in grizzly bear recovery zones. The existing conservation commitments for each of these areas are specified in the ARMs (36.11.431 through 434) and summarized below. The specific conservation commitments are listed in Table E3-1 in Appendix E (EIS Tables). This section also describes the monitoring commitments currently implemented on state lands relative to grizzly bears.

Stillwater and Coal Creek State Forest Blocked Lands Commitments (Stillwater Block)

A key element of the existing rules in the Stillwater Block is the concept of secure habitat for grizzly bears as defined by the Interagency Grizzly Bear Committee (IGBC 1998). Secure habitat is defined by the IGBC as areas that are a minimum distance of 0.31 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. It is recommended that secure habitat be established to encompass lands that meet the seasonal habitat needs of bears, for example denning habitat and spring foraging habitat (IGBC 1998).

DNRC has adopted the IGBC definition of secure habitat in the ARMs as "security core areas" defined 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. Within this area, all administrative or commercial activities are restricted to the denning period, and there are no salvage harvest allowances unless activities are conducted during the denning period or through helicopter harvest. Additionally, road closures are examined and repaired as needed. Management actions in the Stillwater Block must comply with ARM 36.11.431, and helicopter use must comply with ARM 36.11.432(1)(f) (see Table E3-1 in Appendix E, EIS Tables).

Swan River State Forest Commitments

DNRC manages grizzly bear habitat within the Swan River State Forest under the multi-party Swan Agreement. 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 a monitoring and adaptive management program.

There are no specific commitments to manage secure habitat for bears by the cooperators with the exception of the USFS, which manages secure habitat through Amendment 19 (USFS 1995a). Rather, the Swan Agreement introduces a shift in grizzly bear management from managing for secure habitat to providing relatively quiet areas 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 also requires cooperators to maintain a minimum of 40 percent hiding cover by bear management unit (BMU) and open road densities below 1 mile per square mile on at least 33 percent of BMU subunits. A BMU is a federally defined sub-designation within a grizzly bear recovery zone used for habitat evaluation and population monitoring (USFWS 1993). A subunit is an area within a BMU that approximates a female grizzly bear's home range.

Management actions in the Swan River State Forest must comply with measures contained in the Swan Agreement as well as those described under ARM 36.11.431 (see Table E3-1 in Appendix E, EIS Tables).

Commitments for Scattered Parcels within Recovery Zones

DNRC applies conservation commitments to scattered parcels located within grizzly bear recovery zones, as described under ARM 36.11.433. Commitments include measures to ensure that projects are designed to result in no net permanent increase in open road densities for parcels that currently exceed 1 mile per square mile (mi/mi^2), habitat considerations are implemented on a case-by-case basis, and hiding cover is maintained along riparian management zones (RMZs), as well as visual screening along roads where feasible. Under ARM 36.11.421, DNRC is also required to inspect and repair road closures at least every 5 years. Closures on scattered parcels are inspected and repaired through the planning and implementation of timber sales and other projects, which sometimes occur at intervals greater than 5 years.

Additional commitments that are implemented on DNRC projects that benefit grizzly bears include measures to address the following: information and education; firearms; food storage and sanitation; road management; and active den site protection (see program-wide commitments in Table E3-1 in Appendix E, EIS Tables).

Monitoring and Adaptive Management

DNRC currently participates in annual monitoring and reporting of the Swan Agreement implementation. For the Stillwater and Coal Creek State Forests, DNRC monitors road closure structures annually for effectiveness and, when needed, repairs the structures within one operating season. DNRC also tracks road density through its GIS roads layer. If DNRC staff identify an active den site, they develop a site-specific plan with minimization and mitigation measures and monitoring commitments. For gravel operations, timber sale contract inspections determine levels of compliance with contract specifications and requirements, including standard operating requirements and restrictions, special operating requirements and restrictions, BMPs, and site-specific mitigation measures. For various forest management activities within recovery zones, DNRC monitors some projects for implementation of mitigation measures transferred from MEPA documents into contracts. DNRC participates in various voluntary monitoring efforts and has been a cooperator in the Northern Continental Divide Ecosystem (NCDE) Subcommittee population trend monitoring effort and the Northern Continental Divide project providing technical and in-kind assistance consistent with obligations under ARM 36.11.428. There are currently no other monitoring requirements specific to grizzly bears and their habitat.

3.4.1.2 Alternative 2 – Proposed HCP

Under Alternative 2, DNRC would expand its grizzly bear conservation commitments to cover more geographic area and to more fully permeate its program (i.e., rather than just applying commitments at the project level, commitments would also be required in contracts and for field staff working in the field). Under Alternative 2, DNRC would tier its conservation commitments across a wider geographic area than is covered under the existing program. Some commitments would apply across the entire geographic area comprising the HCP project area, and others would apply within a specific subset of geographic areas. The geographic areas include program-wide, non-recovery occupied habitat (NROH), recovery zones (including the Stillwater Block, the Swan River State Forest, and scattered parcels in recovery zones), the Stillwater Block, the Swan River State Forest, scattered parcels within recovery zones, and the Cabinet-Yaak Ecosystem (CYE).

The text below highlights the major differences between the conservation commitments and monitoring and adaptive management program under Alternative 2 versus the commitments and monitoring and adaptive management program under Alternative 1. Table E3-1 in Appendix E (EIS Tables) identifies the conservation commitments for grizzly bears that would apply under Alternative 2.

Program-wide Commitments

Program-wide commitments would apply to all lands within the HCP project area. Under Alternative 2, DNRC would adopt formal policies addressing bear avoidance training and food storage. Additionally, DNRC would minimize roads in avalanche chutes and riparian areas; suspend motorized activities within 0.6 mile of a den site; and apply visual screening requirements program-wide versus only in recovery zones as required for Alternative 1. Also, low-altitude helicopter use would be restricted program-wide in 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 designated security core areas in recovery zones, rather than just in the Stillwater Block under Alternative 1.

Non-recovery Occupied Habitat Commitments

Under Alternative 2, DNRC would add conservation commitments to cover activities conducted within NROH as defined by Wittinger (2002). These commitments would apply to all HCP project area lands within NROH or recovery zones, including scattered parcels in recovery zones, the Stillwater Block, and the Swan River State Forest. Commitments would include measures to minimize new open road construction; discourage the granting of easements; and retain vegetative screening. Commitments would also include spring restrictions on forest management activities, grazing restrictions to lessen potential livestock depredation, and rules regarding the development of gravel pits.

Program-wide commitments would also apply within lands considered to be NROH.

Recovery Zone Commitments

Under Alternative 2, DNRC would modify some of its existing commitments for recovery zones and require additional commitments as well. The commitments would apply to all lands within grizzly bear recovery zones in the HCP project area, including lands within the Stillwater Block, Swan River State Forest, and those scattered parcels in recovery zones. Modifications to existing commitments to provide increased conservation include considering specific grizzly bear habitat features; applying visual screening requirements along open roads to a larger geographic area, and expanding the requirement to examine and repair ineffective road closures on blocked lands to all recovery zone lands. New commitments include a prohibition of any new grazing licenses and a prohibition on motorized management activities in denning habitat.

Program-wide and NROH commitments would also apply within the recovery zones.

Stillwater Block Commitments

These commitments would apply to the Stillwater Block within the HCP project area.

Under Alternative 2, DNRC would provide bears with relatively quiet areas free from commercial activity after a period of active management (the same management/rest approach implemented under the Swan Agreement).

A 50-year transportation management plan would also be adopted for the Stillwater Block. The plan identifies the locations and miles of road that would be constructed in the Stillwater Block and identifies how each road would be used (i.e., restricted, open seasonally, administrative use only, etc.). The transportation plan and associated road restrictions in important habitats during important seasons would also serve to provide quiet areas for bears.

The commitments also establish Class A and Class B lands within the Stillwater Block, where the application of forest harvest and road activity commitments would differ. On Class A lands, no new permanent roads would be constructed and the management/rest approach would be applied. Salvage activities would be permitted, but only when accompanied by a mitigation plan. On Class B lands, new permanent and temporary road construction would be restricted, and spring habitat restrictions would be applied. Gravel pits would be allowed, but would have limitations based on distance to road, season, whether on Class A or B land, and whether in an active or rested subzone.

Program-wide, NROH, and recovery zone commitments would also apply in the Stillwater Block.

Swan River State Forest Commitments

On the Swan River State Forest, DNRC would continue to comply with measures contained in the Swan Agreement. Should the Swan Agreement be terminated during the Permit term, DNRC would implement the commitments of the proposed HCP, which includes establishing subzones and allowing 4 years of management followed by 8 years of rest to provide relatively quiet areas free from commercial activity for grizzly bears. Salvage activities would be permitted, but only when accompanied by a mitigation plan. DNRC would also adopt a 50-year transportation management plan within the Swan River State Forest. This plan identifies the locations and miles of road for the

50 years, limits new and temporary road construction, requires DNRC to restrict public and its own activities on certain roads, and requires the installation of bear presence signs on main open roads. The transportation plan and associated road restrictions in important habitats during important seasons would also provide quiet areas for bears within the Swan River State Forest. Gravel pits would be allowed, but would be restricted by distance to road, season, and whether in an active or resting subzone.

Program-wide, NROH, and recovery zone commitments would also apply in the Swan River State Forest.

Commitments for Scattered Parcels in Recovery Zones

These commitments would apply to all scattered parcels in recovery zones within the HCP project area. Under Alternative 2, in addition to the existing ARMs commitments, DNRC would implement a management/rest program on these lands to provide relatively quiet areas free from commercial activity for grizzly bears (8 years of rest would follow 4 years of management). Salvage activities would be permitted, but may be conducted only once during a rest period and only when accompanied by a mitigation plan. Additionally, DNRC would not exceed baseline open road amounts across all parcels (versus on parcels where road densities exceed 1 mi/mi^2 under the existing program). Lastly, DNRC would increase spring management restrictions and inspect road closures annually. Gravel pits would be allowed on a rested parcel but restricted by minimizing their distance from an open road and minimizing DNRC activities on other gravel pits within the affected administrative unit.

Program-wide, NROH, and recovery zone commitments would also apply to scattered parcels in the recovery zone.

Cabinet-Yaak Ecosystem Commitments

These commitments would apply to the HCP project area within the CYE as described below.

Due to low population levels of grizzly bears within the CYE, DNRC would enhance a subset of the commitments for scattered parcels in recovery zones, including a commitment to apply more restrictions on helicopter use (GB-CY5), analyze road systems and expedite closures (GB-CY4), apply more restrictions for management in the spring period (GB-CY3), and require USFWS approval of mitigation plans for salvage projects (GB-CY2). Commercial forest management activities (including salvage harvest) would be allowed after spring period, but limited to an annual maximum number of operating days per administrative unit (GB-CY1). Commitments GB-CY1, 2, ~~and~~ 3, and 5 (item (2) only) would also apply in NROH associated with the CYE.

Program-wide, NROH, and recovery zone commitments, as well as commitments for scattered parcels in recovery zones, would also apply in the CYE.

Monitoring and Adaptive Management

Under the HCP, monitoring and adaptive management is a formal process negotiated at the time the commitments are developed. A monitoring and adaptive management program provides assurances that the HCP is being appropriately and effectively implemented and is a critical component of the

HCP commitments. Monitoring typically includes implementation monitoring and effectiveness monitoring. Implementation monitoring ensures the commitments are implemented on time and as negotiated and largely requires tracking, reporting, and evaluating whether the covered activities are performed in compliance with the HCP commitments. Effectiveness monitoring typically involves evaluation of a particular conservation commitment or a suite of commitments to ensure it is having the desired effect on the target species or resource. Adaptive management is a process whereby commitments may be changed based on results obtained from effectiveness monitoring or research.

Monitoring and adaptive management for Alternative 2 is described in detail in HCP Chapter 4 (Monitoring and Adaptive Management) in Appendix A (HCP) and includes the following primary components for grizzly bears.

- Monitor road closure structures annually and, when needed, repair within 1 year.
- Monitor and track the status of active management and rest periods.
- Track and continually update the transportation plans for the Stillwater Block and Swan River State Forest.
- Report by project/parcel pre- and post-harvest open road densities and new road construction or road closures on scattered parcels in recovery zones.
- Use the HCP implementation checklist to ensure HCP commitments are implemented at the project level.
- Use adaptive management to address incidences of bear-human conflicts involving DNRC ownership, employees, or contractors and their employees.
- Use adaptive management to address access management if monitoring finds easements are being granted without sufficient scrutiny or mitigation measures.
- Use adaptive management if DNRC is not adequately minimizing new open roads.
- Support monitoring and research efforts for grizzly bears in the future as funding and budgets allow. This includes prioritizing participation in the evaluation of effectiveness of the Swan River State Forest and Stillwater Block transportation plans in mitigating risks to grizzly bears.

3.4.1.3 Alternative 3 – Increased Conservation HCP

Alternative 3 is an HCP alternative that largely builds upon the conservation commitments identified for Alternative 2. Alternative 3 would retain the tiered commitments across the expanded geographic areas for grizzly bears identified for Alternative 2. Alternative 3 would apply additional conservation in specific areas, including department-wide food storage and sanitation provisions, increased spring management restrictions, additional post-denning mitigation, shorter timeframes for repair of ineffective road closures, cooperation with adjacent landowners in the Swan River State Forest in the instance the Swan Agreement is terminated during the Permit term, and USFWS approval of mitigation plans for salvage projects. Like Alternative 1, in the Stillwater Block, Alternative 3 would retain the secure habitat for bears (Stillwater Core) and would not implement the management/rest scenario described for Alternative 2. Alternative 3 would limit roads similar to

Alternative 1 and would not implement the transportation management plan described under Alternative 2.

Table E3-1 in Appendix E (EIS Tables) identifies the conservation commitments for grizzly bears that would apply under Alternative 3. The section below summarizes the differences between the Alternative 3 monitoring and adaptive management program and those under Alternatives 1 and 2.

Monitoring and Adaptive Management

Monitoring and adaptive management for Alternative 3 would generally be the same as Alternative 2 whenever the associated conservation measures are the same between these two alternatives. Under Alternative 3, road closure maintenance commitments in the recovery zones would likely require additional reporting to the USFWS in the event a repair could not be completed in the season the problem was identified. In the Stillwater Block, the commitments for tracking acres of security core over time would be the same as Alternative 1.

3.4.1.4 Alternative 4 – Increased Management Flexibility HCP

Alternative 4 is an HCP alternative that largely incorporates the conservation commitments developed under Alternative 2. Alternative 4 would retain the tiered commitments across the expanded geographic areas identified for Alternative 2. Within NROH, DNRC would relax some elements of the spring management restrictions proposed under Alternative 2 and, on scattered parcels in recovery zones, would relax the timeline for inspecting road closures. Like Alternative 2, in the Stillwater Block, Alternative 4 would provide quiet areas for bears through a management/rest scenario and a transportation management plan.

Table E3-1 in Appendix E (EIS Tables) identifies the conservation commitments for grizzly bears that would apply under Alternative 4. The section below summarizes the differences between the Alternative 4 monitoring and adaptive management program and those under Alternatives 1, 2, and 3.

Monitoring and Adaptive Management

Monitoring and adaptive management for Alternative 4 would generally be the same as Alternative 2 whenever the associated conservation measures are the same between the two alternatives. Under Alternative 4, DNRC would not be required to track and report the number of days used for site preparation, road maintenance, and bridge replacement activities during spring in spring habitat.

3.4.2 Canada Lynx Conservation Strategy

The following sections summarize conservation commitments and monitoring requirements for Canada lynx for all alternatives considered in this analysis. Table E3-2 in Appendix E (EIS Tables) provides a comparative summary of Canada lynx conservation commitments for all alternatives considered in this EIS.

3.4.2.1 Alternative 1 – No-Action, Commitments in the Existing Rules and Regulations

Under the existing program, commitments for Canada lynx are included in state rules (ARMs). The primary conservation commitments for lynx are described under ARM 36.11.435. 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 conservation commitments for these areas and monitoring requirements are summarized below.

Lynx Habitat Commitments

Under ARM 36.11.435 (1) through (6) and (8), on scattered parcels and blocked lands in the NWLO, SWLO, CLO and Northeastern Land Office (NELO), DNRC implements conservation commitments related to den sites and foraging habitat for lynx. Den site measures prohibit salvage within stands that are necessary to meet lynx denning habitat requirements and require DNRC to maintain a minimum of 5 acres of denning habitat, where present, on parcels containing lynx habitat. Foraging habitat measures require DNRC to delayed pre-commercial thinning in lynx habitat in young foraging habitat stands until the average crop tree height is greater than or equal to 15 feet, and to retain 10 percent of the lynx habitat acreage in mature or young foraging habitat.

Additional considerations for lynx applied at the project level include habitat connectivity and proximity of the project to foraging and denning habitat. CWD abundance requirements are met through ARMs 36.11.411 and 414.

Blocked Lands Commitments for Lynx

As described in ARM 36.11.435, on blocked lands, which includes the Stillwater Block and the Swan River State Forest, DNRC's den site commitments require retention of denning habitat on approximately 5 percent of the total lynx habitat acreage within each applicable BMU subunit in patches greater than or equal to 5 acres. The foraging habitat commitments require DNRC, on a BMU subunit basis, to maintain 10 percent of the total lynx habitat acreage in a mixture of mature and young foraging habitat, where appreciable amounts of lynx habitat occur. Salvage is allowed in mature foraging stands, provided that understory sapling densities are not reduced below moderately-stocked condition and CWD abundance is not appreciably altered.

Monitoring and Adaptive Management

There are currently no monitoring requirements specific to lynx and their habitat. DNRC contract administrators document compliance with CWD and snag retention requirements through inspection reports. If DNRC staff identify an active den site, they develop a site-specific plan with minimization and mitigation measures and monitoring commitments.

3.4.2.2 Alternative 2 – Proposed HCP

Under Alternative 2, the overall biological goal of the lynx conservation strategy is to support federal Canada lynx conservation efforts by managing for 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 goals and objectives of the conservation strategy are outlined in HCP Section 2.1.2 (Lynx Conservation Strategy) in Appendix A (HCP).

Similar to the grizzly bear, the lynx conservation strategy under Alternative 2 has a tiered approach, where the degree of conservation commitments varies by geographic area, and is based on existing lynx range and habitat, need for conservation, and land ownership patterns. For Alternative 2, the geographic areas for specific lynx conservation commitments include lynx habitat in the HCP project area and designated lynx management areas (LMAs) in the HCP project area.

The text below highlights the major differences between the conservation commitments and monitoring and adaptive management program under Alternative 2 versus the commitments and monitoring requirements under Alternative 1. Table E3-2 in Appendix E (EIS Tables) identifies the conservation commitments for lynx that would apply under Alternative 2.

Lynx Habitat Commitments

There are ~~six~~five main differences between the lynx habitat commitments under Alternative 2 versus Alternative 1. Under Alternative 2, the following changes in commitments would occur:

1. Commitment LY-HB1 requires DNRC to establish and maintain a lynx habitat map and then apply commitments within mapped lynx habitat.

~~2. Commitment LY-HB2 requires DNRC to provide den site attributes (natural or manmade piles of CWD) in mapped lynx habitat versus providing 5 percent of denning habitat within total lynx habitat acreage under Alternative 1.~~

2. Commitment LY-HB3 includes a formal requirement to prohibit motorized forest management and prescribed burning within 0.25 mile of a known active lynx den site from May 1 through July 15. (Under Alternative 1, den site protection is considered on a case-by-case basis.)

3. Commitment LY-HB4 requires DNRC to retain shade-tolerant trees in pre-commercial thinning units and retain patches of advanced regeneration of shade-tolerant trees as a component of commercial operations in winter foraging habitat versus delaying thinning in young foraging habitat stands and retaining 10 percent of lynx habitat acreage in mature or young foraging habitat under Alternative 1.

4. Commitment LY-HB5 requires DNRC to design projects to maintain a connected network of suitable habitat versus just considering habitat connectivity at the project level.

5. Commitment LY-HB6 requires DNRC to maintain at least 65 percent suitable lynx habitat at the land office scale on scattered parcels outside LMAs (described below).

Lynx Management Area Commitments

Alternative 2 establishes six LMAs within the HCP project area: Garnet, Seeley, Coal Creek, Stillwater East, Stillwater West, and Swan. LMAs were established on lands that are recognized as currently supporting lynx populations or are likely to periodically provide habitat for dispersing lynx and are likely to remain high-priority areas to promote lynx conservation in the future. Within the LMAs, all commitments applicable to lynx habitat in the HCP project area described above would apply. Within the LMAs, DNRC would commit to a 65 percent suitable habitat/35 percent temporary non-suitable habitat ratio, which is based on natural disturbance regimes DNRC attempts to emulate on the landscape as well as the *Lynx Conservation Assessment and Strategy* (LCAS) (Ruediger et al. 2000) that is required of federal agencies. Additionally, no more than 15 percent of the total lynx habitat acres would be converted to temporary non-suitable lynx habitat per decade, and at least 20 percent of the total potential lynx habitat would be maintained as winter foraging habitat. Lastly, for pre-commercial thinning projects targeting saplings in LMAs, 20 percent of the thinning unit would be retained in an unthinned condition.

Monitoring and Adaptive Management

As described for grizzly bears, the HCP requires the development of a monitoring and adaptive management program to accompany the conservation commitments. The monitoring and adaptive management program for Alternative 2 is described in detail in HCP Chapter 4 (Monitoring and Adaptive Management) in Appendix A (HCP). The primary implementation monitoring commitments are

- Revise and update DNRC's lynx habitat map and determine acres and percentages of lynx habitat (by category).
- Report acres and percentages of required habitats for LMAs and scattered parcels with suitable habitat ratios.
- Report amounts of snags, snag recruits, and CWD on two projects per year containing lynx habitat (if available) for the first 5 years of HCP implementation to ensure compliance. Also, during the first 5 years, quantify the abundance of concentrations of woody material post-harvest that may serve as den sites for lynx.
- ~~Monitor lynx den sites where mitigations have been applied.~~
- ~~Identify the number and acreages of lynx den site retention areas associated with blowdown salvage events.~~
- Implement effectiveness monitoring relative to the DNRC SLI database to assess its accuracy and ability to produce meaningful and reliable lynx habitat maps.

3.4.2.3 Alternative 3 – Increased Conservation HCP

Alternative 3 is an HCP alternative that builds upon the conservation commitments identified for Alternative 2 by applying increased conservation in a few specific areas, including den site attributes and protection, habitat connectivity in lynx habitat, and habitat suitability ratios inside and outside LMAs.

Table E3-2 in Appendix E (EIS Tables) identifies the conservation commitments for lynx that would apply under Alternative 3. The section below highlights the major differences between the monitoring and adaptive management program under Alternative 3 versus the monitoring and adaptive management programs under Alternatives 1 and 2.

Monitoring and Adaptive Management

Monitoring and adaptive management for Alternative 3 would generally be the same as Alternative 2 with slightly more reporting required for den site attributes and habitat connectivity. Otherwise, the monitoring and adaptive management commitments would be the same as required under Alternative 2.

3.4.2.4 Alternative 4 – Increased Management Flexibility HCP

Alternative 4 is an HCP alternative that largely incorporates all of the Alternative 2 commitments while providing increased management flexibility relative to a few specific commitments including den site attributes in lynx habitat and habitat suitability inside and outside LMAs.

Table E3-2 in Appendix E (EIS Tables) identifies the conservation commitments for lynx that would apply under Alternative 4.

The section below highlights the major differences between the monitoring and adaptive management program under Alternative 4 versus the monitoring and adaptive management programs under Alternatives 1, 2 and 3.

Monitoring and Adaptive Management

Under Alternative 4, monitoring and adaptive management could require slightly less tracking relative to blowdown salvage units~~ and slightly more reporting related to thinning projects where at least 10 percent of the acres available for thinning must be left in an unthinned condition~~. Otherwise, the monitoring and adaptive management commitments would be the same as required under Alternative 2.

3.4.3 Aquatic Species Conservation Strategies

The following sections provide a summary of the conservation commitments and monitoring requirements for aquatic species under the no-action and action alternatives. Table E3-3 in Appendix E (EIS Tables) provides a comparative summary of conservation commitments for aquatic species for all alternatives analyzed in detail in this EIS.

3.4.3.1 Alternative 1 – No-Action, Commitments in the Existing Rules and Regulations

Under its existing program, DNRC's commitments for aquatic species are included in a variety of state rules (ARMs), state laws (MCA), and guidelines (e.g., Montana Forestry BMPs). Additionally, through these regulations, specifically ARM 36.11.427(2)(a), DNRC is required to minimize impacts to fish populations and habitat by making reasonable efforts, in DNRC's sole discretion, to cooperate in the implementation of conservation strategies developed by the state of Montana (*Bull Trout Restoration Plan*, MBTRT 2000) and the USFWS (*Bull Trout Draft Recovery Plan*, USFWS 2002a) for restoration and recovery of bull trout populations. DNRC also fulfills its commitments as a signatory to the *Memorandum of Understanding and Conservation Agreement for Westslope Cutthroat Trout and Yellowstone Cutthroat Trout in Montana* (MFWP 2007a).

For the sake of comparison to the action alternatives, the existing commitments are grouped by the five components of aquatic habitat addressed in the action alternatives: (1) riparian timber harvest, (2) sediment delivery reduction, (3) fish connectivity, (4) grazing, and (5) cumulative watershed effects (CWEs). The sections below describe the commitments and monitoring and adaptive management program implemented by DNRC under its current program.

Riparian Timber Harvest Commitments

Under its existing program, DNRC's riparian harvest is regulated by the Montana Streamside Management Zone (SMZ) Law (SMZ Law) contained in MCA 77-5-301 through 307 and ARMs 36.11.302 through 313. The SMZ Law designates Class 1, 2, and 3 streams, lakes, and other bodies of water (see Chapter 9, Glossary, for definitions). The law establishes stream protection boundaries based on the stream classification and includes a series of prescriptions for timber harvest within those boundaries (Table E3-3 in Appendix E, EIS Tables).

In addition to the SMZ Law, ARMs 36.11.427(2)(i) and 36.11.427(3) require DNRC to design forest management activities to protect and maintain bull trout, westslope cutthroat trout, and all other sensitive fish and aquatic species by implementing conservation strategies pursuant to the *Restoration Plan for Bull Trout in the Clark Fork Basin and Kootenai River Basin* (MBTRT 2000).

Sediment Delivery Reduction Commitments

The existing program for sediment delivery reduction incorporates various formal operational requirements contained in the Montana Forestry BMPs (DNRC 2004a), SMZ Law, and Forest Management ARMs (36.11.421 through 427). The primary objective under these regulations is to reduce sediment from roads, timber harvest areas, and gravel operations. Reductions are achieved by minimizing roads; addressing sediment sources on existing roads; reducing the potential for sediment delivery from new road construction, reconstruction, maintenance, and use; and reducing the potential for sediment delivery from timber harvest activities and gravel operations. The key elements of these commitments are summarized below.

Minimizing Roads

DNRC's approach to minimizing roads is best described in ARM 36.11.421. Various subsections within this ARM require DNRC to

- Minimize the amount of roads constructed for forest management activities by limiting roads to those necessary to meet near- and long-term forest management needs
- Conduct comprehensive road management planning and, where feasible, plan road systems cooperatively with adjacent landowners
- Consider yarding systems that minimize roads.

Additionally, the SMZ Law prohibits road construction within SMZs except when necessary to cross a stream.

Existing Roads

Under the existing rules (ARM 36.11.421), DNRC closes or abandons roads that are non-essential to near-term future management plans, or where unrestricted access would cause excessive resource damage. DNRC is also required to complete road inventories and assessments during timber sale planning, design, and environmental assessment, and assess and prioritize road maintenance needs by inspecting the condition of both open and closed roads every 5 years. (Currently on scattered parcels, the inspection interval is somewhat longer than every 5 years.) Roads are brought up to BMP standards on a project-by-project basis where feasible and when funding is available.

New Road Construction, Reconstruction, Maintenance, Use

To reduce sediment delivery, DNRC avoids construction of roads in an SMZ except when necessary to cross a stream and minimizes the number of stream crossings necessary for project objectives. In addition, DNRC implements BMPs to reduce sediment delivery from new roads or during reconstruction, maintenance, and use. DNRC implements actions (BMPs, mitigation measures), typically at the project level, aimed at reducing or eliminating identified or potential sources of sediment from new and existing roads.

Timber Harvest, Site Preparation, Slash Treatments

To reduce sediment delivery from timber harvest activities, DNRC implements the riparian harvest commitments described above. Additionally, DNRC prohibits road construction in an SMZ unless necessary to cross a stream or wetland; operation of wheeled or tracked equipment within an SMZ except on established roads, with some exceptions; and broadcast burning in an SMZ without a site-specific alternative practice.

DNRC establishes an RMZ when forest management activities are conducted on sites adjacent to streams determined to have high erosion risk. Within the RMZ, ground-based equipment operations are prohibited on sites with slopes greater than 35 percent and restricted on slopes less than 35 percent to those operations and conditions that do not cause excessive compaction or displacement of the soil. DNRC also establishes wetland management zones (WMZs) when forest management activities are conducted within or adjacent to wetlands located within an SMZ (minimum 50 feet), and limits equipment operations to low-impact harvest systems and operations that do not cause excessive compaction, displacement, or erosion of the soil. DNRC also selects logging systems to minimize erosion within WMZs.

Gravel Operations

To reduce the risk of sediment delivery to streams from gravel operations, DNRC adheres to ARM 36.11.421 for road management and applies Montana Forestry BMPs, which require the minimization of sediment production from borrow pits and gravel sources through proper location, development, and reclamation. DNRC also adheres to Opencut Mining Permit requirements administered by Montana Department of Environmental Quality (MDEQ) for large gravel pits (greater than 10,000 cubic yards of material to be excavated).

Fish Connectivity Commitments

DNRC's management direction for bull trout, westslope cutthroat trout, and Columbia redband trout connectivity is derived from seven primary sources:

1. ARMs – 36.11.422, 36.11.427, 36.11.428, 36.11.436
2. Montana Forestry BMPs – V.A.(2), V.C.(2), V.C.(3), V.D.(1)
3. Montana Stream Protection Act – MCA 87-5-501 to 87-5-509 (including MFWP administration of the 124 permit process and draft internal stream permitting policies)
4. *Restoration Plan for Bull Trout in the Clark Fork River Basin and Kootenai River Basin, Montana* (MBTRT 2000)
5. *Memorandum of Understanding and Conservation Agreement for Westslope Cutthroat Trout and Yellowstone Cutthroat Trout in Montana* (MFWP 2007a)
6. *Bull Trout Draft Recovery Plan* (USFWS 2002a)
7. Existing institutional practices.

These regulations, policies, and agreements are directly or indirectly applicable to fish connectivity, but there are no clear or detailed sets of standards for providing connectivity for bull trout, westslope cutthroat trout, and Columbia redband trout. The existing standard basically ensures fish connectivity for all species and life stages. The following commitments are most applicable to fish connectivity:

- Incorporate BMPs into project design and implementation of all forest management activities, including stream crossings (ARM 36.11.422(2)).
- When installing new stream crossing structures on fish-bearing streams, provide for fish passage as specified in MCA 87-5-501 and the Montana Stream Protection Act (124 permits) (ARM 36.11.427(4)).
- Design stream crossings for adequate passage of fish (if present) with minimum impact on water quality (Montana Forestry BMPs – V.C.(2)).

In addition to commitments for fish crossing installations, DNRC currently inventories and analyzes all road-stream crossings where native fisheries connectivity is a potential issue. This program, referred to as the DNRC Fish Passage Assessment Project, includes inventory, data collection, database compilation, and development of a planning schedule for replacement of structures.

Grazing Commitments

DNRC currently provides grazing licenses for livestock grazing on classified forest trust lands. As described in ARM 36.11.444, DNRC is required to inspect licenses, set license conditions, and generally manage licenses to minimize loss of riparian and streambank vegetation and maintain channel stability and channel morphology characteristics.

License Inspections

Grazing licenses usually have 10-year terms and are inspected midterm and prior to license renewal. If problems are identified and corrective actions prescribed, DNRC may conduct additional monitoring to ensure that the problem is adequately addressed.

During midterm license inspections, the following resources are evaluated: range conditions, levels of riparian forage and browse utilization, levels of streambank disturbance, and overall tract conditions, emphasizing any problems noted on the last inspection. Although not required by the ARMs, DNRC typically assesses noxious weeds during midterm evaluations.

During license renewal inspections, the following resources are evaluated: 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.

Currently, DNRC staff involved in grazing license administration and grazing licensees receive informal training.

License Conditions

By setting license conditions, DNRC sets stocking rates and specifies animal unit months (AUMs), type of livestock, and grazing period. DNRC may require stipulations at any time during the license term and often establishes stipulations during the midterm or renewal inspection to minimize riparian vegetation loss and structural damage to streams.

Streambank and Riparian Vegetation Protection

The ARMs require DNRC to design grazing plans to minimize loss of riparian streambank vegetation and to reduce structural damage to stream banks. Therefore, licenses are managed 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. During the inspections, existing riparian use is evaluated and conditions to be met by the licensees are specified in the grazing plans.

Grazing Mitigation

DNRC offers technical or financial assistance, as necessary, to mitigate or rehabilitate riparian impacts or other problems; however, the licensee is responsible for mitigating the problems.

Cumulative Watershed Effects Commitments

CWE are those collective impacts from past, present, and future state actions specifically affecting watershed resource features, including water yield, flow regimes, channel stability, and in-stream and upland sedimentation due to surface erosion and mass wasting. There are three existing sets of protective measures providing DNRC some level of management direction for assessing and limiting CWE to bull trout, westslope cutthroat trout, and Columbia redband trout habitat.

- **ARM 36.11.423.** Conduct an assessment of CWE when substantial vegetation removal or ground disturbance is anticipated as a result of proposed actions on forested trust lands.

- **MEPA (MCA 75-1-101 through 75-1-324).** Conduct an assessment of cumulative effects as part of a review of potential impacts to the human environment.
- ***Montana Cumulative Watershed Effects Cooperative Memorandum of Understanding* (DSL et al. 1993).** Complete and share analyses and data necessary to conduct CWE assessments with other cooperators.

These existing protective measures are indirectly related to one another, and each provides some level of guidance in assessing potential CWE as a result of a proposed action. However, due to generally high levels of environmental variability and different interpretations of environmental risk, the existing measures have intentionally not identified a set of universal numerical standards or thresholds defining levels of potential impact. Instead, existing standards specify general criteria and standards to determine acceptable levels of risk on a project-level and watershed-level basis.

Monitoring and Adaptive Management

Monitoring consists of a strategy to assess watershed impacts of forest management activities and the effectiveness of mitigation measures (ARM 36.11.424). This strategy includes timber sale contract inspections, internal and statewide BMP audits that evaluate and document the implementation and effectiveness of BMPs applied to a project, ongoing site-specific monitoring to quantitatively determine the effectiveness of BMP and other measures for reducing erosion and non-point source pollution, assessments of fish habitat, evaluations of a variety of harvest methods on different soil types, and inventory and analysis of existing watershed impacts.

Timber sale contract inspections are completed during routine contract administration to determine levels of compliance with contract specifications and requirements. General and site-specific BMP designs and other mitigations recommended by specialists are incorporated into timber sale EAs and contracts. These include standard operating requirements and restrictions, special operating requirements and restrictions, BMPs, and site-specific mitigation measures. BMP audits also evaluate BMPs that address stream crossing installations and fish passage concerns. For internal audits, a DNRC water resource specialist and/or soil scientist reviews most DNRC timber sales and timber permits involving substantial levels of timber harvest and road construction or reconstruction. Statewide audits are completed biannually by ID teams consisting of representatives from various forest landowner groups throughout Montana. Both types of BMP audits (internal and statewide) provide an important feedback mechanism to DNRC regarding the implementation and effectiveness of BMPs.

Individual monitoring projects are also designed to quantitatively investigate the effects of DNRC forest management activities on specific water, habitat, and soil parameters and evaluate the effectiveness of BMPs and other commonly used site-specific mitigations. Monitoring designs, methods, and protocols are developed on a project-by-project basis to address site-specific monitoring objectives. If monitoring indicates that properly implemented BMPs are not achieving desired standards, BMPs are revised and/or the standards are evaluated for appropriateness and modified. Through this adaptive management process, BMPs are adjusted for future sales to improve effectiveness.

3.4.3.2 Alternative 2 – Proposed HCP

Under Alternative 2, the overall biological goal of the aquatic conservation strategies is to protect bull trout, westslope cutthroat trout, and Columbia redband trout populations and their habitat and to contribute to habitat restoration, as appropriate. The goals and objectives of the aquatic conservation strategy are described in HCP Section 2.2 (Aquatic Conservation Strategies) in Appendix A (HCP).

The following sections describe the conservation commitments for each of the five aquatic strategies developed under Alternative 2: (1) riparian harvest, (2) sediment delivery reduction, (3) fish connectivity, (4) grazing, and (5) CWEs. The monitoring and adaptive management program to be implemented under this alternative is also described below. Most of the strategies described below would implement existing ARMs, as well as additional commitments developed under this alternative. The MAPA process would be initiated to add the proposed commitments incorporated in the strategies below to the Forest Management ARMs. Table E3-3 in Appendix E (EIS Tables) provides a comparative summary of the conservation commitments for this and the other alternatives analyzed in detail.

Riparian Timber Harvest Commitments

The riparian timber harvest commitments proposed under Alternative 2 address the riparian functions of large woody debris (LWD) recruitment, stream shading, and streambank stability for streams supporting HCP fish species. ~~Under this alternative, DNRC would establish a tiered system under which additional commitments would be applied when HCP fish species are present in the affected waterbody.~~ Under this a~~A~~lternative~~ 2~~, Class 1 streams and lakes would receive additional RMZ commitments. ~~supporting HCP fish species would be distinguished from Class 1 streams and lakes supporting non-HCP fish species. The existing rules for SMZs and RMZs would apply, as well as additional commitments for Class 1 streams and lakes supporting HCP fish species under the Tier 1 RMZ commitments.~~ These commitments include establishment of an RMZ boundary equivalent to the RMZ boundary required under the existing rules when ~~HCP~~ fish species are present and implementation of a 50-foot no-harvest buffer. The commitments also provide for an expanded RMZ to include the channel migration zone (CMZ) for HCP fish-bearing streams when the CMZ is likely to influence riparian functions potentially affected by timber harvest.

~~For Class 1 streams and lakes supporting non-HCP fish species, the Tier 2 RMZ commitments would apply, although these commitments are the same as the existing rules for Class 1 streams and lakes.~~ For Class 2 and 3 streams, the ~~Tier 3~~Class 2 and 3 RMZ commitments would apply; however, these commitments are the same as the existing rules for Class 2 and 3 streams and lakes.

Sediment Delivery Reduction Conservation Commitments

The sediment delivery reduction commitments address in-stream sedimentation levels; in-stream habitat complexity; and stream channel stability, form, and function. Alternative 2 largely incorporates the commitments described for Alternative 1 and expands them in a few key areas, as discussed below.

Existing Roads

Alternative 2 would implement the existing commitments, plus the following additional commitments that involve classifying road segments by level of sediment delivery risk and prioritizing corrective actions.

DNRC would complete road and stream crossing inventories on all roads for which DNRC has legal access and sole ownership or cost-share or reciprocal road agreements in bull trout watersheds within 10 years of HCP implementation and westslope cutthroat and Columbia redband trout watersheds within 20 years of HCP implementation.

Subsequently, all inventoried road segments and stream crossings would be ranked based on risk of sediment delivery, and site-specific corrective actions for high- and moderate-risk segments would be developed and implemented at the project level based on a prioritized schedule. Corrective actions would be limited to roads for which DNRC has legal access and sole ownership. On shared roads where DNRC does not have legal access and sole ownership, DNRC would work with other cooperators to address moderate- and high-risk sediment delivery road segments.

Corrective actions for all high-risk segments in HCP project area watersheds with bull trout would be completed within 15 years of HCP implementation and westslope cutthroat and Columbia redband trout watersheds within 25 years of HCP implementation. Corrective actions for moderate-risk segments in HCP project area watersheds with HCP fish species would be completed on a project-by-project basis.

DNRC would also incorporate goals, targets, and prescriptions in approved total maximum daily loads (TMDLs) applicable to covered forest management activities when DNRC has actively participated in the TMDL's development and the TMDL planning area is within a watershed containing HCP project area parcels supporting HCP fish species. DNRC would 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.

New Road Construction, Reconstruction, Maintenance, Use

DNRC would implement the commitments described for Alternative 1, plus the following additional commitments.

A DNRC water resource specialist would be required to review road management activities associated with forest management operations located within HCP project area watersheds with HCP fish species, and make recommendations for reducing risk of sediment delivery. DNRC would include appropriate specifications and requirements in forest management contracts and inspect active road construction and maintenance projects weekly.

DNRC would incorporate goals, targets, and prescriptions in approved TMDLs applicable to covered forest management activities when it has actively participated in the TMDL's development and the TMDL planning area is within a watershed containing HCP project area parcels supporting HCP fish species.

Timber Harvest, Site Preparation, Slash Treatments

DNRC would implement the commitments described under Alternative 1, plus the following additional commitments.

DNRC would restrict equipment use and associated forest management activities in RMZs (see also Riparian Timber Harvest Commitments, above).

A DNRC water resource specialist would be required to review all proposed timber harvests greater than 100 mbf and make recommendations for reducing risk of sediment delivery, with some allowances. Agreed-upon specifications and requirements would be included in timber harvest contracts, and contract inspections would be completed during routine contract administration.

DNRC would incorporate goals, targets, and prescriptions in approved TMDLs applicable to covered forest management activities when DNRC has actively participated in the TMDL's development and the TMDL planning area is within a watershed containing HCP project area parcels supporting HCP fish species.

Gravel Operations

In addition to the commitments described for Alternative 1, DNRC would implement the following commitments.

Site-specific BMPs and other mitigation measures would be designed and implemented to reduce the risk of sediment delivery to streams affecting HCP fish species from all gravel pits.

A DNRC water resource specialist would be required to recommend what will be integrated into contract specifications, permits, and Plans of Operations (as required under ARM 17.24.217).

DNRC would ensure that its gravel pits comply with biennial agreements established with county weed boards. Noxious weeds would be managed using an integrated weed management approach, with such practices including, but not limited to, the use of weed-free equipment; re-vegetation of disturbed areas with site-adapted species, including native species as available; and incorporation of biological control measures in timber sale contracts and Plans of Operations (as required under ARM 17.24.217). Non-vegetated areas associated with large gravel pits would not be allowed to exceed 40 acres.

Development of gravel pits allowed within SMZs would be prohibited. If borrows occur in SMZs, a DNRC water resource specialist would be required to develop measures to minimize risk of sediment delivery and integrate these into contract specifications or permits.

Development of gravel pits within RMZs would be prohibited, except for one medium non-reclaimed pit within the portion of RMZ extending beyond the SMZ in both the Stillwater Block and Swan River State Forest.

<u>Fish Connectivity Conservation Commitments</u>

The focus of DNRC's fish connectivity commitments under Alternative 2 is to address barriers to fish passage from road-stream crossings and implement appropriate mitigation measures during structure installations or modifications on HCP-fish-bearing streams. The primary commitment differences from Alternative 1 are that Alternative 2 establishes a preferred means for providing connectivity to adult and juvenile HCP fish species (by emulating streambed form and function at stream crossings) and requires the completion of the Fish Passage Assessment Project initiated under Alternative 1, including the establishment of a prioritization process for replacing or modifying passage barriers as well as a timeline for completing the connectivity improvements.

Grazing Conservation Commitments

Alternative 2 would implement the commitments described for Alternative 1 but would enhance the monitoring and adaptive management components of those commitments. The specific changes in monitoring are described below. Alternative 2 follows the basic grazing monitoring described under Alternative 1, with the following key additional components intended to more quickly identify and address grazing problems:

- Develop and complete formal training on implementation for all DNRC staff involved in grazing license administration. Provide grazing licensees with informal training opportunities and education outreach materials.
- During licensing inspections, in addition to narrative criteria, use numerical criteria in a grazing coarse-filter approach to identify potential problem areas. Numerical criteria would include riparian forage utilization, riparian browse utilization, and streambank disturbance.
- Complete field verification of potential problem sites within 1 year of receiving the results of grazing coarse-filter evaluations. Potential problems would be identified when grazing coarse-filter results indicate levels of livestock use and/or impacts above specified numerical and narrative criteria. DNRC would alert licensees to any potential problems.
- Prioritize sites with verified problems (assigning higher priority to those affecting HCP fish species) in need of corrective action. Address all problems within 1 year and highest priority problem sites before livestock turnout the following year.
- Develop and document site-specific corrective actions for addressing verified grazing problems.
- Complete implementation and effectiveness evaluations (within 1 year of development and implementation of corrective actions) on sites where corrective actions are implemented.
- Adjust licenses and continue monitoring to facilitate progress until improvements are verified to be effective if previous improvements or changes to grazing management are determined to be ineffective at correcting problem sites.

Cumulative Watershed Effects Conservation Commitments

As with the grazing strategy, the CWE conservation strategy is primarily a monitoring and evaluation strategy that follows the existing ARMs. Under Alternative 2, the commitments include a formalized method of analysis for CWE, with a watershed coarse-filter methodology consisting of a sequential step approach based on cumulative effects potential. A process for developing project-level thresholds based on streambank stability, beneficial water uses, and watershed conditions is included. Thresholds would be set at a level that ensures compliance with water quality standards and protects beneficial uses, including HCP species, with a low to moderate degree of risk. When thresholds are exceeded, mitigation would be implemented to offset effects.

Monitoring and Adaptive Management

Monitoring and adaptive management for Alternative 2 is described in detail in HCP Chapter 4 (Monitoring and Adaptive Management) in Appendix A (HCP). Alternative 2 would incorporate the monitoring and adaptive management commitments described for Alternative 1, as well as additional monitoring to complement the proposed commitments. For the riparian timber harvest commitments, Alternative 2 includes monitoring of LWD recruitment, in-stream shade conditions, and in-stream temperature. For sediment delivery reduction commitments, Alternative 2 would monitor projects through BMP audits and timber sale inspections. BMPs that fail to provide adequate protection of HCP fish species would be revised and reported to the USFWS. For fish connectivity commitments, the primary monitoring component is effectiveness monitoring of streams for which road crossing improvements have been completed. Under the grazing commitments, DNRC would monitor and document the effectiveness of corrective actions. Under the CWE commitments, DNRC would document mitigation measures developed for projects with moderate or high risks and evaluate the effectiveness of the program every 5 years.

3.4.3.3 Alternative 3 – Increased Conservation HCP

Alternative 3 is an HCP alternative that largely builds upon the conservation commitments described for Alternative 2. Alternative 3 would apply additional conservation measures related to riparian harvest, grazing, and CWE. For the sediment delivery strategy and fish connectivity strategy, Alternative 3 requires corrective actions to be completed in a shorter timeframe. For the CWE strategy, this alternative specifies when a Level 3 analysis is required and requires mitigation when a moderate or high level of watershed risk is identified.

Table E3-3 in Appendix E (EIS Tables) identifies the conservation commitments that would apply under Alternative 3. The section below summarizes the differences between the monitoring and adaptive management program for Alternative 3 versus the programs described for Alternatives 1 and 2.

Monitoring and Adaptive Management

Under Alternative 3, monitoring and adaptive management would largely be the same as required under Alternative 2. Alternative 3 would require less reporting on Tier 1 RMZ harvest because no harvest would be allowed. However, Alternative 3 would require reporting and approval from the USFWS for salvage in riparian areas and more frequent reporting on grazing monitoring efforts.

3.4.3.4 Alternative 4 – Increased Management Flexibility HCP

Alternative 4 is an HCP alternative with increased management flexibility relative to Alternative 2. Alternative 4 would implement a mix of conservation commitments from both Alternatives 1 and 2. The primary commitments included from Alternative 2 are those that require corrective actions. However, Alternative 4 would relax the timeframes required for completing the actions.

Table E3-3 in Appendix E (EIS Tables) identifies the conservation commitments that would apply under Alternative 4. The section below summarizes the differences between the monitoring and adaptive management program for Alternative 4 versus the programs described for Alternatives 1, 2, and 3.

Monitoring and Adaptive Management

Under Alternative 4, monitoring and adaptive management would be the same as required under Alternative 2.

3.4.4 Transition Lands Strategy and Changed Circumstances

The transition lands strategy is a component of the overall conservation strategy for the HCP species. The changed circumstances portion of the HCP identifies events that can reasonably be anticipated and planned for by DNRC and the USFWS, and it incorporates measures to be implemented if such circumstances occur.

DNRC manages over 5.1 million surface acres of state trust lands to maximize long-term revenue for trust beneficiaries while promoting healthy and diverse forests. To accomplish its mission, DNRC transitions lands into and out of trust lands ownership through its land acquisition, development, and disposition program. It also responds to natural events and administrative changes that affect how state trust lands are managed.

Over time, DNRC considers opportunities to sell, purchase, 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 land holdings for more efficient management. Protecting the future revenue-generating capacity of trust lands includes not only forest management activities, but other income-producing activities, such as grazing; mineral, oil and gas exploration, development, and extraction; recreation; real estate uses; and other future uses not yet identified.

Conditions that affect HCP species in the project area may change during the term of the plan. The HCP identifies changed circumstances (as defined in 50 CFR 17.3) that can reasonably be anticipated and planned for by DNRC and the USFWS, and incorporates measures to be implemented if such circumstances occur. DNRC and the USFWS have identified fires, insect and disease outbreaks, wind events, slope failures, floods, and climate change as the natural events to be addressed as changed circumstances in the HCP. DNRC and the USFWS have also identified several administrative changes as changed circumstances for the HCP – changes in HCP species listing status (new listing of an HCP species, new listing of a non-HCP species, or de-listing of an HCP species); occupation of the Bitterroot Ecosystem (BE) by grizzly bears; extinction of an HCP species; termination of the Swan Agreement; and changes in DNRC’s Forest Management ARMs.

This section summarizes differences between the alternatives regarding DNRC’s process for acquiring, developing, and disposing of trust lands (transition lands strategy), and well as how it would respond to natural events and changes in administrative procedures identified as changed circumstances.

3.4.4.1 Alternative 1

<u>Transition Lands Strategy</u>

Montana statutes provide for the sale, purchase, or exchange of state trust lands. Real estate transactions are proposed and planned on a case-by-case basis, with terms and mitigations developed at the project level. Transactions comply with several policies, laws, and rules, including MEPA, the *DNRC Real Estate Management Programmatic Plan: Final EIS and ROD* (DNRC 2005a), DNRC's land banking rules, and other applicable state and county laws.

Issues related to impacts of a proposed land sale, land exchange, or development on grizzly bears, lynx, and/or other wildlife species are evaluated and addressed at the project level. The amount of trust lands that could potentially be developed is determined by direction contained in the Real Estate Management Programmatic Plan, by the land banking rules, and by the management discretion of the Land Board. Regarding federally listed species, DNRC or any subsequent owners of trust lands are required to comply with Section 9 of the ESA, which prohibits the "taking" of federally listed species.

<u>Changed Circumstances</u>

Under the current forest management program, DNRC complies with the existing Forest Management ARMs, MCA, MEPA, and other applicable state and federal policies, laws, and rules to address events identified as changed circumstances.

DNRC regularly responds to natural disturbance events that affect forest health on trust lands by scheduling timber harvests to capture the salvage value of affected trees. Because the quality of wood in dead trees deteriorates quickly, the associated environmental review processes are often conducted under compressed timelines. In addition, DNRC's salvage timber program (MCA 77-5-207) provides for 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 an event occurs; therefore, salvage projects are often processed as emergency situations. Blowdown events and subsequent forest management activities are often small, localized projects that typically occur as small salvage sales through a timber permit.

Regarding climate change, while potential effects are known, there is not sufficient site-specific information to plan for and manage the effects of climate change at this time. DNRC staff are participating in the state's climate change advisory committee, which has been directed to examine state-level greenhouse gas reduction opportunities in all sectors in Montana, and take into consideration opportunities to "save money, conserve energy, and bolster the Montana economy." Additionally, DNRC staff are discussing the ramifications of climate change on the management of forested trust lands. However, no policy or change in management has been proposed at this time.

3.4.4.2 Alternative 2 – Proposed HCP

As part of its proposed HCP, DNRC has included processes for addressing land use and ownership changes (transition lands) and changed circumstances that may occur during the Permit term.

Transition Lands Strategy

HCP Chapter 3 (Transition Lands Strategy) in Appendix A (HCP), describes DNRC's proposed transition lands strategy for moving lands into or out of the HCP project area over the 50-year Permit term. To maintain the overall integrity of the conservation levels provided under the proposed HCP, the transition lands strategy would provide two important benefits: (1) long-term biological assurances by setting limits or thresholds on the amount of land DNRC can remove from the HCP project area within a specified time period, and (2) the opportunity and framework for interested parties to extend conservation benefits on DNRC lands through leases, licenses, or other legal instruments pursuant to existing state laws.

Limits on removal of lands from the HCP project area would include 5 and 10/15 percent net loss caps, depending on the type of habitat involved. Over the 50-year Permit term, DNRC would cap the removal of HCP project area lands in the NCDE and CYE grizzly bear recovery zones, CYE grizzly bear NROH, LMAs, and bull trout core habitat areas (as defined in MBTRT 2000) to 5 percent of the baseline of original HCP project area lands in these habitat areas. For all other HCP project area lands, DNRC would cap the removal of lands ~~to 10 percent of the original baseline over the 50-year Permit term~~at 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 would increase to 15 percent.

If HCP project area lands within grizzly bear recovery zones, CYE grizzly bear NROH, LMAs, or bull trout core habitat areas are proposed for removal from the HCP project area, DNRC would explore options for interested parties to manage the lands for conservation benefits. In such cases, a federal, state, or non-federal land management or conservation agency or entity would have 60 days upon notification by DNRC to respond with 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. Upon written request from the USFWS, DNRC would also have the option of applying deed restrictions with enforceable terms or other binding conservation measures. Potential deed restrictions may include, but would not be limited to, development limitations or specifications, riparian setbacks, food disposal and storage requirements, livestock grazing restrictions, or other conservation measures.

The transition lands strategy would also provide a mechanism for DNRC to add lands to the HCP project area. This process would involve obtaining approval from the USFWS for the proposed addition. To facilitate the USFWS's review of a proposed addition, DNRC would provide detailed information regarding baseline conditions of the proposed lands, a description of relevant HCP commitments based on those baseline conditions, as well as a plan of action demonstrating how DNRC would incorporate the relevant HCP commitments into its management of the proposed lands.

This strategy also would allow for the continuation of DNRC's land acquisition, development, and disposition program. Lands identified for addition to or removal from the HCP project area would be done under the guidance of DNRC's Real Estate Management Programmatic Plan, the HCP transition lands strategy, and in coordination with the FMB.

DNRC and the USFWS would hold annual update meetings to facilitate the exchange of information related to proposed and completed transactions of HCP project area lands. Additional meetings may be convened more frequently based on the mutual consent of both parties. Topics of discussion at such meetings would include the status of net loss thresholds, along with the completed or known proposed transfers, purchases, sales, developments, leases, and/or exchanges that occurred over the past year and those expected to occur during the upcoming year. DNRC would also notify the USFWS of proposed or completed real estate transactions involving all HCP project area lands, including those discussed at the annual update and those that were not identified at the time of the annual update. Closing documents would be made available to the USFWS upon request.

Real estate development on HCP project area lands would not be a covered activity in the proposed HCP, which means a Permit would not be requested from or provided by the USFWS for real estate development under Alternative 2.

Changed Circumstances

DNRC's proposed process for addressing changed circumstances under Alternative 2 is discussed in HCP Chapter 6 (Changed Circumstances) in Appendix A (HCP). In the event of a changed circumstance, ~~this~~the proposed process, which requires USFWS oversight, would ~~reduce the risk~~ ensure that ~~an~~ HCP ~~commitment~~commitments or appropriate alternative measures are implemented to benefit the HCP species ~~would not be met through USFWS oversight~~, while allowing DNRC to continue to meet its fiduciary and trust responsibilities, as well as any other regulatory requirements.

Under Alternative 2, when a natural disturbance changed circumstance is triggered, DNRC would incorporate input from the USFWS through early involvement during site visits and through internal review of MEPA documentation. The goal would be to foster effective interactions between the USFWS and DNRC throughout the planning process. The process would involve DNRC notifying the USFWS (or vice versa) as soon as it has determined that a changed circumstance has likely occurred, conducting site visits right away to assess site conditions, and preparing a contingency plan (mitigation plan) to address the changed circumstance. HCP Section 6.2 (Changed Circumstances Due to Natural Events) in Appendix A (HCP), identifies the biological concerns related to each identified natural event and the HCP species, and for each HCP species, defines the changed circumstance (trigger) and proposed DNRC response.

For administrative changed circumstances, the process under Alternative 2 would involve DNRC notifying the USFWS (or vice versa) as soon as it has determined that an administrative changed circumstance has occurred, DNRC and the USFWS cooperatively developing a course of action to address issues raised by the changed circumstance. HCP Section 6.3 (Changed Circumstances Due to Administrative Changes) in Appendix A (HCP), describes the proposed DNRC response for each identified administrative changed circumstance.

To address climate change under Alternative 2, new research and guidance materials related to the future management of state forests in light of climate changes and potential effects of climate change on the HCP species would be a topic of discussion as necessary between DNRC and the USFWS at scheduled annual meetings. Both parties would work together to develop appropriate responses to new research or guidance materials regarding the impacts of climate change on forest management and/or the HCP species.

3.4.4.3 Alternative 3 – Increased Conservation HCP

Under Alternative 3, DNRC's procedures for moving lands into and out of the HCP project area and addressing changed circumstances would be the same as described for Alternative 2.

3.4.4.4 Alternative 4 – Increased Management Flexibility HCP

DNRC's procedures for moving lands into and out of the HCP project area and addressing changed circumstances under Alternative 4 would be the same as Alternatives 2 and 3.

3.5 Alternatives Considered but Eliminated from Detailed Analysis

During the scoping process and the HCP EIS planning and development process, numerous alternatives were considered and discussed between DNRC and the USFWS. Also, in response to public comments on the Draft EIS, the USFWS and DNRC considered one additional alternative described in this section: an alternative that would require less road building. The final decision on which alternatives would be evaluated in the EIS was based on several factors:

- Does it meet the project purpose and need?
- Does it satisfy the alternatives screening criteria (see Section 3.3, How the Alternatives Were Selected for Detailed Analysis)?
- Is it reasonable, feasible, and/or viable (40 CFR 1502.14)?

Alternatives considered but eliminated from detailed analysis included those varying the number of species covered, geographic area of coverage, length of Permit period, and approach to ESA compliance. The reasons for their elimination are described below.

3.5.1 Alternatives Varying the Number of Species Covered

3.5.1.1 Original List of Forest-associated Species

Description: This alternative includes all the forest-associated species DNRC evaluated when deciding in 2003 which species to carry forward in the Notice of Intent (NOI) to prepare an EIS (68 FR 81:22412-22414, April 28, 2003). The original 12 species were gray wolf, grizzly bear, bald eagle, Canada lynx, bull trout, wolverine, fisher, northern goshawk, black-backed woodpecker, pileated woodpecker, flammulated owl, and westslope cutthroat trout. The Columbia redband trout was not originally included as an HCP species, but was added later when more was learned of its distribution on forested trust lands.

Rationale: Including all of these sensitive forest-associated species as HCP species would provide greater long-term assurances to DNRC than an HCP with fewer species. However, following the scoping process and during the HCP EIS planning and development process, DNRC realized the risk of incidental take for these other species was low, the current Forest Management ARMs protect their habitats to a large degree (e.g., bald eagle nest sites), and the HCP conservation strategies for the HCP species would likely provide additional protection for these forest-associated species. Given these realizations and the length of time and DNRC resources required to address all of these additional species in the HCP EIS documentation, DNRC concluded this alternative should be dropped from further consideration.

3.5.2 Alternatives Varying the Geographic Area of HCP Coverage

3.5.2.1 Original NOI HCP Project Area

Description: This alternative consists of a larger project area of state trust lands. The NOI described the HCP project area as the approximately 700,000 acres of blocked and scattered forested trust lands covered under the SFLMP. Also considered were 300,000 acres of non-forested parcels that could be affected by access associated with timber management activities on forested trust lands.

Rationale: DNRC carefully evaluated which lands should be included in the HCP based on the scope of activities for which it was seeking Permit coverage, the occurrence of suitable habitat for the HCP species, and the risk of take or adverse impacts on the HCP species for the given area of land evaluated. DNRC recognized that the risk of take or adverse impacts on HCP species is not equal across all DNRC ownership. For some DNRC lands, the risk of take or adverse impacts is very low or non-existent. Therefore, including a larger project area would not meet the purpose and need to minimize and mitigate take to the maximum extent practicable where take occurs.

3.5.2.2 Smaller HCP Project Area

Description: A smaller project area was considered for the HCP. For example, DNRC considered covering specific state forests, specific areas of blocked lands, or just scattered parcels.

Rationale: DNRC carefully evaluated which lands should be included in the HCP based on the scope of activities for Permit coverage, the occurrence of suitable habitat for the HCP species, and the risk of take or adverse impacts on the HCP species for the given area of land evaluated. Ultimately, DNRC concluded that seeking HCP coverage on a smaller area of its lands may put DNRC at risk for take of a listed species on other lands where similar activities occur, which would not meet the purpose and need for pursuing the HCP.

3.5.3 Alternatives Varying the Length of the Permit Term

3.5.3.1 Shorter Permit Term

Description: This alternative is the same as Alternative 2 (Proposed Action), but the Permit term would be shorter than 50 years.

Rationale: Part of DNRC's purpose and need for pursuing the HCP is to gain long-term regulatory certainty. This is particularly important for DNRC, which must generate reliable long-term revenues through forest management, an endeavor that may require decades or more to see a return on investment. Additionally, DNRC was unsure it could secure the necessary funding and staff to implement all the conservation commitments within the required timeframe of a shorter Permit term. Therefore, a shorter Permit term did not meet DNRC's purpose and need for pursuing the HCP, and this alternative was dropped from further consideration.

3.5.3.2 Longer Permit Term

Description: This alternative is the same as Alternative 2 (Proposed Action), but the Permit term would be longer than 50 years.

Rationale: DNRC would have a longer time period of long-term assurances for its management. However, given changes in scientific knowledge, species status, and the uncertainty in the long-term and changing conservation needs of listed species, a Permit term longer than 50 years appeared inappropriate. Further, forest practices and methods, as well as management strategies, are also changing and improving over time, and 50 years was deemed a reasonable planning horizon for implementation of the HCP, as well as the required monitoring and adaptive management program. Therefore, the longer Permit term was dropped from further consideration.

3.5.4 Alternatives Providing Alternate Approaches to ESA Compliance

3.5.4.1 No Take

Description: An alternative was considered that would limit management activities to avoid the potential for take of the listed species and their habitats as identified in HCP Chapter 7, DNRC's Identification of Impacts that Have the Potential to Constitute Take under the HCP.

Rationale: This alternative would not meet DNRC's purpose and need because DNRC would likely not be able to achieve its trust lands mission to generate revenue since building, maintaining, and improving the road network is a necessary part of that mission. Additionally, DNRC would prefer to have a Permit for the HCP species, rather than revising the Forest Management ARMs to achieve "no take" because revised Forest Management ARMs would not require any form of documentation or concurrence of no take from the USFWS. Without this document or concurrence, DNRC believes it would be more susceptible to a legal challenge if another party felt DNRC's strategy did not avoid take. Under a no-take strategy, both agencies were concerned that, to the detriment of native fish species, including the listed bull trout, DNRC would also not be able to improve habitats by addressing ongoing problems of sedimentation and fish passage barriers because corrective actions may result in incidental take and therefore would not be allowed under the revised Forest Management ARMs. From the USFWS' perspective, issuing a Permit would require that the HCP's commitments to conserve the species and its adaptive management program would be maintained throughout the Permit term, whereas, without it, DNRC could change its Forest Management ARMs at any time, potentially resulting in a decrease in conservation for the HCP species.

3.5.4.2 Section 4(d)

Description: This alternative consists of applying ESA Section 4(d) rules for federally threatened species, which would be developed by the USFWS for listed species. The USFWS uses the ESA Section 4(d) rulemaking process to limit and define the extent of the take prohibition. The USFWS accomplishes this by describing specific programs that, although they might result in some ~~harm~~take, are found to contribute to the conservation of the affected species. The Section 4(d) rulemaking process can create exemptions to the extension of the take prohibition to specific threatened species if the USFWS finds that existing regulations are consistent with the conservation of listed fish and wildlife to the extent that additional federal protections are not needed to conserve the species.

Rationale: Application of the 4(d) rules represents an alternate process for complying with the ESA. However, this alternative does not meet the screening criteria for several reasons. The 4(d) rulemaking process would not provide DNRC long-term assurances, because it only applies to federally listed threatened species and the conservation measures could be changed ~~at any~~over time, requiring DNRC to potentially ~~continue to~~ change its ARMs ~~as~~if the 4(d) rules change. Implementation of this alternative would also not be economically feasible for DNRC because of the uncertainty of when and if the USFWS would ~~grant~~develop a 4(d) rule~~making process~~ for ~~DNRC, as well as the potential need to continually revise the ARMs~~forest management activities for each of the HCP species. Therefore, this alternative does not meet the project purpose and need and was dropped from further consideration.

3.5.4.3 Compliance through Section 7 of the ESA

Description: This alternative would consist of collaborative conservation plans and agreements with neighboring federal landowners, and potentially with private landowners, in the DNRC planning area. As an example, the Swan Agreement was implemented through this process. The alternative would require federal and state agencies to work together in developing multiple agreements and multiple sets of conservation measures for listed species. The Interagency Cooperation Regulations (50 CFR 402) provide for this type of cooperation as an alternative approach under Section 7 of the ESA.

Rationale: Section 7 represents an alternative process for complying with the ESA. However, this alternative did not meet the screening criteria for several reasons. First, implementation would not be economically feasible for DNRC due to the administration costs of negotiating and implementing multiple agreements with the federal agencies. Second, through the agreements with federal agencies, those agencies would then have discretion over DNRC's actions, which may affect DNRC's ability to meet its trust mandate. ~~Second~~Also, it would not provide long-term assurances because Section 7 applies only to listed species, and thus would preclude non-listed HCP species. ~~Further, the Section 7 process may be reinitiated at any time when (among other things) a change in a species status occurs.~~ Lastly, it may not be possible for the multiple agencies to come to agreement on management and conservation strategies, as the federal agencies have multiple-use resource mandates, while the state's trust lands mission is primarily focused on providing trust revenues. Because this alternative would not provide long-term assurances, would not cover non-listed species, and may compromise DNRC's ability to generate trust revenues, it does not meet the purpose and need for the project and was excluded from further consideration.

3.5.4.4 Federal Standards HCP

Description: This alternative would consist of an HCP where federal programs and federal recovery standards would be applied to HCP project area lands. Federal programs and recovery standards would include the Inland Native Fish Strategy (INFISH) (USFS 1995b), USFS Forest Plans, and the USFS and United States Bureau of Land Management (BLM) lynx conservation agreement, among others.

Rationale: This alternative would represent a higher level of conservation and less management flexibility than the proposed HCP. This alternative would decrease the opportunity for timber harvest and would result in a revenue loss; therefore, implementing this alternative would not meet the economical feasibility screening criteria. Further, this alternative conflicts with DNRC's management philosophy to emulate natural disturbances to achieve DFCs. DNRC and the USFWS recognize the value of the management concepts embraced in the federal standards and has adopted many of these management concepts in the HCP conservation strategies with a slightly greater level of flexibility where necessary to achieve DNRC's mission.

3.5.5 Alternatives Considered between the Draft EIS and Final EIS

3.5.5.1 Less Road Building

Description: Between publication of the Draft and Final EIS, the USFWS and DNRC considered alternatives to decrease the proposed extent of road building under the HCP.

Rationale: Alternatives that would require less road building might include the use of alternative harvesting methods such as forwarders and helicopters, relying solely on the existing road network on DNRC lands and adjacent land ownerships to conduct forest management activities, and conducting more road reclamation immediately upon completion of timber harvest activities. However, these options are not economically feasible or operationally practicable in all situations and would likely result in increased costs and lost revenue to the trust beneficiaries, thereby not meeting DNRC's purpose and need. The agencies discussed the idea of less road building between publication of the Draft EIS and Final EIS and again concluded that, while DNRC continues to explore technological advances in harvesting and yarding equipment, which will likely decrease the amount of roads needed for forest management in the future, roads are needed to manage the forested landscape. DNRC has determined that the amount of roads proposed under the no-action alternative and the HCP alternatives is the minimum amount DNRC can build while still meeting its trust mandate. Therefore, DNRC was not able to substantially vary the transportation network in the proposed alternatives.

3.6 Preferred Alternative

3.6.1 DNRC Preferred Alternative

The proposed action (Alternative 2) is DNRC's preferred alternative. This alternative provides the best balance between providing for HCP species conservation and allowing for DNRC management flexibility to fulfill its trust mandate. DNRC is confident that it can secure the funding to implement the commitments and meet the timelines proposed in Alternative 2. DNRC also believes that Alternative 2 ~~best represents the methods and processes~~meets the intent of the ESA Section 10 process for avoiding, minimizing, and mitigating the impacts of take resulting from its forest management activities ~~on HCP species~~ to the maximum extent practicable. For a more in-depth rationale as to why Alternative 2 is DNRC's preferred alternative, please see HCP Chapter 5 (Alternatives) in Appendix A (HCP).

3.6.2 USFWS Preferred Alternative

While development of the HCP was driven by the DNRC, USFWS personnel provided guidance and technical assistance throughout the process. Therefore, the USFWS supports ~~the selection of~~

the proposed action (Alternative 2) as its preferred alternative and does not anticipate Permit conditions beyond those already included in the proposed action. Prior to finalizing its selection of ~~the~~a preferred alternative, USFWS will review the HCP relative to the requirements of Sections 7 and 10 of the ESA and NEPA.

3.7 Environmentally Preferred Alternative

Alternative 3, HCP with Increased Conservation, is the environmentally preferred alternative. This alternative includes more protective measures than those required under the current forest management program or proposed under the other two action alternatives. This alternative would also retain the grizzly bear secure habitat within the Stillwater Core and not increase the level of active forest management in that area. The more protective measures under Alternative 3 include greater restrictions on forest management activities in habitats and during seasons important to HCP species. This alternative would also require shorter timeframes to identify the need for and implement correcting actions, resulting in the fastest rate of habitat improvement over existing conditions versus the other alternatives.

3.8 Comparison of Resource Effects by Alternative

Table E3-4 in Appendix E (EIS Tables) provides a summary of resource effects by alternative that are described in detail in Chapter 4 (Affected Environment and Environmental Consequences).

Chapter

Affected Environment and Environmental Consequences

Table of Contents (continued)

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4 Affected Environment and Environmental Consequences

This chapter describes the affected environment and analyzes the direct and indirect environmental effects associated with the alternatives described in Chapter 3 (Alternatives). Table E3-4 in Appendix E (EIS Tables) provides a summary of effects presented in this chapter. Cumulative effects are presented in Chapter 5 (Cumulative Effects). For resources that could potentially be affected by implementation of the alternatives, affected environment discussions describe the relevant regulatory framework and present technical background information. These discussions identify the current conditions against which the anticipated environmental effects of the alternatives are evaluated. The remaining sections of this chapter present the physical environment first, followed by the biological environment, and then the social environment. The specific order of the sections is as follows:

- Climate (Section 4.1)
- Forest Vegetation (Section 4.2)
- Air Quality (Section 4.3)
- Transportation (Section 4.4)
- Geology and Soils (Section 4.5)
- Water Resources (Section 4.6)
- Plant Species of Concern, Noxious Weeds, and Wetlands (Section 4.7)
- Fish and Fish Habitat (Section 4.8)
- Wildlife and Wildlife Habitat (Section 4.9)
- Recreation (Section 4.10)
- Visual Resources (Section 4.11)
- Archaeological, Historical, Cultural, and Tribal Trust Resources (Section 4.12)
- Socioeconomics (Section 4.13).

Sections 4.14 and 4.15 at the end of this chapter address irreversible and irretrievable commitments of resources and the relationship between short-term uses and long-term productivity. Unavoidable adverse impacts are identified within the individual resource sections in this chapter.

Analysis Areas

Sections 1.3.2 (EIS Planning Area) and 1.3.3.1 (HCP Project Area), describe the EIS planning area and HCP project area, respectively (see also Figures D-1 and D-3 in Appendix D, EIS Figures). These areas are used to define the analysis areas for which the affected environment, environmental consequences, and cumulative effects will be described. The HCP project area is composed of

548,500 acres of trust lands occurring on both blocked and scattered parcels. The blocked lands are mostly contiguous blocks of DNRC ownership in the Stillwater and Coal Creek State Forests (Stillwater Block) and the Swan River State Forest. The EIS planning area encompasses a geographic area potentially influenced by implementation of the HCP and totals 39 million acres. It includes the HCP project area and all other lands in the NWLO, SWLO, and CLO. The EIS planning area also defines the cumulative effects analysis area for many of the resource areas (see Chapter 5, Cumulative Effects, for additional discussion of cumulative effects). ~~The remainder of this section describes the current climatic conditions within the EIS planning area, as well as potential effects of global climate change.~~

<<< Draft EIS Sections 4.1.1.1 (Climate and Precipitation in the EIS Planning Area) and 4.1.1.2 (Global Climate Change) were deleted in their entirety. See new Section 4.1 (Climate) for a discussion of these topics. >>>

Evaluation Criteria and Effects Evaluations

Evaluation criteria for resource effects are defined for each of the resource topic areas within their individual subsections in this chapter. The criteria are briefly described immediately before the detailed discussion of environmental consequences for each resource topic.

The scientists who conducted the analysis for this EIS based the effects analysis on best professional judgment and best available science after weighing all of the quantitative and qualitative evaluation criteria that were developed, as well as their review of applicable literature. They also accounted for the fact that, under the adaptive management program, each action alternative allows for change in the conservation commitments over time based on feedback from research and monitoring activities.

The HCP is a programmatic plan for managing the habitats of HCP species on forested trust lands in western Montana. The commitments that define the four alternatives represent a programmatic planning effort for forest management activities that take place over the term of the Permit within the HCP project area. Consequently, the analysis for each resource area focuses specifically on evaluating the impacts of the policies and procedures that are being proposed for modification under the alternatives. Conclusions are based on reasonably available data and generally qualitative analyses, supported by quantitative data where available and appropriate.

A variety of data sources were used for the EIS analysis, primarily DNRC's SLI database, which is described in HCP Section 1.3.3.2 (Use of DNRC Resources) in Appendix A (HCP). The SLI database is a dynamic database, whereby DNRC conducts field inventories for a subset of forest stands on an annual basis and subsequently updates the database. Because the scientists conducting the EIS analysis needed to work from a fixed set of data, the decision was made to use DNRC's 2004 SLI database. The dates of other data layers used for both HCP development and EIS analysis are listed in the tables displaying the data or are described in HCP Chapter 9 (Data Sources Used in HCP Development) in Appendix A (HCP). Given the time required to prepare and finalize the EIS/HCP, some estimates of stand conditions or habitat conditions have likely changed since 2004. This is typical for a programmatic analysis of this scale that spans several years for development, public review, and finalization of environmental analyses. At the end of the first year after Permit issuance, along with annual reporting requirements, DNRC will provide an update to the USFWS on habitat conditions in the HCP project area for continued monitoring and tracking of the HCP commitments. The updates in the data layers and stand conditions in the HCP project area are not expected to change the conclusions reached in this EIS analysis.

Under Alternative 2, grizzly bears in the Swan River State Forest would be managed in accordance with the Swan Agreement (current ARMs). In the event the agreement is terminated, the HCP would be in effect and grizzly bears would be managed in accordance with the HCP conservation commitments. Therefore, the analysis of effects on grizzly bears under Alternative 2 represents implementation of the proposed HCP conservation commitments. For lynx and bull trout conservation under Alternative 2, the HCP would be followed on all HCP project area lands.

The affected environment sections describe existing conditions for resources within the analysis area that would potentially be affected by implementing the proposed conservation commitments. Discussions focus on those resources that would be most affected, or have a high likelihood of being affected, by the commitments and that would, in turn, have a high likelihood of affecting fish and wildlife, particularly the species proposed for coverage under the HCP.

Discussions of environmental consequences focus on substantive beneficial and adverse effects on resources that would result from implementing the proposed conservation commitments. For the no-action alternative, potential effects are discussed in terms of trends and future conditions. The potential effects of the proposed HCP and the two other action alternatives are compared to the effects of the no-action alternative. Emphasis is placed on analyzing potential impacts on species and habitat proposed for coverage under the HCP, as well as pertinent issues raised during internal and public scoping. Mitigation measures that would reduce or avoid the potential occurrence of certain adverse impacts are described for each resource. Any remaining unavoidable adverse impacts are identified. Irreversible and irretrievable commitments of resources, as well as the relationship between short-term uses and long-term productivity, are described in the final two sections of this chapter.

As described in Chapter 3 (Alternatives), the HCP and associated Permit would have a proposed permit duration of 50 years. Consequently, the analysis in the EIS generally considers long-term effects to be those occurring over the course of the 50-year Permit term. Short-term effects are considered to occur over a period of less than 10 years.

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4.1 CLIMATE

4.1.1 AFFECTED ENVIRONMENT

4.1.1.1 Conditions in the EIS Planning Area

<<< This section contains text from Draft EIS Section 4.1.1.1 (Climate and Precipitation in the EIS Planning Area. >>>

Montana's northern and mountainous interior location results in climate conditions that vary considerably. The Continental Divide exerts a marked influence on climate and precipitation regimes within the planning area. West of the Continental Divide, the climate of the NWLO and SWLO is strongly influenced by moisture-laden air masses from the Pacific Ocean (NCDC 2003). Rainfall and snowmelt water are usually plentiful in the mountainous areas of the NWLO, especially at higher elevations (Woods et al. 2002). Compared to areas east of the mountain barrier, summers in the NWLO and SWLO are cooler in general, winters are milder, and precipitation is more evenly distributed throughout the year (NCDC 2003).

East of the Continental Divide, the climate of the CLO is continental, characterized by warm summers and wintertime invasions of sub-zero air followed by warm, dry Chinook winds (Caprio and Farnes 2004). Compared to the two western land offices, a greater proportion of annual precipitation falls between May and September in the CLO. In Helena, 62 percent of the average annual precipitation occurs in those 5 months, versus 48 percent in Kalispell (NWLO) and 50 percent in Missoula (SWLO) (WRCC 2005). On average, less precipitation falls in areas east of the Continental Divide compared to areas on the west side: 11.9 inches in Helena, versus 15.2 in Kalispell and 13.5 in Missoula (WRCC 2005).

Throughout the planning area, the wet season occurs during late spring and early summer, except in narrow strips along the Bitterroot Mountains and the Continental Divide, where a large portion of the precipitation occurs during the winter months (Caprio and Farnes 2004). May and June are the wettest months at weather stations in Kalispell, Missoula, and Helena (WRCC 2005). A secondary peak in precipitation occurs during November, December, and January in Kalispell and Missoula; however, no such wintertime peak occurs in Helena (WRCC 2005). East and west of the Continental Divide, precipitation varies widely and depends largely on topographic influences. Areas adjacent to mountain ranges in general are the wettest, although there are a few exceptions in valleys where the rain shadow effect appears (NCDC 2003).

Precipitation is a primary factor influencing vegetation conditions, runoff, sediment yield, and water quality. Annual precipitation varies by geographic location and largely depends on topographic influence. The western mountainous areas of the state are the wettest and the north-central area is the driest. Some of the wetter mountainous areas, such as the peaks in the Whitefish Range and Mission Mountains Wilderness in the NWLO and the Bitterroot Range in the SWLO, average more than 85 inches of precipitation per year (Caprio and Farnes 2004). Sheltered mountain valleys are some of the driest areas in the state because of rain-shadow effects. Such areas include Missoula and Deer Lodge in the SWLO and Lonepine in the NWLO, where annual precipitation averages are only 11 to 14 inches (Caprio and Farnes 2004; WRCC 2005).

Occasional thunderstorms occur during the summer months in Montana. Particularly over mountainous areas, these thunderstorms result in limited rainfall but often large amounts of lightning. However, they can also be highly variable spatially and can form very intense short-duration rainfalls. Localized flash flooding and large erosion events are often caused by these localized convective storms. These dry thunderstorms are quite common in Montana during the summer, and they are a primary cause of most wildland fires in the state.

Based on precipitation data from 1961 thru 1990 (Oregon Climate Service 2005; WRCC 2005), average annual precipitation in the vicinity of the NWLO ranges from 16 to 22 inches in the Lake County area, increasing to between 34 to 85 inches per year in the mountains. Annual average precipitation in the SWLO ranges from 12 to 14 inches in the Bitterroot Valley, 8 to 14 inches in the upper Swan River Valley, 16 to 34 inches in the surrounding mountains, and 34 to 85 inches along the western and southwestern highlands and Mount Powell area. For the CLO, average annual precipitation in the lowlands around the Dillon and Townsend areas and in the northwestern portion ranges from 8 to 14 inches, and along the western edge and southwestern mountains, it averages from 22 to 60 inches per year. Nearly half the annual long-term average total precipitation falls in Montana from May through July (WRCC 2005).

The state's snowfall varies dramatically from year to year. Annual snowfall ranges from about 20 inches in the dryer northern areas east of the Continental Divide to 300 inches in the western mountains (WRCC 2005). Most snow falls between November and March, but heavy snowstorms can occur as early as mid-September or as late as May 1 in the higher-elevation southwestern half of the state (WRCC 2005). Mountain snow pack in the wetter areas can often exceed 100 inches in depth as the annual snow season approaches its end around April 1 to 15.

The highest volume of stream flow in Montana rivers occurs during the spring and early summer months with the melting of the winter snow pack. Heavy rains falling during the spring thaw occasionally constitute a serious flood threat (WRCC 2005). Ice jams, which occur during the spring breakup (usually in March), can cause backwater flooding. Flash floods, although restricted in scope, are probably the most common form of flooding and result from locally heavy rainstorms in the spring and summer.

Since 1976, however, trend analysis from the National Weather Service's Climate Prediction Center shows that Montana has been experiencing increasing annual average temperatures, western Montana has been experiencing decreasing annual average precipitation, and the rest of Montana is experiencing no or a slight increase in annual average precipitation. Additionally, this analysis shows a shift in the timing of when precipitation falls throughout the state (Climate Prediction Center 2010). Based on weather station data collected between 1951 and 2004, Billings, Great Falls, Bozeman, Missoula and Kalispell, are experiencing increasing average March temperatures (Montana Climate Office 2010a) and decreasing annual snowfall (Montana Climate Office 2010b). These changes are attributed primarily to a changing climate, which is discussed in the next section.

4.1.1.2 Climate Change

This section discusses climate change, including what it is; why it is happening; current understanding about the direction and magnitude of trends globally, regionally, and locally; and responses to climate change at the global, national, state, and local levels. For the each of the other resources discussed in this chapter (i.e., Sections 4.2, Forest Vegetation, through 4.13, Socioeconomics), effects of and trends in climate change on that resource are discussed in the affected environment section. In the environmental consequences discussion for each resource, climate trends are factored into the analysis of potential effects of the alternatives.

What is Climate Change?

Climate patterns naturally vary both over time and across the globe. Decadal and interannual weather patterns, such as the Pacific Decadal Oscillation and the El Nino/Southern Oscillation that affect United States climate, as well as weather patterns occurring on a more geologic scale, are natural sources of variation in the earth's climate. Other natural sources of climatic variation include volcanic eruptions, which tend to result in short-term cooling effects for 2 to 3 years, and the sun's historical 11-year cycle of energy output (Karl et al. 2009). However, the rate of acceleration and direction of change since the 1980s have been found to extend beyond the historical range of variability, due largely to human-related emissions of greenhouse gases (GHGs) that trap heat in the earth's atmosphere (CIRMOUNT Committee 2006).

A natural component of the earth's climate is the "greenhouse effect," which warms the earth's surface. GHGs such as water vapor, carbon dioxide (CO_2), ozone, methane, nitrous oxide, and fluorinated gases absorb heat radiated from the earth's surface and lower atmosphere and then radiate much of that energy back toward the surface. When these gases are ranked by their contribution to the greenhouse effect, the most important are water vapor (36 to 72 percent), CO_2 (9 to 26 percent), methane (4 to 9 percent), and ozone (3 to 7 percent) (Kiehl and Trenberth 1997).

In the absence of this natural greenhouse effect, the earth's average surface temperature would be about 60° F (33° C) colder (Karl et al. 2009). The amount of warming caused by GHGs is a function of the ability of these gases to absorb solar radiation and the atmospheric concentration of each gas. While their ability to absorb solar radiation is constant, the atmospheric concentrations of these gases are altered by natural processes and human activities (Joyce and Birdsey 2000). Rising atmospheric concentrations of GHGs increase the temperature of air, land, and water, affecting water evaporation, rainfall, wind, and other components of weather (Karl et al. 2009).

Factors Affecting Climate Change

Many lines of evidence, from observational studies to climate models, are believed by many scientists to have firmly established the scientific basis for asserting that the global climate system is changing due to human activity (Pederson et al. 2009). The Intergovernmental Panel on Climate Change (IPCC) concluded in its Fourth Assessment Report that "warming of the climate system is unequivocal" (IPCC 2007a). However, the IPCC also recognizes that observed and projected effects of human-induced climate change have various levels of uncertainty associated with them.

The atmospheric concentration of CO_2 has been increasing since the beginning of the industrial era in the mid-1700s (IPCC 2007a; Karl et al. 2009). While many accept that this increase has been the main factor causing atmospheric warming over the past several decades (IPCC 2007a; Karl et al. 2009), others believe that climate change is primarily influenced by natural warming and cooling cycles occurring over decades and centuries.

Sources of CO_2 and Other GHG Emissions

Although natural sources also contribute to GHG, the burning of fossil fuels (coal, oil, and natural gas) and land use changes (primarily deforestation in the tropics and agriculture) are the primary causes of the increase in atmospheric GHGs (Joyce and Birdsey 2000; IPCC 2007a; Karl et al. 2009). Changes to the land surface, such as deforestation, the replacement of other areas of natural vegetation with agriculture and cities, and large-scale irrigation, alter how much heat is reflected or absorbed by the land surface (Karl et al. 2009). Agricultural and industrial processes have also increased emissions of other GHGs (Joyce and Birdsey 2000; IPCC 2007a; Karl et al. 2009). The IPCC concluded that the largest growth in GHG emissions between 1970 and 2004 came from the energy supply, transport, and industry sectors, while emissions from the residential and commercial buildings, forestry (including deforestation), and agriculture sectors grew at a lower rate (IPCC 2007a).

Aerosols are tiny particles of liquid or solid matter suspended in the atmosphere that can cause regional and local climate impacts. Some aerosols are naturally occurring, such as sea salt and sulfuric acid from volcanoes, while others are human-caused, such as industrial emissions and dust. Smoke is also an aerosol, and it is generated by both natural events and human activities. Notably, aerosols tend to remain in the atmosphere for a relatively short period of time (a few weeks), and human-induced aerosols typically do not mix into the atmosphere, remaining near their source (Joyce and Birdsey 2000). Thus, aerosols tend to affect local climate for the relatively short periods they remain suspended in the atmosphere. Regardless, aerosols affect climate by (1) reflecting solar energy radiation away from the earth, (2) contributing to the formation of clouds, which reflect heat back to the earth, or (3) influencing precipitation by changing cloud properties (IPCC 2007a).

In addition to the atmosphere, carbon is also stored in the terrestrial biosphere, soils, and the ocean. Incorporation of carbon into vegetation is typically the most rapid component of the carbon cycle. Trees and plants absorb CO_2 through photosynthesis and convert it to carbon in plant biomass. Atmospheric concentrations throughout the year reflect the seasonal uptake of CO_2, which results in the growth of vegetation (Joyce and Birdsey 2000). Forests store much larger amounts of carbon in plant biomass than other terrestrial ecosystems (Diaz et al. 2009). Globally, forests contain 75 percent of all plant biomass, and nearly half of all soil carbon (ORFI 2006). On average, United States forests store 50 percent of carbon in soils, 33 percent in live plant biomass, 10 percent in standing and downed woody debris, 6 percent in the forest floor, and 1 percent in understory plants (Turner et al. 1995 *in* Diaz et al. 2009).

Forests are often net sinks of CO_2; that is, they absorb more CO_2 through photosynthesis than they emit into the atmosphere through cellular respiration and decomposition. When trees are harvested and converted to durable wood products, some of the carbon remains stored in those products for long periods (CCS 2007). Transfers of carbon to soils and ocean depths occur on the decade-to-century time scale (Joyce and Birdsey 2000).

Both the rate of carbon sequestration and the emission of CO_2 through respiration and decomposition factor into a forest's net carbon content. While older, more mature forests can maintain large amounts of carbon in their biomass, and thus be a significant sink of carbon despite relatively low growth rates, they also tend to emit substantial amounts of CO_2 through respiration and decomposition. Conversely, younger stands have higher sequestration rates and typically convert more carbon to biomass, but the amount of carbon stored in the trees is lower than in the mature stands they replace.

Effects of Forest Management on CO_2 and Other GHG Emissions

Increases in atmospheric GHG levels, primarily CO_2, could be caused by a variety of factors related to forest management activities: (1) CO_2 emissions and dust from forest harvest and road construction, reconstruction, maintenance, and use; (2) the addition of aerosols into the atmosphere from smoke, as well as CO_2, methane, and nitrous oxide emissions, generated by wildfires and prescribed burning; and (3) reductions of carbon stored in forests and the ability of those forests to sequester additional carbon.

The equipment used to construct, reconstruct, and maintain roads also contributes CO_2 emissions to the atmosphere. These activities, as well as road use, can generate dust, which can then contribute to local atmospheric aerosol levels.

Amounts of GHG emissions and smoke-related aerosols generated from wildfires and prescribed burning can be affected by changes in the frequency and size of wildfires and changes in prescribed burning. Factors contributing to the frequency and size of wildfires include amounts of fuel available to burn (fuel loading), wildfire suppression policies, and access to wildfires, while factors affecting changes in prescribed burning include changes in policies and expected levels of burning.

A forest's ability to sequester or release carbon is affected by several disturbance factors:

- **Harvest.** During the harvest process, carbon is lost from a stand through the removal of trees, soil disturbance, removal of understory growth and woody debris, and processing of wood products, while additional emissions are generated from vehicles and machinery transporting and processing the wood. Much of the carbon loss from harvest occurs within several years after harvest (Smith et al. 2006 *in* Diaz et al. 2009). As much as one-third of the carbon stored in the timber may be stored over the long term in manufactured wood products (ORFI 2006). Due to lower total biomass, reforested stands typically do not store as much carbon as the mature forest stands they replace. Reforested stands will generally have negative effects on total carbon storage until the new trees are large enough to store more carbon than was lost through harvest, processing, and decomposition (ORFI 2006).

- **Wildfires, insects, and disease.** Forest mortality as a result of wildfires, insect infestations, and disease are the primary sources of unintentional carbon emissions from forests in the western United States and can result in the net loss of carbon storage over decades to centuries (ORFI 2006). While dead trees are no longer able to sequester carbon, if left on the landscape to decompose naturally, the release of stored carbon back into the atmosphere can occur over decades (Diaz et al. 2009). The release of carbon from dead trees in the years following a fire may exceed the amount of carbon lost during the actual fire (Dixon and Krankina 1993 *in* Diaz et al. 2009; Janisch and Harmon 2002 *in* Diaz et al. 2009).

- **Temperature or water stress.** Increases in temperature and/or decreases in available water can stress trees. In response to such stress, such as during periods of drought, trees will stop photosynthesizing and may release more carbon through respiration than they take up by photosynthesis (Running 2009). Such stress may also increase tree mortality (Allen et al. 2010) or increase susceptibility to insect infestation and disease.

Several forest management practices have been identified as ways of increasing carbon storage in forests (Diaz et al. 2009).

- Extend harvest rotation intervals to allow additional carbon storage in larger living trees and preserve carbon stored in standing and downed wood.
- Reduce harvest disturbance using partial harvest techniques and retaining whole or parts of cut trees on site during and after harvest.
- Retain standing and downed dead tress and snags; the carbon held in dead biomass can persist in the forest for very long periods.
- Apply fertilizers or organic amendments in stands where nutrients are a limiting factor to tree growth.

In an environment such as western Montana, where forests are naturally subject to large disturbance events, including wildfires and insect infestations, management practices can be implemented to reduce the risk of tree loss from those events. While mature forests sequester more carbon than younger forests, they may be at more risk to wildfire, insects, and disease. Retaining more standing and downed dead trees may also increase the risk of wildfire by providing additional fuel and potential ignition points.

Climate Change Trends

Annual emissions of CO_2 increased by about 80 percent between 1970 and 2004 from 21 to 38 gigatonnes (23 to 42 billion United States tons), and in 2004, CO_2 emissions accounted for 77 percent of total human-caused GHG emissions (IPCC 2007a). As of February 2010, the average level of global atmospheric CO_2 was about 388 parts per million (Co2unting.com 2010; ESRL 2010), which is 39 percent greater than the estimated pre-industrial level of 280 parts per million (IPCC 2007a). Additionally, the rate of annual increase in atmospheric CO_2 levels from 2000 to 2007 was 33 percent faster than in the 1990s (PCGCC 2009a). From pre-industrial times to 2005, the global atmospheric methane level has increased from about 715 to 1,774 parts per billion, and global atmospheric nitrous oxide has increased from about 270 to 319 parts per billion (IPCC 2007a).

Increases in atmospheric GHG levels have led to increasing global average temperatures. Since 1900, the global average temperature has increased by about 1.5° F (0.8° C) (Karl et al. 2009). This increase in global temperature has resulted in global, regional, and local changes in climate patterns. Warming of the climate system has been detected in changes in surface and atmospheric temperatures and in sea surface temperatures (IPCC 2007a).

CO_2 can remain in the atmosphere for at least 100 years (Karl et al. 2009), and recent findings indicate that a quarter of it may remain for much longer (PCGCC 2009a). Due to the length of time GHGs remain in the atmosphere, continued warming of global average temperature will occur even if human-caused GHG emissions were to stop completely. However, depending on the level of continued GHG emissions, the IPCC projected an increase in global average temperature of an additional 2 to 11.5° F (1.1 to 6.4° C) relative to 1980 through 1990 temperatures by the end of this century (IPCC 2007a). IPCC's upper estimate may be more likely based on updated modeling and a CO_2 emission growth rate since 2000 that tracks the IPCC's worst-case model scenario (PCGCC 2009a).

Global Trends

Across the globe, many effects of climate change have been observed and vary regionally. The IPCC stated three general conclusions based on observed changes in climate in its Fourth Assessment Report (IPCC 2007b).

1. Warming of the climate system is unequivocal, as is now evident from observations of increases in global average air and ocean temperatures, widespread melting of snow and ice and rising global average sea level.

2. Observational evidence from all continents and most oceans shows that many natural systems are being affected by regional climate changes, particularly temperature increases.

3. Other effects of regional climate changes on natural and human environments are emerging, although many are difficult to discern due to adaptation and non-climatic drivers.

Some of the many observed effects of climate change include the following:

- A longer ice-free period on lakes and rivers (Karl et al. 2009)

- More frequent and intense weather events, such as heavy downpours, droughts, and hurricanes (Karl et al. 2009; IPCC 2007a)

- A lengthening of the growing season (Karl et al. 2009) by as much as 10 to 20 days in the last few decades (Linderholm 2006)

- Ecological changes in the phenology (biological responses, such as leaf-out, blooming, breeding, migration, and emergence from hibernation) and distribution of plants and animals (Parmesan 2006; Eastbaugh 2008; IPCC 2007a)

- Range contractions of range-restricted species, particularly polar and mountain-top species, with some extinctions (Parmesan 2006)

- Shifting of wildlife and plant species ranges northward and to higher elevations (Linderholm 2006; IPCC 2007a), with some extinctions of lower latitude/altitude populations (Linderholm 2006)

- Invasion of opportunistic, weedy, and/or highly mobile species (Linderholm 2006).

By 2100, the IPCC predicts a global average temperature rise of 3.6 to 7.9° F (2.0 to 4.5° C) over 1980 through 1999 temperatures and considers a rise of less than 2.7° F (1.5° C) very unlikely

(Eastbaugh 2008). In general, those effects already observed are likely to continue. However, the occurrence, direction, and intensity of most of these effects will vary regionally. Some of these changes will likely be irreversible (IPCC 2007a).

Regional Trends

In the United States, the average temperature has risen more than 2° F (1.1 °C) over the past 50 years, and most areas have warmed 1 to 2° F (0.6 to 1.1° C) compared to the 1960s and 1970s (Karl et al. 2009). Additionally, temperatures have risen faster in winter than in any other season over the past 30 years (Karl et al. 2009). In North America, the temperature rise has been greatest at higher latitudes (Parmesan 2006). The winter temperature has increased by 7° F (4° C) between 1981 and 1991 at latitudes above 45° N (Joyce and Birdsey 2000). In recent years, spring has arrived earlier (an average of 10 days to two weeks earlier than 20 years ago [Karl et al. 2009]) and the growing season has a lengthened by about 12 days (Joyce and Birdsey 2000).

Precipitation patterns in the United States have changed. Since 1970, United States overall precipitation has increased by about 5 percent, mainly due to increased precipitation coming in the fall (Joyce and Birdsey 2000). The largest increases, up to 20 percent, have occurred in the Gulf Coast states, lower northeastern United States, and Midwestern states, while California, Montana, Wyoming, North Dakota, parts of Colorado, and Nebraska have actually experienced a decrease in annual precipitation of similar magnitude (Joyce and Birdsey 2000). Additionally, the proportion of precipitation occurring in extreme events has increased (Karl et al. 2009; Dale et al. 2001).

Temperature changes in the western states, including Montana, are greater than those in than any other part of the contiguous United States (Saunders et al. 2008; CIRMOUNT Committee 2006). While the global climate averaged 1.0° F (0.6° C) warmer in 2003 through 2007, the 11 western states averaged 1.7° F (0.9° C) warmer (Saunders et al. 2008). Additionally, temperatures in the western United States have increased more at high elevations than at lower ones (Saunders et al. 2008), and annual average temperature increases have been more pronounced in winter and spring (Cayan et al. 2001; Joyce and Birdsey 2000). Spring temperatures have increased 1.8 to 5.4° F (1 to 3° C) since the late 1970s (Cayan et al. 2001; Cayan et al. 2005). Mote et al. (2005) found that the average winter (November through March) temperature in the western United States warmed at a rate of 2.9° F (1.6° C) per century from 1950 to 1997, with more than half of approximately 400 United States Historical Climatology Network weather stations exhibiting average winter temperature increases more than 1.8° F (1° C) per century and some stations exhibiting rates as high as 7.2° F (4° C) per century. A statistical analysis of the long-term regional change in observed temperature and snowmelt-streamflow timing trends indicated that these change were not fully explained by the Pacific Decadal Oscillation (Cayan et al. 2005).

For the future, climate models generally project that warming in the interior west will be greater than areas near the coast. The IPCC predicts that the West will continue to warm, with a 3.8 to 10.6° F (2.1 to 5.9° C)increase over the 21st century compared to 1980 to 1999 temperatures (Saunders et al. 2008). In mountainous areas, the warming rate is conservatively estimated at 0.5° F (0.3° C) per decade, increasing the amount of there areas that would be in the transient snow zone, where snow accumulates and repeatedly melts during the snow season (Mote 2006).

Local Trends

From 2003 through 2007, the average global temperature was 1.0° F (0.6° C) warmer than during the 20th century, with western Montana averaging 2.1° F (1.2° C) warmer (Saunders et al. 2008). In western Montana, the annual average temperature rose 2.39° F (1.33° C) from 1900 to 2006 (Pederson et al. 2009). A regional analysis of trends revealed that, while these changes track both the inter-annual and multi-decadal variability exhibited in global and northern hemisphere temperature records, the rise in extreme temperatures and seasonal averages has been two to three times greater than that of the global average (Pederson et al. 2009).

In western Montana, a variety of effects from increasing temperatures and a changing hydrologic cycle have been observed. These include less frequent extremely cold days and more frequent hot days (Karl et al. 2009; Pederson et al. 2009), as well as increasing length of season over which hot days occur (Pederson et al. 2009), decreasing annual average precipitation in western Montana (Climate Prediction Center 2010), a shift in the timing of when precipitation falls throughout the state (Climate Prediction Center 2010), and decreasing annual snowfall (Montana Climate Office 2010b).

With temperatures projected to continue to increase over this century (Karl et al. 2009; Running 2009), continued changes are projected for western Montana. More frequent extreme events, such as heat waves, droughts, and heavy rainfall are expected (Karl et al. 2009), as well as increased summer maximum temperatures and winter minimum temperatures (Pederson et al. 2009). Throughout the 21st century, the growing season in the northern Rocky Mountains is projected to increase by about two months, spring snowmelt is projected occur 4 to 6 weeks earlier, and the summer drought period is projected be 6 to 8 weeks longer (Running 2009).

The lengthening of the growing season could provide a negative feedback to atmospheric CO_2 concentrations (more carbon absorbed and stored by plants) and local climate change, since a longer growing season in northwestern Montana corresponds to greater photosynthetic activity. Alternatively, a longer growing season and warmer temperatures could increase respiration and decomposition rates, offsetting the net gain in carbon sequestration realized through photosynthesis, and ultimately providing a positive feedback mechanism (more carbon released into the atmosphere) (Brooks et al. 2004; Keyser et al. 2000).

A large portion of Montana (about 22.4 million acres, or 24 percent) is forestland (CCS 2007). Forestry and land use were estimated to offset about 72 percent of the state's gross GHG emissions in 1990, although that portion is expected to decrease over time as overall emissions in the state are forecasted to increase (CCS 2007).

Response to Climate Change

Public response to climate change has included development of policies, research on effects and trends, and regulatory efforts to reduce GHG emissions. Various responses have been implemented at the global, national, state, and local levels. However, as knowledge about effects of and contributions to climate change evolve, so too will global, national, state, and local responses to climate change. The following subsections summarize recent and current policy, research, and regulatory responses related to climate change.

Global Response

The international climate change effort was launched by governments at the 1992 “Earth Summit” with the signing of the United Nations Framework Convention on Climate Change (UNFCCC) (PCGCC 2009b). With 192 member parties, including the United States, the UNFCCC’s ultimate objective is to stabilize GHG concentrations in the atmosphere at a level that will prevent dangerous human interference with the climate system. The UNFCCC was designed to assist countries in adapting to the inevitable effects of climate change (UNFCCC 2009a). Parties meet annually to review implementation of the Convention and negotiate the process of addressing climate change (UNFCCC 2009b). The fifteenth session, COP15, was held December 7 to 19, 2009, in Copenhagen, Denmark, and the Copenhagen Accord documents the decisions and resolutions adopted at that COP.

The UNFCCC, which encourages industrialized countries to stabilize GHG emissions, is complemented by the 1997 Kyoto Protocol, which set binding targets for reducing GHG emissions. Under this treaty, 37 industrialized countries and the European Community have committed to reducing their emissions by an average of 5 percent below 1990 levels by 2012 (UNFCCC 2010).

National Response

Current United States climate policy includes (1) a wide array of public-private partnership initiatives to reduce current and near-term United States GHG emissions; (2) establishment of the multi-agency Climate Change Technology Program to accelerate development and deployment of key GHG emission reduction technologies; (3) coordination and integration of federal research through the United States Global Change Research Program (USGCRP); and (4) extensive engagement in international climate change activities, including support of activities under the UNFCCC and the IPCC (EPA 2009).

In the Global Change Research Act of 1990, Congress mandated an integrated research program to understand and predict the effects of climate change to inform policymakers and help resource managers anticipate and adapt to a rapidly changing world (The Wildlife Society and Ecological Society of America 2009). Thirteen federal agencies and departments have participated in the USGCRP, including the Department of the Interior (DOI) United States Geological Survey (USGS).

More recently, a variety of federal programs and research initiatives have been established to address various aspects of climate change.

- The Consolidated Appropriations Act of 2008 (Public Law 110-161) provided funding to the USGS to conduct research on the wildlife impacts of climate change, including the planning and establishment of the National Climate Change and Wildlife Science Center (NCCWSC). These centers were developed to provide climate change impact data and analysis geared to the needs of fish and wildlife managers as they develop adaptation strategies in response to climate change (DOI 2010).

- DOI Secretarial Order No. 3289, Amendment No. 1 (February 22, 2010) established “a Department-wide approach for applying scientific tools to increase understanding of climate change and to coordinate an effective response to its impacts on tribes and on the land, water, ocean, fish and wildlife, and cultural heritage resources that the Department manages" (DOI 2010). This Order included the following:

- Designation of the NCCWSC regional hubs as DOI Climate Science Centers (CSCs) with a broader mandate to synthesize and integrate climate change impact data and develop tools that the Department's managers and partners can use when managing the Department's land, water, fish and wildlife, and cultural heritage resources (DOI 2010).

- Development of a network of regional collaborative Landscape Conservation Cooperatives (LCCs) to work interactively with the relevant CSCs and help coordinate adaptation efforts in their respective regions (DOI 2010).

The USGS also administers two programs that specifically address climate change in mountain ecosystems in the western United States. The Western Mountain Initiative is a collaboration between the USGS, USFS, National Park Service, and partner universities to study climate change and ecological interactions to better understand and predict likely outcomes in mountain ecosystems in the western United States (USGS 2010a). The USGS Northern Rocky Mountain Science Center's Climate Change in Mountain Ecosystems program was established in 1991 to monitor, conduct research, and model ecosystem responses to climatic variability at Glacier National Park. This research program has since been expanded to include five additional protected areas throughout the western United States (USGS 2010b).

The USFWS' Strategic Plan for Climate Change lays the foundation for the agency's role in the DOI's national efforts to conserve fish and wildlife in a rapidly changing climate. Key elements of the strategy include adaptation, mitigation, and engagement.

- **Adaptation** is defined by the IPCC as an adjustment in natural or human systems in response to actual or expected climatic stimuli or their effects, which moderates harm or exploits beneficial opportunities. Adaptation forms the core of the USFWS' response to climate change and refers to planned management actions the USFWS will take to help reduce the effects of climate change on fish, wildlife, and their habitats.

- **Mitigation** is defined by the IPCC as human intervention to reduce the sources or enhance the sinks of GHGs. Mitigation in the strategic plan involves the reduction of the USFWS' "carbon footprint" by using less energy, consuming fewer materials, and altering our land management practices. Mitigation is also achieved through biological carbon sequestration in native habitat types.

- **Engagement** involves reaching out to join forces and seek solutions for the challenges to fish and wildlife conservation posed by climate change. By building knowledge and sharing information in a comprehensive and integrated way, the USFWS and its partners and stakeholders will increase their understanding of global climate change effects on species and their habitats.

Although the United States participated in its design and was one of its initial signatories, the Kyoto Protocol was not ratified by United States Senate. Since ratification of the UNFCCC, the United

States has yet to sign any further international agreements requiring emissions reductions over time (Diaz et al. 2009). However, on October 5, 2009, President Barack Obama signed Executive Order 13514, Federal Leadership in Environmental, Energy and Economic Performance, which requires federal agencies to measure, manage, and reduce GHG emissions toward agency-defined targets. It also requires federal agencies to meet a number of energy, water, and waste reduction targets (CEQ 2010). There is currently no comprehensive federal mandate for reducing GHG emissions in the United States. Members of Congress have proposed more than 10 cap-and-trade bills as of December 2009, but none have passed to date.

However, as the result of a Supreme Court decision (*Massachusetts v. EPA*, 549 United States 497 (2007)), the EPA was directed by the Court to determine whether GHG from new motor vehicles cause or contribute to air pollution that may reasonably be expected to endanger public health or welfare, or whether the science is too uncertain to make a reasoned decision. Based on its examination of scientific evidence and consideration of public comments, EPA issued its final rule under Section 202(a) of the Clean Air Act (CAA). It concluded that GHGs threaten the public health and welfare of the American people and that GHG emissions from on-road vehicles contribute to that threat (40 FR 66496-66546, December 15, 2009). These findings allow EPA to finalize its proposed GHG standards for light-duty vehicles, a subset of on-road vehicles, to reduce GHG emissions by nearly 950 million metric tons and conserve 1.8 billion barrels of oil over the lifetime of model year 2012 through 2016 vehicles. On-road vehicles contribute more than 23 percent of total United States GHG emissions. EPA's endangerment finding covers the emissions of six key GHGs: carbon dioxide, methane, nitrous oxide, hydrofluorocarbons, perfluorocarbons, and sulfur hexafluoride (EPA 2010).

Regional, State, and Local Response

Through the USFWS' strategic plan, two LCCs have been developed in the EIS planning area: the western portion of the planning area falls within the Great Northern LCC, and the eastern portion falls within the Plains and Prairie Potholes LCC. These LCCs are currently being formed and staffed, with coordination provided by the USFWS' Mountain Prairie Region. The USFWS and USGS are working together through the Great Northern LCC. The Great Northern LCC will include a variety of science and management partners and will complement many existing conservation partnerships. The Great Northern LCC will provide multiple science support services to resource management practitioners to enhance landscape-scale adaptive management. Within the Plains and Prairie Potholes LCC, the USFWS and its partners are working to develop and apply the scientific tools necessary to determine how climate change, coupled with existing stressors such as the conversion of native prairie for agricultural purposes, may affect the health and productivity of shared natural resources in this landscape. The actions of the Plains and Prairie Pothole LCC will support and supplement state wildlife action plans and enhance protection for fish and wildlife resources in the region.

With no comprehensive federal mandate for reducing GHG emissions in the United States, most GHG regulation to date has been pursued by local governments and individual states, including the formation of regional agreements between groups of states (Diaz et al. 2009). State and regional efforts include a wide range of policies, including cap-and-trade programs, renewable portfolio standards, and climate action plans (PCGCC 2009b). Local government entities, such as cities, have also pursued efforts to address climate change and reduce GHG emissions.

In 2005, in light of the consequences that climate change could have on the economy, environment and quality of life in Montana, Montana Governor Brian Schweitzer directed the MDEQ to establish a Climate Change Advisory Committee (CCAC). This effort included development of a comprehensive strategy and forecast of GHG emissions in Montana from 1990 to 2020, as well as 54 policy recommendations designed to help reduce Montana's greenhouse gas emissions to 1990 levels by the year 2020 (CCAC 2007).

During the 2007-2008 Legislative Session, the Montana Legislature's Environmental Quality Council (EQC) subsequently completed an analysis of climate change policy issues in Montana. The EQC studied issues related to climate change, including reviewing the CCAC's policy recommendations, gathering public input on climate change and the recommendations, completing a thorough review of 15 of the CCAC's recommendations, then completing a more in-depth review of several topics. This process resulted in nine pieces of draft legislation being forwarded to the 2009 Legislature for review (EQC 2008).

In the 2007 Regular and Special Sessions and the 2009 Regular Session, the Montana Legislature passed CO_2-related legislation, as well as other bills addressing renewable portfolio standards, fuel efficiency standards, building efficiency requirements, renewable energy, and energy conservation related to climate change (EQC 2008; Montana 2010a).

Montana, along with six other states and four Canadian provinces, participates in the Western Climate Initiative (WCI), which is a cooperative effort to address climate change and jointly implement a strategy to reduce GHG emissions in the region. The WCI's strategy includes a cap-and-trade program, as well as other design recommendations that, when enacted by state law, are anticipated to reduce regional GHG emissions to 15 percent below 2005 emissions by 2020 (WCI 2010).

At the same time Montana joined the WCI in 2007, Montana Governor Schweitzer announced the 20x10 Initiative and the 30 mpg Initiative. Starting January 1, 2008, the goal of the 20x10 Initiative is to achieve a 20 percent reduction from 2007 levels in each executive branch agency's facility energy requirements by 2010. Reductions will be sought in electricity, natural gas, propane and fuel oil use (Montana 2010b). The 30 mpg Initiative established fleet average of 30 mpg for state vehicles purchased through 2010.

Other actions taken by Montana include a mandatory renewable portfolio standard, requiring 15 percent of electricity generation from eligible renewable sources by 2015; public benefit funds dedicated to supporting energy efficiency and renewable energy projects; alternative fuel policies that include a renewable fuel standard and financial incentives for biofuels; and a statewide target of reducing GHG emissions to 1990 levels by 2020 (PCGCC 2009b).

Other entities within the state have also taken more local actions to reduce their carbon footprints. The University of Montana established a Farm to College Program in 2003 to shorten the physical travel distance of food purchased for their dining venues. The University's Missoula Campus has also studied biomass technologies and evaluated the feasibility of using wood products to fuel steam generation instead of natural gas (EQC 2008).

Since its creation in 2005, mayors of five Montana cities (Billings, Bozeman, Helena, Missoula, and Red Lodge) have also joined the United States Conference of Mayor's Climate Protection Agreement, committing to reduce their cities' carbon emissions below 1990 levels, in line with the Kyoto Protocol (Mayors Climate Protection Center 2010). Additionally, Helena formed a climate change task force in 2007, and this task force completed its action plan in 2009 (Helena Climate Change Task Force 2009).

4.1.2 ENVIRONMENTAL CONSEQUENCES

This section describes the effects on climate change that may result from changes to forest management activities under the four alternatives. The analysis focuses on potential sources and amounts of GHG emissions and carbon sequestration that may occur as a result of DNRC's forest management activities.

4.1.2.1 Introduction and Evaluation Criteria

As discussed above, forest management activities can affect atmospheric levels of CO_2 and other GHGs in three primary ways: (1) CO_2 emissions and dust from forest harvest and road construction, reconstruction, maintenance, and use; (2) the addition of aerosols in the atmosphere from smoke, as well as CO_2, methane, and nitrous oxide emissions, generated by wildfires and prescribed burning; and (3) removal of forest biomass, reducing the amount of carbon stored in those forest stands and affecting the ability of those forest stands to sequester additional carbon.

The amount of timber harvest and miles of existing and proposed new roads affect the levels of CO_2 and other GHGs, as well as dust, added to the atmosphere, while the amount of timber harvest affects how much carbon is lost from those harvested forest stands and how much a forest's ability to sequester carbon is changed. As discussed above, CO_2 is the most common human-caused GHG emission. Consequently, changes in levels of this GHG are addressed in this evaluation. To evaluate changes in these effects between the alternatives, the following evaluation criteria were used.

- Road construction, reconstruction, and maintenance: miles of existing and proposed roads, as well as an estimate of road miles improved, maintained, and upgraded annually

- Timber harvest: annual sustainable yield.

For all the alternatives, DNRC would continue to follow existing management strategies and policies related to wildfire response actions and prescribed burning that would directly and indirectly influence aerosol and GHG emission levels. Consequently, this potential effect on climate change is not discussed further.

4.1.2.2 Comparison of Alternatives

Using a study that measured road construction costs along with machine productivity and fuel consumption rate, Loeffler et al. (2009) developed estimates of diesel fuel consumption and resulting CO_2 emissions from forest road construction. For cut-fill construction on slopes up to 50 percent, CO_2 emissions are 13,400 pounds per road mile, and for full bench construction on slopes greater than 50 percent, they are 74,400 to 182,700 pounds per road mile (Loeffler et al. 2009). Converted to metric tons, which is the typical reporting unit for CO_2 levels, each mile of cut-fill construction yields approximately 6.1 metric tons of CO_2, and full bench construction yields 33.7 to 82.9 metric tons of CO_2.

Table 4.1-1 provides estimates of annual CO_2 emissions that would be generated by new road construction and existing road improvement, maintenance, and upgrades during the Permit term. Emissions of CO_2 from existing road improvement, maintenance, and upgrades are expected to be much smaller than those estimated for new road construction in Table 4.1-1, but were included in the calculations to provide worst-case estimates of annual CO_2 emissions. These estimates assume that 95 percent of road miles use cut-fill construction on slopes less than 50 percent and 5 percent use full-bench construction on slopes greater than 50 percent.

TABLE 4.1-1. ESTIMATED ANNUAL CO_2 EMISSIONS FROM NEW ROAD CONSTRUCTION AND EXISTING ROAD IMPROVEMENT, MAINTENANCE, AND UPGRADES IN THE HCP PROJECT AREA BY ALTERNATIVE

	Alternative 1	Alternative 2	Alternative 3	Alternative 4
Miles of New Road Construction by Year 50	1,407.9	1,387.3	1,322.0	1,387.3
Average New Road Miles per Year	28.2	27.7	26.4	27.7
Miles of Road Improvement, Maintenance, and Upgrades[1]	100	100	100	100
Estimated CO_2 Emissions per Year (metric tons)[2]	956 to 1,271	953 to 1,267	943 to 1,254	953 to 1,267

[1] Road improvements, maintenance, and upgrades are typically implemented under timber sale contracts associated with a project. DNRC timber sale contracts active between 2001 and 2003 accounted for improvement of 121 miles of existing road and maintenance activities on approximately 172 miles of existing road. Based on this, a total of 100 miles of annual road maintenance and improvement was used for all alternatives.
[2] Calculation assumes 95 percent of road miles use cut-fill construction on slopes less than 50 percent and 5 percent use full bench construction of slopes greater than 50 percent.

Based on these estimates, Alternative 3 would likely result in the lowest CO_2 emissions from new road construction and existing road improvement, maintenance, and upgrades, followed by Alternatives 2 and 4, then Alternative 1 (Table 4.1-1). However, since the miles of new road construction are nearly the same for all four alternatives, the estimates of annual CO_2 emissions are not substantially different among the alternatives. Due to the similar amounts of new and existing road miles among the alternatives, effects on emissions of CO_2 and generation of road dust are expected to be similar.

To compare emissions associated with forest management of stands among the alternatives, an estimate of roundwood carbon content and an estimate of carbon emissions per unit of hardwood per kilometer of haul distance to a mill were used to calculate carbon emissions associated with the transport of harvested timber. Skog and Nicholson (2000) provide a regional estimate of 215.0 kilograms of carbon per cubic meter (kg-C/m^3) of roundwood for northern Rocky Mountain softwood, and Healey et al. (2009) provide an estimate of 0.0214 kg-C/m^3 per kilometer of emissions for hauling timber to a mill (factoring in empty return trips). The estimated haul distances on paved and unpaved roads provided in 12 recent DNRC timber sale bid packages were used to estimate an average haul distance (79.2 kilometers). Carbon emissions associated transport of harvested timber were calculated based on these factors and are presented in Table 4.1-2. These emission levels were then doubled to estimate total emissions associated with stand management for a single rotation, since timber transport can represent more than half of all fossil fuel carbon emissions related to forest management (Healey et al. 2009). As a fraction of total carbon content in the harvested timber, GHG emissions associated with forest management are small (Table 4.1-2), and this is consistent with the findings of others (Sonne 2006).

TABLE 4.1-2. ESTIMATED CARBON CONTENT AND EMISSIONS FROM HARVESTED STANDS IN THE HCP PROJECT AREA BY ALTERNATIVE

	Alternative 1	Alternative 2	Alternative 3	Alternative 4
Annual Sustainable Yield (million board feet)	53.2	57.6	50.6	58.0
Roundwood Carbon Content (metric ton)[1]	26,991	29,223	25,672	29,426
Average Haul Distance (kilometers)[2]	79.2	79.2	79.2	79.2
Transport Emissions (metric tons)[3]	212.7	230.3	202.3	231.9
Percent of Roundwood Carbon Content	0.8	0.8	0.8	0.8
Forest Management Emissions (metric tons)[4]	425.4	460.6	404.6	463.8
Percent of Roundwood Carbon Content	1.6	1.6	1.6	1.6

[1] Based on a factor of 215.0 kg-C/m^3 of roundwood for Northern Rocky Mountains softwood (Skog and Nicholson 2000).
[2] Average of haul distances for paved and unpaved roads from 12 timber sales offered by DNRC in 2009 and 2010 (Beaver Smith, Lion Mountain #2, Shilo Road, Skyles Lake, Boorman Peak, Lupfer3, Mill Creek, North Elliston, Richard Salvage, Ride the Pine, Six Hills, Trout Creek Salvage).
[3] Calculated using a factor of 0.0214 kg-C/m^3 of roundwood per kilometer of haul distance to a mill (adjusted for empty return trips) (Healey et al. 2009).
[4] Transport emissions doubled since GHG emissions from the transport of harvested timber can account for more than half of all GHG emissions associated with managing forest stands through their entire rotation (Sonne 2006; Healey et al. 2009).

Although the estimated roundwood carbon content does not include carbon stored in the soil, standing and downed woody debris, understory plants, or the forest floor or harvested stands, it does provide a means to compare the relative loss of carbon from harvested stands among the alternatives.

Among the four alternatives, the annual sustainable yield would range between 50.6 million board feet for Alternative 3 and 58.0 million board feet for Alternative 4 (Table 4.1-2). Alternative 3 would be expected to result in the least amount of carbon loss from the ecosystem and the smallest reduction in ability to sequester carbon from harvested forest stands, as well as the least amount of CO_2 emissions generated from forest management activities. Alternative 1 would result in the next smallest effect, followed by Alternative 2 then Alternative 4. However, increased access from new road construction proposed to support more active forest management in the Stillwater Core under Alternatives 2 and 4 may reduce the risk of catastrophic loss of carbon and carbon sequestration ability due to wildfire or insect infestation.

On a broader scale, annual CO_2 emissions estimated at 900 to 1,300 metric tons for new road construction and existing road improvement, maintenance, and upgrades (Table 4.1-1), as well as 405 to 464 metric tons of carbon emissions from forest management activities (Table 4.1-2), are very minor compared to statewide annual CO_2 emissions. For 2005, Montana's annual CO_2 emissions were estimated at 36.8 million metric tons, and they are projected to be 41.7 million metric tons by 2010 (CCS 2007). Additionally, the statewide forest and land use carbon sink was estimated to be 23.1 million metric tons in 2005 (CCS 2007).

As noted in the discussion of affected environment, above, there are about 22.4 million acres of forestland in Montana (CCS 2007). Much of this forestland is located in the western portion of the state, and a large portion of those lands are managed by federal land management agencies, primarily the USFS (see Figure 1-1). Consequently, forested trust lands in the HCP project area (446,095 acres, Table 2.3) constitute a small fraction of the forestland within the planning area.

4.1.2.3 Summary

Under each of the alternatives, management of timber stands, new road construction, and existing road improvement, maintenance, and upgrades would contribute to atmospheric concentrations of CO_2, as well as other GHGs. However, at the landscape scale, there would be no appreciable differences in net CO_2 emissions due to changes in forest management activities among the four alternatives. Additionally, emissions generated from these forest management activities would constitute a small fraction of statewide emissions from all sources.

While a portion of sequestered carbon would remain in the wood products generated, much of this would slowly be released over time. After harvest, the ability of those forest stands to store carbon would be reduced, with the level dependent on the intensity of harvest. However, as harvested areas regenerate, they would be able to store more carbon. By maintaining a consistent harvest rotation and forest productivity historically and throughout the Permit term, losses of carbon from newly harvested stands would be expected to be offset by increased carbon intake from regenerating stands harvested in previous years, resulting in little or no net change in CO_2 emissions.

A more detailed discussion of the differences in forest stand attributes expected under the four alternatives is provided in Section 4.2 (Forest Vegetation). Across the planning area landscape, forest stand attributes would be similar among the alternatives. Progress toward DFCs would continue, resulting in more younger forest and less older forest compared to current levels. By managing stands toward DFCs, the risk of large-scale carbon loss from natural disturbance events would be reduced. While a small overall shift to younger forests would reduce the forest's overall ability to store carbon, this reduction would be slight relative to amount of public and private forestland within the planning area. However, this may be offset by continued growth and increasing carbon sequestration by timber stands previously harvested during the past several decades.

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4.2 Forest Vegetation

This section describes the affected environment and environmental consequences of the no-action and action alternatives on forest vegetation.

The State of Montana includes more than 94 million acres, of which approximately 5.2 million surface acres are designated trust lands owned by the State of Montana and managed to provide income for the trust beneficiaries (see Chapter 2, Environmental and Procedural Setting). Approximately 730,000 acres of all trust lands are managed under DNRC's forest management program, which generates revenues for the trust through timber harvest and other timber-related activities. The HCP project area encompasses 548,500 acres, representing less than 1 percent of the total acres in the State of Montana. The HCP project area is located within the NWLO, SWLO, and CLO of DNRC, which, including all land ownerships, comprise more than 39 million acres. Approximately 17 million acres of this total are managed for timber production, recreation, wildlife, grazing, and other uses by the State of Montana, USFS, Native American Tribes, or private entities including timber companies. The HCP project area represents less than 1 percent of the forestlands managed in the planning area.

Section 4.2.1 (Affected Environment) presents a discussion of the policies and regulations that shape the forests on trust lands, and the current conditions that are mostly likely to change or differ among the proposed alternatives. Section 4.2.2 (Environmental Consequences) addresses issues raised during public scoping and describes the conditions that would be likely to change under the proposed action alternatives.

4.2.1 Affected Environment

This section describes the rules and regulations under which DNRC operates its forest management program; describes the management of forested trust lands; and describes the existing forest vegetation conditions found on trust lands in the HCP project area.

4.2.1.1 Regulatory Framework

DNRC's forest management actions are governed by a variety of policies, rules, regulations, and multi-party management agreements. Specifically, the policies, rules, regulations, and agreements that have the greatest influence on how the forest management program and timber harvest practices are implemented include the SFLMP, the Forest Management ARMs (36.11.401 through 450), statutes pertaining to state lands (MCA Title 77, Chapter 5), and the Swan Agreement, as summarized in Table 4.2-1. The application of these rules, regulations, and agreements ultimately shapes the forests found on trust lands. Chapter 2 (Environmental and Procedural Setting) provides a more detailed description of DNRC's management philosophy, the SFLMP, and the statutes pertaining to trust lands.

TABLE 4.2-1. RULES, REGULATIONS, AND AGREEMENTS GOVERNING DNRC'S FOREST MANAGEMENT PROGRAM

Rules, Regulations, and Agreements	Purpose (Summarized)
State Forest Land Management Plan (SFLMP)	Provides the management philosophy and direction for the program.
Forest Management ARMs (36.11.401 through 450)	Provides specific legal resource management standards and establishes desired future condition objectives for stand management.
Statutes. State Lands (MCA Title 77, Chapter 5)	Defines the administration and designation of state lands, their purpose, classification, uses, and obligations to the trust beneficiaries. Chapter 5 contains provisions related to the management of state forest lands.
Determination of Annual Sustainable Yield (MCA 77-5-222 through 223)	Requires DNRC to determine the annual sustainable yield on forested trust lands under the direction of the board at least once every 10 years.
Timber Salvage Program (MCA 77-5-207)	Provides for the timely salvage logging on state forests of dead or dying timber or timber that is threatened by insects, disease, fire, or windthrow.
State forest lands - deferral of management prohibited (MCA 77-5-116)	Prohibits the designation, treatment, or disposal of any interest in state forest lands for the preservation or nonuse of these lands prior to obtaining funds for the affected beneficiary.
Swan Agreement	Provides grizzly bear conservation through coordinated forest management activities on USFS, state trust, and Plum Creek Timber Company lands in the Swan Valley (Swan River State Forest).

Within the Forest Management ARMs, there are regulations pertaining to specific resources that have the potential to influence forest vegetation across the DNRC landscape. These ARMs are identified below, along with the respective sections where they are discussed.

Rule	Section Where it is Addressed
Road Management (ARM 36.11.421)	Section 4.4 (Transportation)
Old Growth (ARM 36.11.418)	Section 4.2.1.3 (Current Conditions), subsection Age Class.
Listed Terrestrial Species (ARMs 36.11.431 through 435, Grizzly bears and Canada lynx)	Section 4.9 (Wildlife and Wildlife Habitat)
Snag Retention and Coarse Woody Debris (ARMs 36.11.411 and 414)	Section 4.9 (Wildlife and Wildlife Habitat)
Weed Management (ARM 36.11.445)	Section 4.7 (Plant Species of Concern, Noxious Weeds, and Wetlands)
SMZ Rules (ARMs 36.11.301 through 313)	Section 4.8 (Fish and Fish Habitat)

4.2.1.2 Forest Vegetation Management

The SFLMP provides the philosophical basis for DNRC's forest management program. The SFLMP ~~(codified in ARM 36.11.404)~~ takes a coarse-filter approach to biodiversity, and that approach is codified in ARM 36.11.404. This approach operates at a landscape scale and focuses on maintaining an appropriate mix of forest stand structures and compositions on trust lands. Maintaining a diversity of stand structures and compositions also provides a range of current and prospective trust revenue opportunities, including a sustainable yield of timber and maintenance of forest health and biodiversity, while reducing risks of catastrophic fires and insect or disease attacks.

Because the coarse-filter approach may not adequately address the full range of needs required to support biodiversity, a fine-filter approach, as provided for in ARM 36.11.406, is employed to address the needs of threatened, endangered, or sensitive species.

To achieve its biodiversity objectives, DNRC manages large, blocked ownerships for a DFC characterized by the proportion and distribution of forest cover types and structures (snags, coarse woody debris, large live trees) historically present on the landscape. Across its ownership, on scattered or smaller parcels, DNRC strives to create and maintain a semblance of historical conditions (cover type and structure) to the extent feasible.

Annual Sustainable Yield

DNRC is required to review and re-determine the annual sustainable yield for forested trust lands at least every 10 years, as specified by MCA 77-5-221 through 223. Montana law defines the annual sustainable yield 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).*

The current annual sustainable yield is calculated using a forest management model that considers the acres available for management and capable of growing timber, and finds an optimal solution, given a mathematical representation of management objectives and constraints (DNRC 2004b). The DNRC forest model seeks to optimize the present net value (PNV) and maximize harvest across the planning horizon (in order to meet its trust mandate that the use of trust lands result in income for the intended beneficiary) while meeting management policies and constraints. PNV is the difference between the present value of cash inflows and the present value of cash outflows. PNV is used in capital budgeting to analyze the profitability of an investment or project. The economics associated with PNV are further discussed in Section 4.13 (Socioeconomics).

When the sustainable yield was last calculated in 2004, it incorporated all applicable laws and environmental commitments by DNRC as described in the Forest Management ARMs. Biodiversity, forest health, endangered species considerations, and DFCs are important aspects of state forest land management. These factors were modeled in the SYC and were reflected in the various constraints applied to the model. These constraints included

- ARMs constraints that require certain treatments in certain types of stands such as within old-growth stands and riparian areas
- Allocation constraints that force certain areas to be managed under specific management regimes
- Forest condition constraints that limit the number of acres in a certain condition or require a minimum number of acres in a certain condition
- Old-growth constraints that require the model to have a minimum of 55,700 acres (about 8 percent of DNRC's forested acres) that meet the Green et al. (1992) old-growth definition at year 100, and then maintain at least 55,700 acres of old growth through the remainder of the planning horizon (years 101 to 175)
- Implementation and operational constraints that establish the number of acres DNRC can reasonably treat each year across the various land offices.

Harvest Allocation

After the sustainable yield is determined, a proportion of the yield is distributed to each of the land offices. Each administrative unit also has a specific annual yield to contribute to the overall sustainable yield for the land office. However, the amount contributed by each unit can vary from year to year based on a number of factors, such as emergency salvage priorities due to large fires, insects, or disease, and timing and coordination challenges that come with planning projects across thousands of acres.

Timber Stand Management

DNRC manages forestlands intensively for healthy and biologically diverse forests to generate revenue for trust beneficiaries. To accomplish this, stands are selected for management and assigned timber treatments (described below) to meet one or more management objectives, including

- Regenerate stands
- Improve stand productivity
- Move stands toward DFC
- Address insect and disease issues
- Reduce fire hazards
- Address wildlife habitat and aquatic considerations.

Above all, treatments are required to maintain the long-term productivity of the site in order to ensure the long-term capability to produce trust revenue (ARM 36.11.420). On blocked lands, ARM 36.11.407 directs DNRC to manage for a DFC that can be characterized by the distribution and proportion of those forest types and structures historically present on the landscape. For scattered parcels, management is based on restoring a semblance of historical conditions within the state ownership (ARM 36.11.416).

To implement the DFC ARM (36.11.405), DNRC assigns each stand in the SLI database (described in Chapter 2, Environmental and Procedural Setting, and below in subsection Data Sources under Section 4.2.1.3, Current Conditions) to a DFC classification. The DFC classification system provides an estimate of what forest conditions would have been like prior to European settlement in Montana under natural disturbance regimes. This classification system was constructed to systematically assign a particular cover type given the presence of key tree species or evidence that the species was present in a stand at least in low to moderate amounts.

DNRC then applies timber treatments to achieve DFC objectives with the intent to promote long-term, landscape-level diversity through an appropriate representation of forest conditions across the landscape. For example, on a warm, dry site, a stand currently dominated by Douglas-fir (*Pseudotsuga menziesii*) would typically be managed to increase the abundance of ponderosa pine (*Pinus ponderosa*). In some cases, the current cover type matches the DFC cover type. Where this occurs, silviculture prescriptions and harvest treatments are designed to maintain the current cover type. Where the current cover type does not match the DFC cover type, silviculture prescriptions and harvest treatments are designed to move stands toward DFC cover types by generally removing shade-tolerant species and retaining species associated with early seral stages (usually shade-intolerant species) during partial harvest treatments or through natural regeneration and/or planting the desired species after an even-aged treatment.

Interim treatments or alternative treatments that do not fully meet DFC objectives but are critical for addressing more immediate needs within a stand (i.e., fire hazard reduction, insect/disease infestations, or habitat considerations) may also be applied.

Harvest Treatments

Once the DFC for a stand has been identified, DNRC selects a harvest treatment that emulates the natural disturbance regimes that historically occurred in that cover type, most commonly: stand-replacement fire, mixed-severity fire, or non-lethal fire (ARM 36.11.408). DNRC also considers other natural disturbances such as insects, disease, and wind when selecting treatments.

A treatment is then applied to emulate the natural disturbance (primarily fire) acting on the forest. Treatments that are designed to emulate stand-replacement fire include clearcut, and seed tree harvests. Shelterwood treatments typically emulate mixed-severity fires. Commercial thinning and selection harvests emulate mixed-severity and non-lethal fire or gap-replacement disturbances. DNRC also uses timber harvesting to maintain forest health, increase tree growth, reduce wildfire severity and mortality, and promote desired forest cover types or DFCs. Emulating fire disturbances and managing for DFCs is guided by the coarse-filter approach described in the SFLMP.

DNRC’s timber harvests can be 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; such methods include clearcutting, seed tree, and shelterwood. 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 are commercial thinning and sanitation cutting.

These treatments are defined below.

- **Clearcut.** The cutting of essentially all trees, producing a fully exposed microclimate for the development of a new age class. Regeneration is typically accomplished by planting or seeding or using seedlings established in advance of the treatment (Helms 1998). DNRC always retains some structural elements when clearcutting, such as small reserve patches and large snags and snag recruits.
- **Seed tree.** The cutting of all trees except for a small number of widely dispersed trees retained for seed production and to produce a new age class in a fully exposed microenvironment. Seed trees are often removed after regeneration is established, unless they are required to attain goals other than regeneration (i.e., live large tree or snag requirements) (Helms 1998).
- **Shelterwood.** The cutting of most trees, leaving those needed to produce sufficient shade to produce a new age class in a moderated microenvironment. Shelterwood trees may be removed after regeneration is established, unless they are required to attain goals other than regeneration (i.e., live large tree or snag requirements) (Helms 1998).
- **Selection.** A cutting method applied in uneven-aged forests to regenerate and maintain a multi-aged structure by removing some trees in all size classes either singly, in small groups, or in strips (Helms 1998).
- **Commercial thinning.** Any type of thinning that produces merchantable material at least equal to the value of the direct costs of harvesting (Helms 1998).
- **Sanitation cutting.** The removal of trees to improve stand health by stopping or reducing the actual or anticipated spread of insects and disease (Helms 1998).

Most of the recent harvests completed on DNRC land have employed either selection or commercial thinning prescriptions (Table 4.2-2).

Salvage Harvest

The term salvage is defined under ARM 36.11.403(71) as “the removal of dead trees or trees being damaged or killed by injurious agents other than competition, to recover value that would be otherwise lost.” Injurious agents include wildfires and major outbreaks of insects and diseases that ultimately inflict high tree mortality rates throughout forested stands. Wind events can also be considered injurious; however, such events typically result in far less mortality than wildfires or insect and disease outbreaks on trust lands.

TABLE 4.2-2. PERCENT OF THE TOTAL TIMBER HARVESTED ON DNRC-MANAGED LANDS STATEWIDE BY SILVICULTURAL METHOD FOR FISCAL YEARS 1998 THROUGH 2005

	Percent of Total Harvest[1]	
Silvicultural Treatment Method	**Fiscal Years 1998–2000[2]**	**Fiscal Years 2001–2005[3]**
Clearcut	4	5
Seed tree	8	18
Shelterwood	2	8
Selection	55	47
Commercial thinning	31	22

[1] Total harvest for fiscal years 1998 to 2000 was 27,141 acres; total harvest for fiscal years 2001 to 2005 was 31,492 acres.
[2] Source: DNRC (2000a).
[3] Source: DNRC (2005b). Percentages do not include fire-salvaged acres.

Salvage is not considered a timber treatment but comprises a substantial proportion of the value harvested on trust lands in some years. A considerable portion of recent DNRC harvest volume has been derived from salvage harvest resulting from fires and insect and disease outbreaks. For fiscal years 2001 to 2005, fire salvage comprised 26 percent of the total harvest acreage on forested trust lands (DNRC 2005b). This harvest occurred primarily in areas affected by large wildfires, including the fires in the Sula State Forest in 2000 and the Coal Creek State Forest in 2001, as well as the Maxey Ridge and Wilson Creek fires in the Bozeman area in 2001. Fire and insect and disease salvage volume sold for fiscal years 2006, 2007, and 2008 and the percentage of the total volume sold those years as salvage harvest are presented in Table 4.2-3. The high fire salvage volume associated with fiscal year 2008 is attributed to large wildfires, including the Chippy Creek, Jocko Lakes, Blackcat, and Mile-marker 124 fires.

TABLE 4.2-3. SALVAGE HARVEST VOLUME SOLD AND PERCENTAGE OF TOTAL VOLUME SOLD COMPRISING SALVAGE HARVEST FOR FISCAL YEARS 2006, 2007, AND 2008

Fiscal Year	Salvage Type	Salvage Harvest Volume Sold (million board feet)[1]	Percent of Total Volume Sold as Salvage Harvest
2006	Insect and Disease	16.5	31
	Fire	1.0	1.9
2007	Insect and Disease	27.2	51
	Fire	6.5	12.2
2008	Insect and Disease	2.5	4.8
	Fire	19.9	37.8

[1] Salvage harvest volume sold does not include volume sold as timber permits.
Source: DNRC (2008b).

Forest Improvements

DNRC strives to maintain forested trust lands in a healthy condition in order to protect the future income-generating capacity of the land. The forest improvement program uses fees from harvested timber to improve the health, productivity, and value of forested trust lands. Uses of these fees as authorized by statute include disposal of logging slash; reforestation including seed collection, seedling production, and tree planting; acquisition of, access to, and maintenance of roads necessary for timber harvest; other treatments necessary to improve the condition and income potential of state forests; and compliance with other legal requirements associated with timber harvest. Specific activities include piling of logging slash, prescribed burning, site preparation, reforestation, fertilization, thinning, and forest inventory.

Slash Disposal and Prescribed Burning

Slash is the woody debris that is dropped to the forest floor during forest practices. Slash disposal refers to the treatment of woody residue generated from forest management activities. Guidelines for slash disposal to meet fire hazard reduction requirements and to meet the nutrient and CWD retention requirements are included in the ARMs (36.11.410 and 414). Slash disposal is also an element of site preparation to facilitate stand regeneration. Slash disposal may include brush piling, pile burning, and broadcast burning. The annual average acres of slash disposal and prescribed burning from fiscal years 1995 through 2005 and the total acres treated in 2006 are presented in Table 4.2-4. In fiscal year 2006, pile burning was the most common type of slash disposal employed by DNRC (Table 4.2-4).

TABLE 4.2-4. AVERAGE ANNUAL ACRES OF SLASH DISPOSAL AND BROADCAST BURNING ON TRUST LANDS DURING FISCAL YEARS 1996 THROUGH 2005, COMPARED TO 2006

Method	Annual Average, 1996–2005[1]	Fiscal Year 2006[1]
Brush piling	817	1,654
Pile burning	1,677	3,792
Broadcast burning	285	417

[1] The acres in the table represent the stand area where these treatments occurred, but do not necessarily reflect the actual area treated. The amount of area actually treated is typically much smaller than the stand area. For example, during the process of pile burning, slash from throughout a harvest unit is gathered into a small area before being burned.
Source: DNRC (2005b, 2006a).

Prescribed burns are those set "to deliberately burn wild land fuels in either their natural or their modified state and under specific environmental conditions, which allows the fire to be confined to a predetermined area and produces the fire intensity and rate of spread required to attain planned resource management objectives" (Helms 1998). DNRC currently employs broadcast burning and pile burning as prescribed fire methods. These methods are used primarily to control the fire hazard associated with slash generated from forest management activities and for site preparation to meet reforestation objectives. DNRC rarely uses broadcast burning as a management tool for slash disposal due to liability issues and the prohibitively high costs to conduct such projects. Using the data presented in Table 4.2-4, an average of 1,962 acres are treated through prescribed burning (pile and broadcast burning) each year, and 4,209 acres were burned in fiscal year 2006.

Site Preparation

The Society of American Foresters defines site preparation as "hand or mechanized manipulation of a site, designed to enhance the success of regeneration" (Helms 1998). DNRC uses burning, herbicides, and mechanical scarification to create conditions conducive to the establishment and growth of desired tree species. Many of the activities conducted under slash disposal also accomplish site preparation goals, such as slash piling and burning.

Reforestation

Reforestation is "the reestablishment of forest cover either naturally or artificially by direct seeding or planting" (Helms 1998). DNRC regularly engages in reforestation activities, primarily by planting in burned areas or areas where regeneration harvest treatments have occurred, and by interplanting in open areas following partial harvests. DNRC reforestation is primarily limited to shade-intolerant species (ponderosa pine, western larch [*Larix occidentalis*], and western white pine [*Pinus monticola*]), often with seedlings selected from genetically superior seed sources. DNRC also monitors regeneration survival using surveys to assess survival of planted acres and inventory surveys to assess natural regeneration.

Between fiscal years 2001 and 2005, DNRC planted trees on approximately 5,103 acres (average of 1,020 acres per year). Between 2001 and 2005, regeneration surveys occurred on approximately 7,421 acres or an average of 1,484 acres per year. Planting and regeneration surveys may increase or decrease within a monitoring period, depending on the number and severity of fires requiring planting treatments.

Fertilization

Fertilization associated with forest management on trust lands consists of occasional applications of small amounts of fertilizers to individual planted trees. DNRC applies a few thousand doses of fertilizer annually on lands designated for tree planting. A dose is typically about 1 ounce, and there may be 200 to 300 doses per acre when trees are planted. These applications are designed to increase growth rates or to overcome nutrient deficiencies in the soil. When warranted, DNRC also uses fertilizer on newly constructed road cuts and fills to promote establishment of grass. The type of fertilizer applied varies based on the soil deficiency at the site, but is generally some combination of nitrogen, phosphorous, and/or potassium.

Pre-commercial Thinning

Pre-commercial thinning is defined under ARM 36.11.403(59) as "the removal of trees not for immediate financial return but to reduce stocking to concentrate growth on the more desirable trees." From fiscal years 1998 and 2004, DNRC conducted pre-commercial thinning on approximately 12,466 acres of forested trust lands statewide with an annual average of 1,781 acres (DNRC 2005b). Most recently, pre-commercial thinning occurred on 1,537 acres in fiscal year 2006 (DNRC 2006a).

Forest Inventory

Funding from timber receipts is used to collect and analyze forest resource inventory data, including a comprehensive inventory of all timber resources on forested trust lands. This data is housed in a GIS inventory, including the SLI database used to support forest management planning, which is coordinated through the Technical Services Section of the FMB.

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. From 1997 through 2002, an average of 47,450 acres of SLI data were collected each year. Most of the inventory field data were collected from within the NWLO and SWLO by DNRC contractors (and their employees). In 2004, the inventory program collected 14,200 acres of SLI data. To date, approximately 1,206,000 acres of forested and non-forested trust lands statewide have been inventoried and mapped.

Wildfire Prevention and Suppression

The state fire policy is contained in MCA 76-13-115. In general, the policy prioritizes the safety of the public and firefighters during wildfire suppression activities. The policy states that the state's priority is to minimize property and resources loss from wildfires and minimize expense to taxpayers through aggressive and rapid initial attack. The policy acknowledges that all property in Montana has wildfire protection from a recognized fire protection entity and that all federal, state, or local agencies must cooperate and coordinate fire fighting activities, including cooperation, when restricting activity or closing areas to access becomes necessary. The policy further states that fire prevention, hazard reduction, and loss mitigation are important components of the fire policy. It encourages all private, federal, and state landowners to responsibly manage lands to mitigate fire hazards and prevent fires on their properties, and acknowledges that sound forest management activities can reduce fire risk and improve the diversity and vigor of forested landscapes. Lastly, it encourages the development of fire protection guidelines for wildland-urban interface to improve safety and reduce the risk and loss in these areas.

The state policy influences forest management on trust lands. Fires on trust lands are addressed through rapid initial attack, and the majority of fires are put out before they cost major losses to the trust beneficiaries. DNRC's forest program also embraces the philosophy that sound forest management activities can reduce fire risk and improve the diversity and vigor on forested landscapes, while recognizing the natural role fire plays in forest ecosystems in Montana. This is demonstrated in the two previous subsections (Timber Stand Management and Harvest Treatments).

When a fire does cause losses of timber resources, MCA 77-5-207 provides for "timely salvage logging on state forests of dead or dying timber or timber that is threatened by insects, disease, fire …" The MCA states that DNRC should consider (1) the economic value of the timber to be salvaged; (2) the cost of salvage efforts; and (3) the long-term costs to all forest resources from insects, disease, or fire that otherwise might be controlled through salvage operations. The MCA also states that the DNRC should, to the extent practicable, harvest dead and dying timber before there is substantial wood decay and value loss.

Insects and Diseases

There are no specific regulations or policies pertaining to threats to timber resources attributed to insects and diseases. As described above in two previous subsections (Timber Stand Management and Harvest Treatments), insect and disease infestations are important considerations in selecting stands for management and selecting appropriate timber treatments to prevent, limit, or control outbreaks.

Even healthy, well-managed forests exhibit certain endemic levels of insects and disease. However, insect and disease outbreaks appear to be increasing. Aerial detection flights indicate that the amount of forest acres infested by various insects is generally increasing, and the amount of the annual change in acres infested is also increasing (Meyer 2006).

When an outbreak occurs on trust lands, DNRC pursues timber salvage in accordance with MCA 77-5-207 described under Wildfire Prevention and Suppression.

Monitoring and BMP Audits

DNRC conducts contract compliance monitoring as well as post-harvest monitoring for compliance with the SFLMP and ARMs for all major resource areas. Monitoring activities, including BMP audits, are described in Chapter 2 (Environmental and Procedural Setting).

DNRC inspects all active timber sales for contract compliance. For the last monitoring period reported (fiscal years 2001 through 2005), 2,224 timber sales inspections were completed and 16,429 items were documented as satisfactory, whereas 405 items required direction for improvement and 47 violations were documented (DNRC 2005b).

For the last monitoring period reported (fiscal years 2001 through 2005), of 111 wildlife mitigation measures applied on five timber sales, only 5 percent were considered inadequate. The results of the monitoring were used to adjust future mitigation measures related to snag retention and road closures (DNRC 2005b).

Statewide and internal BMP audits consistently demonstrate that BMP applications meet or exceed standards. For the last monitoring period reported (fiscal years 2001 through 2005), internal BMP audits found 97 percent of the 3,141 practices evaluated were appropriately applied and 98 percent of the practices were effective at protecting soil and water resources (DNRC 2005b). Statewide BMP audits on DNRC sites in 2004 also found 97 percent of the practices were appropriately applied and 98 percent were effective (DNRC 2004c).

4.2.1.3 Current Conditions

In applied forest science, many terms are used to describe forest conditions or forest attributes. For the purposes of this analysis, this section focuses on those conditions most likely to change or differ among the proposed alternatives or those conditions that are important to HCP species. This section identifies the current SYC for forested trust lands and includes a discussion of the following forest attributes: cover type and DFCs; size and age class distribution, including old growth; stocking levels; and disturbance processes, such as wildfire and forest insects and diseases.

Other forest attributes, such as connectivity, snags, and CWD are important features in the landscape and provide essential habitat components for numerous wildlife species. These attributes are discussed in Section 4.9 (Wildlife and Wildlife Habitat). Additionally, forest management in riparian areas also has the potential to influence forest vegetation. Forested riparian areas contribute important habitat components to fish-bearing streams, including shade, woody debris that creates habitat, and stream channel stability. Therefore, timber management in riparian areas is discussed in detail in Section 4.8 (Fish and Fish Habitat).

Data Sources

The forest attribute information contained in this section and the next section (Section 4.2.2, Environmental Consequences) was derived from two sources. The primary source of data was DNRC's SLI database, which contains field data collected on timber stands managed by DNRC. The second source of data was the output data from the forest management model used to calculate the annual sustainable yield for DNRC forested trust lands (DNRC 2004b).

Sustainable Yield

The 2004 SYC serves as the baseline for the no-action alternative and represents more than just an annual volume goal or target. It also 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 SFLMP and ARMs. This is clearly seen when comparing the various model runs in the *2004 Sustained Yield Calculation* (DNRC 2004b), as highlighted in Table 4.2-5. Without the environmental commitments and legal constraints placed on DNRC's forest management program, the annual sustainable harvest level could be as high as 94.6 million board feet with a PNV of $346 million over the model period. The model run adopted by the Land Board incorporated all environmental and legal commitments and resulted in a sustainable yield of 53.2 million board feet and a PNV of $146 million. The current annual sustainable yield represents 56 percent of the potential volume and 42 percent of the potential revenue of the unconstrained biological capability of DNRC's forested trust lands.

TABLE 4.2-5. FOREST MANAGEMENT MODEL RESULTS FOR BENCHMARK RUN 001 (BM001) AND ADOPTED SUSTAINABLE YIELD CALCULATION 008 (SYC008) FROM THE 2004 SUSTAINED YIELD CALCULATION

	BM001 (Biological Potential)	SYC008[1]	Difference
Acres Managed	668,168	430,784	237,384 (64.5% of BM001)
Volume Harvested (million board feet)	94.6	53.2	41.4 (56.2% of BM001)
Present Net Value (PNV)	$346 million	$146 million	$200 million (42% of BM001)

[1] SYC008 was adopted by the Land Board in November 2004.
Source: DNRC (2004b).

Table 4.2-6 shows the current sustainable yield allocation by land or administrative unit office. The three land offices with lands included in the HCP project area (CLO, NWLO, and SWLO) are responsible for harvesting 95.5 percent of the total statewide DNRC harvest. The sustainable yield for the Stillwater and Swan Units in the NWLO are separated from the other NWLO administrative units (Kalispell, Plains, and Libby), because these are large, consolidated blocks of state ownership with unique management opportunities and a high level of public interest.

TABLE 4.2-6. CURRENT ANNUAL SUSTAINABLE YIELD BY LAND OFFICE AND NWLO ADMINISTRATIVE UNIT

Land Office and Administrative Unit	Annual Sustainable Yield (million board feet)	Percent of Total Sustainable Yield[1]
Northwestern Land Office (NWLO)		
Stillwater Unit	10.1	19.0
Swan Unit	6.7	12.6
Other Units (Kalispell, Plains, Libby)	16.4	30.8
Total NWLO	33.2	62.4
Southwestern Land Office (SWLO)	13.6	25.6
Central Land Office (CLO)	3.9	7.3
Eastern Land Offices (NELO, ELO, and SLO)	2.5	4.7
Total All Land Offices	**53.2**	**100.0**

[1] Percentages may not add up due to rounding.
NELO = Northeastern Land Office; ELO = Eastern Land Office; SELO = Southeastern Land Office.
Source: DNRC (2008a).

Current Forest Cover Types and Desired Future Conditions

While many forest stands contain multiple tree species, cover type classifications are routinely used to describe and categorize stands based on the dominant tree species present. For the purposes of this analysis, stands were classified into distinct cover types based on the dominant species in the stand as shown in Table 4.2-7 and Figure 4.2-1.

TABLE 4.2-7. HCP PROJECT AREA LANDS BY CURRENT COVER TYPE AND LAND OFFICE

	CLO		NWLO		SWLO		TOTAL	
Cover Type	**Forest Acres**	**Percent of Forest Acres in Cover Type**	**Forest Acres**	**Percent of Forest Acres in Cover Type**	**Forest Acres**	**Percent of Forest Acres in Cover Type**	**Forest Acres**	**Percent of Forest Acres in Cover Type**
Mixed conifer	390	0.7	65,536	25.4	4,523	3.4	70,450	15.8
Hardwoods	656	1.2	816	0.3	569	0.4	2,041	0.5
Western larch/ Douglas-fir	0	0.0	65,402	25.4	20,857	15.9	86,260	19.3
Douglas-fir	35,620	62.9	7,046	2.7	29,242	22.2	71,908	16.1
Ponderosa pine	6,045	10.7	47,552	18.4	48,640	37.0	102,237	22.9
Lodgepole pine	7,413	13.1	20,363	7.9	12,432	9.5	40,208	9.0
Subalpine fir	5,385	9.5	37,470	14.5	5,117	3.9	47,972	10.8
Western white pine	0	0.0	7,790	3.0	207	0.2	7,997	1.8
Non-commercial	64	0.1	96	0.0	293	0.2	452	0.1
Non-stocked	1,083	1.9	5,830	2.3	9,657	7.3	16,570	3.7
Total	**56,657**	**100.0**	**257,901**	**100.0**	**131,537**	**100.0**	**446,095**	**100.0**

Note: Totals may not sum due to rounding.
Source: DNRC (2008a).

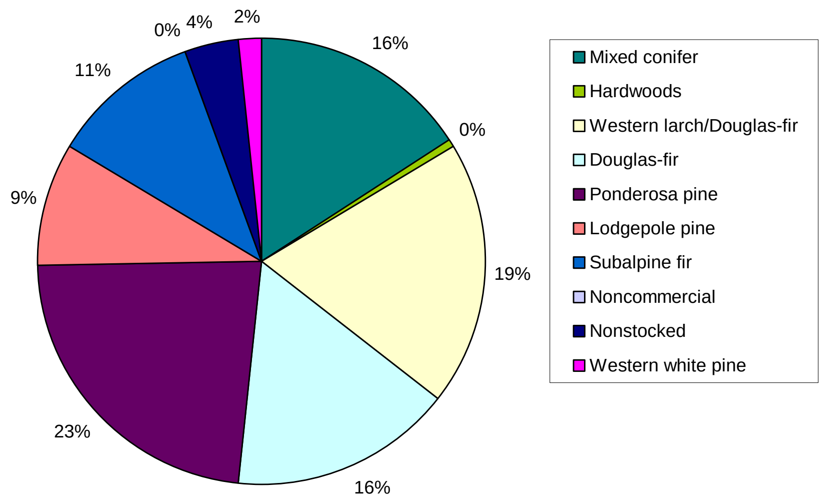

FIGURE 4.2-1. CURRENT COVER TYPES IN THE HCP PROJECT AREA

The current species composition of a stand reflects site variables, management history, and natural processes. As shown in Table 4.2-7, the CLO and SWLO have a higher proportion of the Douglas-fir cover type, which is typically found on the warmer, drier sites more common in the eastern and southern parts of the state. In contrast, the mixed conifer and western larch/Douglas-fir cover types are more prevalent on the cooler, moist sites found in the northwest part of the state.

While Table 4.2-7 reflects current cover type conditions, DNRC's forest management activities are designed to move stands toward DFC cover types. The acreage in each land office by current cover type and DFC type is summarized in Table E4-1 in Appendix E, EIS Tables.

The comparison of current cover type acres with DFC cover types for the CLO in Table E4-1 in Appendix E, EIS Tables, shows little differences because the SLI data for the CLO is predominantly based on aerial photo interpretation and not on field data. Therefore, comparisons between current and DFC cover types cannot be made on a programmatic scale at this time for the CLO. In the CLO, the current cover type is converted to DFC following analysis conducted at the project level. This is achieved by selecting silvicultural treatments that emulate the stand development and tree species expected to occur based on the project area's disturbance regime(s).

On the NWLO and SWLO, detailed stand and site information is available to make comparisons between current and DFC cover types. For example, the mixed conifer cover type on the NWLO is currently over-represented when compared to historical amounts as represented by target DFC acres (Table E4-1 in Appendix E, EIS Tables). Even though there is an overabundance of the mixed conifer cover type (65,536 acres) across the NWLO as compared to the DFC target (17,141 acres), only 14,360 acres currently contain the mixed conifer cover type and appropriately match the DFC. This implies that much of the mixed conifer cover type (51,176 acres) currently occupies sites where other cover types are desired, and this "surplus" acreage should be converted to other cover types to more accurately reflect historical conditions. Conversely, some sites where mixed conifer cover types are desired (2,781 acres) are currently occupied by a different cover type.

Size Class

Forest stands are commonly grouped into size classes for forest management purposes, for describing habitat suitability for wildlife, and as an indication of biodiversity. DNRC uses three size classes, seedling/sapling (less than 5 inches diameter at breast height [dbh]), poletimber (5 to 9 inches dbh), and sawtimber (greater than 9 inches dbh), to describe or group forest stands.

Grouping forest stands by size class is helpful for describing habitat suitability for certain wildlife species. For example, ~~young~~summer foraging habitat for lynx includes densely stocked forest stands in the seedling/sapling and poletimber classes where the trees are predominantly ~~less than 5 inches~~between 1 and 9 inches dbh and the crowns are between ~~3~~6 and ~~20~~40 feet high. These are typically young conifer stands with high stem densities that provide potential habitat for snowshoe hares, the predominant prey species for lynx. Size class and its relevance to wildlife are discussed in Section 4.9 (Wildlife and Wildlife Habitat).

The following size classes are summarized in Table 4.2-8 and Figure 4.2-2, and were derived from DNRC's SLI database:

- **Non-stocked.** Fewer than 50 seedlings and saplings per acre or grass/forb
- **Seedlings/saplings.** Predominantly trees less than 5 inches dbh
- **Poletimber.** Predominantly trees between 5 and 9 inches dbh
- **Young sawtimber.** Predominantly trees greater than 9 inches dbh and less than 100 years old with at least 10 percent crown cover
- **Mature sawtimber.** Predominantly trees greater than 9 inches dbh and greater than 100 years old with at least 10 percent crown cover, but many acres lack old-growth characteristics, such as large live trees greater than 150 years old, snags, and significant amounts of CWD.

TABLE 4.2-8. HCP PROJECT AREA LANDS BY CURRENT SIZE CLASS AND LAND OFFICE

	NWLO		SWLO		CLO		HCP Project Area	
Size Class	**Acres**	**Percent of Total**	**Acres**	**Percent of Total**	**Acres**	**Percent of Total**	**Acres**	**Percent of Total**
Non-stocked	5,830	2.3	9,657	7.3	1,742	3.1	17,230	3.9
Seedling/sapling	30,271	11.7	7,033	5.3	1,056	2.0	38,360	8.5
Poletimber	17,969	7.0	6,115	4.6	13,278	23.4	37,362	8.4
Young Sawtimber	37,688	14.6	30,707	23.3	24,335	43.0	92,730	20.8
Mature Sawtimber	166,142	64.4	78,024	59.3	16,246	28.7	260,412	58.4
Total	**257,901**	**100.0**	**131,537**	**100.0**	**56,656**	**100.0**	**446,094**	**100.0**

Note: Totals may not sum due to rounding.
Source: DNRC (2008a).

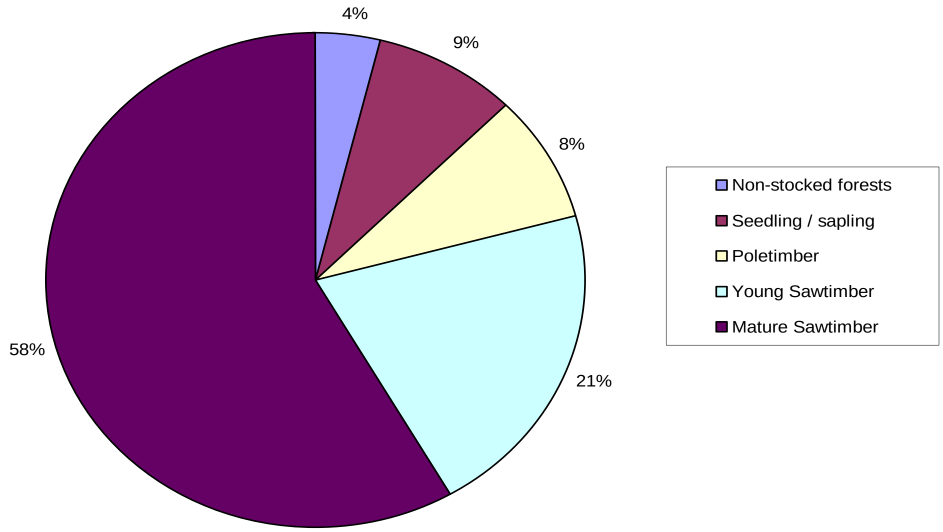

FIGURE 4.2-2. CURRENT SIZE CLASSES IN THE HCP PROJECT AREA

Across the three land offices in the HCP project area, 3.9 percent of the forested trust lands are classified as non-stocked, while 8.5 percent are classified as seedling/sapling (Table 4.2-8). Poletimber and sawtimber stands represent a total of 87.5 percent of the forested acres, with young and mature sawtimber stands representing almost 80 percent of the area across the three land offices.

The relative amounts of the seedling/sapling class are highest in the NWLO (11.7 percent) and lowest in the CLO (2.0 percent). This difference reflects the higher proportion of stands in the NWLO that receive regeneration (even-aged) harvests compared to the more common partial harvests (uneven-aged) applied in the SWLO and CLO. The NWLO has more cool, moist sites where even-aged management is more appropriate as compared to more warm, dry sites on the SWLO and CLO where uneven-aged management is more appropriate. Also on the SWLO and CLO, many sites retain a sufficient number of sawtimber-sized trees (overstory) post-harvest to still be classified as sawtimber stands.

Many of the sawtimber stands also have a seedling/sapling and/or poletimber understory component due to natural or post-harvest conditions. Such stands are typically characterized by two distinct size and age classes consisting of some large, residual overstory trees with an understory of smaller trees. These stands are typically categorized as low-volume sawtimber stands because the younger trees do not have any board foot volume associated with them until they grow to commercial size (8 inches dbh or more). Therefore, the actual amount of area with either a seedling/sapling (8.5 percent) and/or a poletimber (8.4 percent) component is likely higher than what is shown in Table 4.2-8.

Age Class

Similar to size class, DNRC assigns an age class to all stands in the SLI database based on the predominant size class of the stand. Age class information is helpful in describing forest structure and development, for describing biodiversity, and for assessing wildlife habitat.

Seedling/sapling stands (less than 5 inches dbh) are typically represented by the 0- to 39-year age class. Likewise, poletimber stands, where most of the trees are 5 to 9 inches dbh, are typically represented by the 40- to 99-year age class. Unlike these younger age stands, however, sawtimber stands (greater than 9 inches dbh) can be represented by the 40- to 99-year, 100- to 150-year, 150-or-more-year age classes, depending on site quality, stocking, past management practices and disturbances, species composition, and many other factors.

Forest structure is also influenced by stand age. In general, younger stands represented by the 0- to 39-year and 40- to 99-year age classes tend to exhibit single- or two-storied canopy structures. Single-storied stands have a single canopy layer with minimal vertical canopy structure or stratification, whereas two-storied stands have two canopy layers, such as an overstory of larger, older trees with an understory of young regeneration. Multi-storied stands, where the canopy is stratified into three or more layers, are typically older (100 years old or older, including old growth), more complex, and further along in stand development.

The coarse-filter approach from the SFLMP emphasizes management for a variety of forest structures and compositions to promote biodiversity. Age class distribution is one of the parameters generally considered when assessing suitability of habitat for a variety of wildlife species. For example, stands in the 100- to 150-year and 150-or-more-year age classes situated on warm sites containing large trees that are open to moderately dense can provide important habitat for species such as flammulated owls. Each age class, with its associated forest structure, provides important wildlife habitat, as discussed in greater detail in Section 4.9 (Wildlife and Wildlife Habitat).

Table 4.2-9 and Figure 4.2-3 provide the current age classes in the HCP project area. Approximately 12 percent of the HCP project area on the NWLO and SWLO is 0 to 39 years old, while roughly 25 percent is 40 to 99 years old. A large number of acres in the HCP project area are in the older age classes (Table 4.2-9). Stands that are 100 or more years old represent 62 percent of the area on the NWLO and 56 percent of the area on the SWLO. Stands in the older age classes have 10 percent or more crown cover consisting of mature sawtimber (greater than 9 inches dbh and 100 or more years in age) but may have an understory of young regeneration (0 to 39 years).

Old Growth

The term old growth is sometimes used to describe the later, or older, stages of forest stand natural development (Green et al. 1992), which share some common characteristics or attributes. Characteristics associated with old growth generally include stands with relatively large, old trees where the stand exhibits some degree of a multi-storied structure; has signs of decadence, such as rot and spike-topped trees; and contains standing large snags and large down logs. These attributes vary widely in old-growth stands across the landscape, with some old-growth stands exhibiting high levels of old-growth attributes (i.e., many large trees, a well-developed multi-storied canopy structure, and many standing large snags and large down logs) and some exhibiting low levels of old-growth attributes.

TABLE 4.2-9. HCP PROJECT AREA LANDS BY CURRENT AGE CLASS AND LAND OFFICE

	CLO[1]		NWLO		SWLO		HCP Project Area	
Age Class	**Acres**	**Percent of Total**	**Acres**	**Percent of Total**	**Acres**	**Percent of Total**	**Acres**	**Percent of Total**
No age data[2]	0	0	5,126	2.0	7,085	5.4	12,211	2.7
0 - 39 years	13,282	23.4	31,952	12.4	15,679	11.9	60,913	13.6
40 - 99 years	6,895	12.2	61,588	23.9	34,788	26.4	103,271	23.1
100 - 150 years	22,977	40.6	63,414	24.6	43,310	32.9	129,701	29.1
150+ years	13,503	23.8	95,821	37.2	30,676	23.3	140,000	31.4
Total	**56,657**	**100.0**	**257,901**	**100.0**	**131,537**	**100.0**	**446,095**	**100.0**

[1] Age data for the CLO estimated from age data collected randomly across the CLO.
[2] Acres with no age class defined represent stands where no age data currently exist.
Note: Totals may not sum due to rounding.
Source: DNRC (2008a).

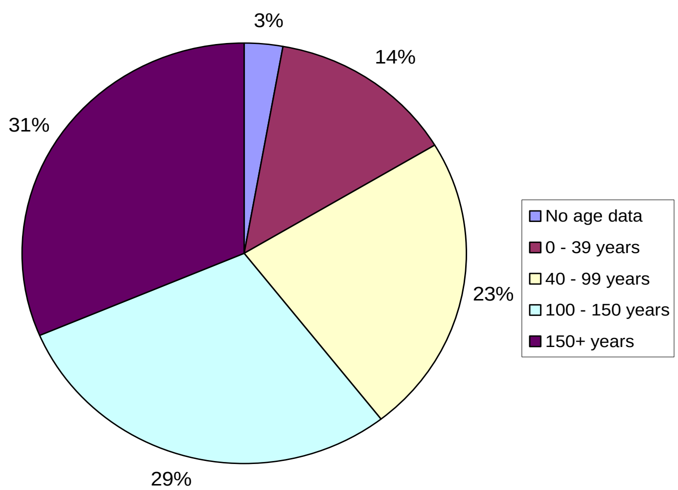

FIGURE 4.2-3. CURRENT AGE CLASSES IN THE HCP PROJECT AREA

While this qualitative definition of old growth provides a useful description for communication purposes, a quantifiable definition is needed to determine which stands will be classified as old growth for making project-level decisions and treatment recommendations. Therefore, old growth is defined in the ARMs (36.11.403(48)) as "forest stands that meet or exceed the minimum number, size, and age of those large trees" as noted in *Old-Growth Forest Types of the Northern Region* (Green et al. 1992).

Table 4.2-10 shows the number, size, and age of trees needed to meet minimum old-growth requirements for specific cover types. Using these criteria, the number of old-growth acres by land office is shown in Table 4.2-11 for the HCP project area and the unit offices in the NWLO. Figure 4.2-4 shows the percentages of old-growth habitat across the HCP project area.

TABLE 4.2-10. CRITERIA USED TO IDENTIFY OLD-GROWTH FOREST STANDS ON FORESTED TRUST LANDS IN WESTERN MONTANA

Cover Type	Minimum Age	Trees per Acre	Minimum dbh (inches)
Mixed conifer	180	10	21
Western larch/Douglas-fir	170	10	21
Douglas-fir	170	8	21
Ponderosa pine	170	8	21
Lodgepole pine	140	10	13
Alpine fir	180	10	17
Western white pine	180	10	21

Source: Adapted from *Old-Growth Forest Types of the Northern Region* (Green et al. 1992).

TABLE 4.2-11. ACRES OF OLD GROWTH BY LAND OFFICE IN THE HCP PROJECT AREA

Land Office and Administrative Unit	Total acres	Total Old-growth Acres	Percent of Total Acres that are Old Growth
NWLO			
Swan Unit	37,913	12,829	33.8
Stillwater Unit	107,328	15,775	14.7
Other NWLO Units	112,660	8,247	7.3
Total NWLO	257,901	36,851	14.3
SWLO	131,537	10,839	8.2
CLO	56,657	5,666	10.0
Total	**446,095**	**53,356**	**12.0**

Note: Totals may not sum due to rounding.
Source: DNRC (2008a).

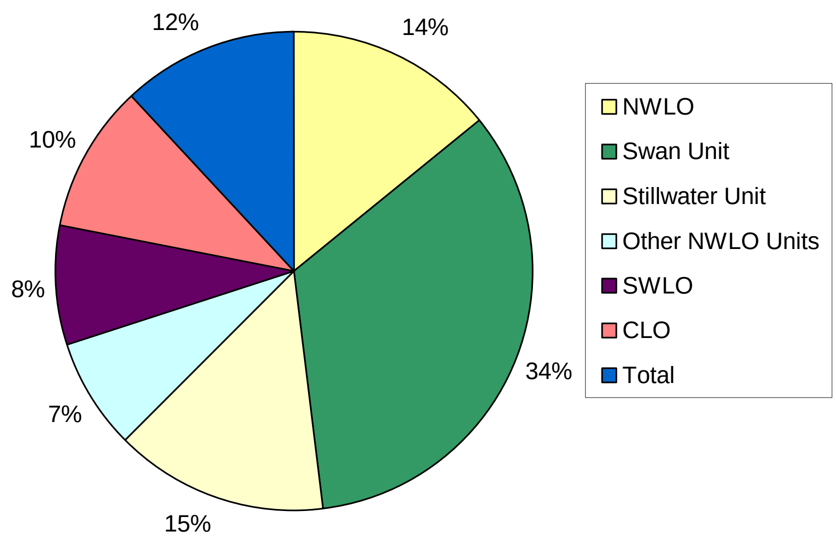

FIGURE 4.2-4. PERCENTAGE OF OLD-GROWTH HABITAT IN THE HCP PROJECT AREA

Within the HCP project area, 12 percent of the area is classified as old growth. Among the three land offices within the HCP project area, the NWLO has the highest proportion of old growth, with 33.8 percent of the Swan Unit classified as old growth, 14.7 percent of the Stillwater Unit classified as old growth, and 7.3 percent across the other NWLO administrative units, which contain scattered parcels rather than blocked lands.

Crown Closure

Crown cover is the ground area covered by the crowns of trees or woody vegetation as delimited by the vertical projection of crown perimeters and is commonly expressed as a percent of total ground area. For the purpose of this analysis, the term crown closure will be used synonymously with crown cover. DNRC uses percent total crown closure as a surrogate for stocking levels. Stocking levels refer to the density of the trees in a stand relative to a desired level. The size of trees in a stand is also a consideration when describing stocking levels. A fully stocked sapling stand may have 400 trees per acre, whereas a sawtimber stand may be considered fully stocked with just 100 trees per acre. Figures 4.2-5 through 4.2-7 illustrate the differences in crown cover for low-stocked, medium-stocked, and well-stocked stands.

Crown closure has implications for forest productivity, forest health, biodiversity, and wildlife habitat. Densely stocked stands, where tree crowns touch or overlap each other, for example, are often more susceptible to insect and disease, because the individual trees are more likely to suffer stress from competition for limited site resources such as water, sunlight, and nutrients. Low-stocked stands, where tree crowns are spread widely apart and do not touch each other, may be less productive from a timber standpoint because some of the site resources are not being captured and converted into tree growth.

Crown closure is also an important parameter for describing the characteristics and quality of habitat for many wildlife species. A more complete discussion of wildlife habitat and species associations related to stocking levels and stand density is provided in Section 4.9 (Wildlife and Wildlife Habitat).

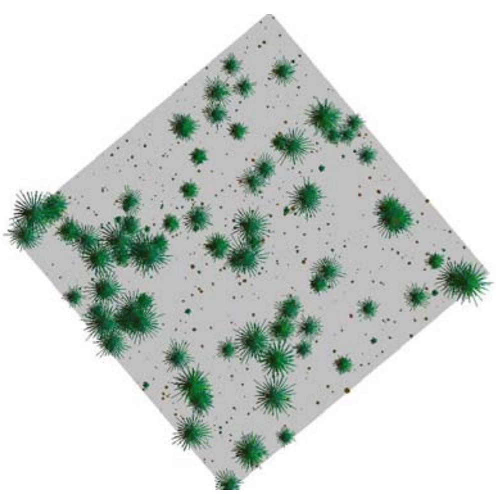

FIGURE 4.2-5. OVERHEAD VIEW OF REPRESENTATIVE CROWN CLOSURE IN A LOW-STOCKED STAND

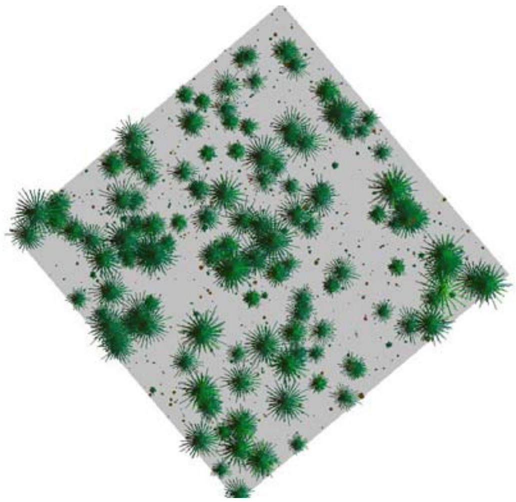

FIGURE 4.2-6. OVERHEAD VIEW OF REPRESENTATIVE CROWN CLOSURE IN A MEDIUM-STOCKED STAND

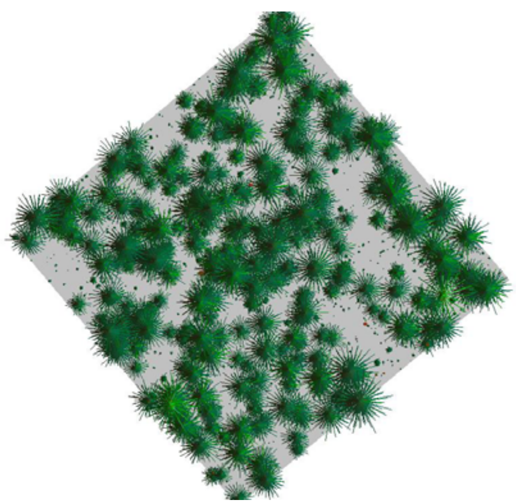

FIGURE 4.2-7. OVERHEAD VIEW OF REPRESENTATIVE CROWN CLOSURE IN A WELL-STOCKED STAND

Table 4.2-12 summarizes forested trust lands within the HCP project area by crown closure (stocking level) and land office. Stocking level is represented by the percentage of total crown cover occurring within each SLI stand. Total crown cover includes the overstory, mid-story, and understory canopy layers.

As shown in Table 4.2-12 and Figure 4.2-8, 56.7 percent of the HCP project area is classified as well-stocked and 28.1 percent as medium-stocked. The NWLO has the highest proportion of medium- to well-stocked stands and the lowest proportion of low-stocked stands, as compared to the CLO and SWLO. This stocking trend reflects the change from higher-productivity stands in the NWLO to comparatively lower-productivity stands in the SWLO and CLO as well as a higher percentage of low-stocked stands moving eastward due to a higher amount of savannah-like forest types (forests with widely spaced trees and sparse crown cover).

TABLE 4.2-12. HCP PROJECT AREA LANDS BY CROWN CLOSURE (STOCKING LEVEL) BY LAND OFFICE

Crown Closure (Stocking Level)	CLO		NWLO		SWLO		HCP Project Area	
	Forest Acres	Percent of Land Office	Forest Acres	Percent of Land Office	Forest Acres	Percent of Land Office	Forest Acres	Percent of HCP Project Area
Well-stocked (>70% crown cover)	25,743	45.4	165,442	64.1	61,899	47.1	253,084	56.7
Medium-stocked (40-69% crown cover)	17,536	31.0	67,644	26.2	40,268	30.6	125,449	28.1
Low-stocked (<40% crown cover)	12,303	21.7	18,985	7.4	19,713	15.0	51,000	11.4
Non-stocked	1,075	1.9	5,830	2.3	9,657	7.3	16,562	3.7
Total	**56,657**	**100.0**	**257,901**	**100.0**	**131,537**	**100.0**	**446,095**	**100.0**

Note: Totals may not sum due to rounding.
Source: DNRC (2008a).

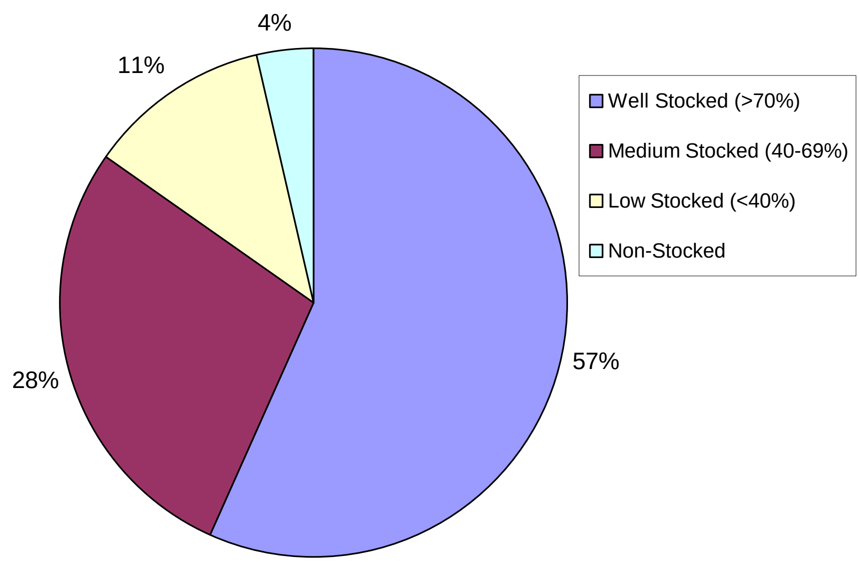

FIGURE 4.2-8. CURRENT CROWN CLOSURE (STOCKING LEVEL) IN THE HCP PROJECT AREA

Disturbance Processes

There are two primary disturbance processes of concern to DNRC forest managers: wildfires and insect or disease outbreaks. Both of these processes are endemic to state forests and have long played important ecological roles in shaping forest vegetation across the landscape. These processes are further described below.

Wildfire

This section describes the frequency, causes, and trends of fires in the planning area.

Fire Frequency

Fire has a long-standing ecological role in the forests of the northern Rocky Mountains. Fire regimes, reflecting the frequency and severity of fires in a given area over time, vary based on forest vegetation, climate, and precipitation. To characterize fire frequency and conditions in the planning area, forests are grouped into four categories: dry montane forests, moist montane forests, lower supalpine forests, and upper subalpine forests. These forests are characterized below followed by historical and current fire conditions for each. The following information is summarized from *Forest Fires in the U. S. Northern Rockies: A Primer* (Cilimburg and Short 2005):

- **Dry montane forests.** Low-elevation, warm, dry sites with less than 20 inches of rain per year, typically dominated by ponderosa pine, Douglas-fir, and western larch.
- **Moist montane forests (mixed conifer forests).** Mid-elevation forests (3,000 to 7,000 feet) receiving at least 20 inches of mean annual precipitation. The wetter conditions allow drought-tolerant tree species such as ponderosa pine, Douglas-fir, western larch, western white pine, and lodgepole pine (*Pinus contorta*) to grow alongside less drought-tolerant species like grand fir (*Abies grandis*), western redcedar (*Thuja plicata*), western hemlock (*Tsuga heterophylla*), Engelmann spruce (*Picea engelmanii*), and subalpine fir (*Abies lasiocarpa*).
- **Lower supalpine forests.** Generally located on cool, moist sites between 5,000 and 7,000 feet in elevation. Mean annual precipitation ranges from 20 to 50 inches, with much falling as snow. Subalpine fir and Englemann spruce dominate many stands of this forest type.
- **Upper subalpine forests.** Generally occurring above 7,000 feet and extending to the upper timberline. Mean annual precipitation ranges from 25 to 60 inches, with extreme cold in winter and severe frosts in summer. Only the most cold-tolerant tree species, like subalpine fir, Englemann spruce, lodgepole pine, and whitebark pine (*Pinus albicaulis*), can persist within the region's upper subalpine zone.

Fires in the dry, montane forests of Montana and Idaho occur frequently because vegetation is regularly flammable (Cilimburg and Short 2005). Historically, fire in dry montane forests led to stands with groups of widely spaced trees often with sparse, low foliage. Native Americans likely increased the fire frequency in these forests, particularly in heavily used valleys, whereas more recent fire suppression has had the opposite effect. These efforts created thick forests with regenerating trees, increasing the likelihood that a fire would carry through the treetops and leave many dead trees in its wake.

Fires in the moist montane forests of Montana and Idaho are highly variable, with a mean return interval of 78 years and a range of 25 to 50 years on the warmest and driest of these forests (typically Douglas-fir cover types) to 70 to 250 years for the moist, humid forests usually dominated by western redcedar and western hemlock (Cilimburg and Short 2005). The warm, wet conditions of moist montane forests encourage dense growth, but also tend to snuff out most ignitions. The longer a stand goes without fire, however, the more likely the fire will carry up to the tree canopies. Therefore, these stands are predisposed to crown fire. Under normal weather conditions, fires in these forests will creep through the understory with occasional flare-ups in the dry areas, fuel laden areas, or on steep slopes. During drought years, stand-replacing fires can occur particularly on steep slopes.

Fires in lower subalpine forests of Montana and Idaho are typically infrequent, with a mean fire return interval of 117 years. These sites tend to develop dense thickets of fire-sensitive trees. Thus, when periodic drought occurs, these heavily stocked stands are prone to severe, stand-replacing fires. However, lodgepole cover types within this forest category follow a different pattern. These drier stands often support regular understory fires in addition to periodic stand-replacing fires, and recent increases in mountain pine beetle outbreaks encourage crown fires in these stands (Cilimburg and Short 2005).

Fires in upper subalpine forests of Montana and Idaho tend to be infrequent, with a mean return interval of 139 years due to the cold weather, rocky conditions, and widely spaced vegetation in this elevation zone. Fires that do occur tend to creep through the understory and affect few trees. Crown fires are infrequent, with a recurrence interval of 200 years (Cilimburg and Short 2005).

Fire Causes

Fire ignitions are commonly classified as either lightning- or human-caused (NIFC 2001). Historically, lightning strikes from dry thunderstorms caused the majority of fires in the planning area. Native Americans also likely contributed to historical forest fires as well (Cilimburg and Short 2005). Today, data from 1998 through 2007 indicate that nearly half of all fires on lands for which DNRC has direct protection responsibilities statewide are human-caused (DNRC 2008c). However, lightning-caused fires still burn more acres than human-caused fires (DNRC 2008c) because human-caused fires are more quickly reported, accessed, and extinguished (often due to threats to human life or property) (Cilimburg and Short 2005).

Fire Season

The forest fire season in the Northern Rockies peaks in midsummer when temperatures are high and humidity is low, forest vegetation is dry, dry lightning is pervasive, and winds are common (Cooper et al. 1991; Rorig and Ferguson 1999; Kipfmueller and Swetnam 2000). Each year has a fire season, but some years bring more fires than others. More of the forest is capable of supporting fires and spreading fires during drought years than in normal years. Recent notable fire seasons across the Northern Rockies occurred in 2000, 2001, and 2003 where regions were reported to be in moderate to severe drought (NIFC 2001; Anonymous 2003).

Recent Fire Data

Figure 4.2-9 shows the amount of trust land acres burned from 1988 to 2007 across three landscape scales: the HCP project area, planning area, and statewide. Since 2000, severe fire seasons have become more frequent. Prior to 2000, the amount of acres burned in the HCP project and planning areas was relatively stable, with occasional years, such as 1988, showing increased activity. From 1988 through 1999, only 1 year (1988) exceeded 5,000 acres burned across all three landscape scales. However, from 2000 through 2007, 3 years (2000, 2001, and 2006) have seen more than 5,000 acres burned in the HCP project and planning areas, and 5 years have seen over 5,000 acres of trust lands burned statewide. Comparing the trend in annual acres burned across each landscape scale shows similarity for all years except 2006, when much of the fire activity occurred on the east side of the state, outside of the HCP project and planning areas.

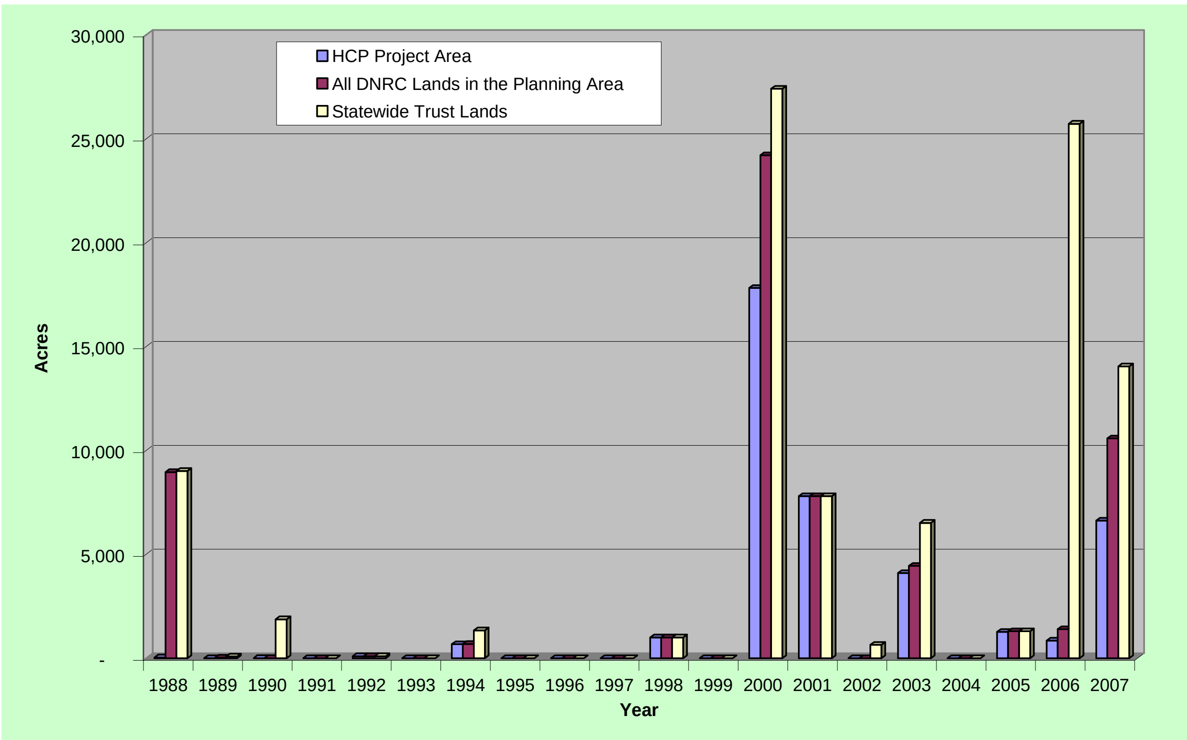

FIGURE 4.2-9. ANNUAL TRUST LAND ACRES BURNED FROM 1988 TO 2007

The average amount of acres burned on all ownerships in the planning area has also increased when comparing the two time periods: 1988 to 1999 and 2000 to 2007. For all ownerships combined, the average amount of acres burned annually has increased from 63,482 acres burned annually from 1988 to 1999 to 268,714 acres from 2000 to 2007, which is a 323 percent increase.

The impact of this increase in terms of the percent of each ownership burned from 1988 to 2007 differs greatly. From 1998 to 2007, a higher proportion of National Park Service (NPS) and USFS ownerships burned (24.6 and 13.3 percent, respectively) than other ownerships.

Comparatively, just 3.3 percent of trust lands in the planning area burned from 1988 to 2007. The variability in the proportion of ownership burned can be attributed in part to differing forest and fire management policies among ownerships. For example, NPS lands are virtually excluded from active forest management, and fires are generally allowed to burn on NPS land unless there is a risk to structures or private property.

Based on the data from 1988 to 2007, severe fire seasons have become more common since 2000. This trend is consistent across all ownerships within the planning area. Given current forest conditions and the drought status in Montana (NRIS 2005a), the trend of increasing acres burned now appears to be the norm rather than the exception they once were. Forest management and fire suppression policies that differ by ownership will also impact the amount of acres burned in the HCP project and planning areas. Fire activity is more likely on ownerships with large amounts of acreage in the HCP planning area that have less-aggressive forest and fire management policies, such as the USFS and NPS. Fires on those ownerships could affect adjacent managed forest ownerships, such as trust lands, in the project and planning area.

Forest Insects and Diseases

The following subsections describe two disturbance processes affecting forest health. insects and forest disease. Even healthy, well-managed forests exhibit certain endemic levels of insects and disease. However, several factors as described below are likely to contribute to higher insect infestation and disease infection levels on forested trust lands in the foreseeable future.

Insects

Forest stands in Montana may be susceptible to damage from a variety of insect pests, including, but not limited to

- Spruce budworm (*Choristoneura occidentalis*)
- Mountain pine beetle (*Dendroctonus ponderosae*)
- Western pine beetle (*Dendroctonus brevicomis*)
- Douglas-fir beetle (*Dendroctonus pseudotsugae*)
- Spruce beetle (*Dendroctonus rufipennis*).

Insects affect specific species of trees as their names indicate; however, stands with high densities, multi-stories, or previous injuries tend to be more susceptible (USFS 1996; Johnson and Lyon 1991; Hagle et al. 2003; and Sinclair et al. 1987). Some insects cause deformities or reduce seed production, but most of them cause reduced growth or mortality. Insect infestations are typically prevented by maintaining species~~- and age-diverse stands~~ and age class diversity within stands and across landscapes; maintaining vigorous trees with minimal injuries; and for some insects, by thinning stands (Amman and Logan 1998). If detected in a timely manner, insect infestations can be treated with insecticides or prompt removal of infested trees.

DNRC assesses stand susceptibility to each insect and assigns a hazard rating of low, medium, or high (DNRC 2005b). Hazard ratings represent the relative susceptibility of stands to attack by the specified insect. A given acre may have a high hazard rating for some insects and a low rating for others. The hazard ratings are dependent on factors such as tree species mix, size, stocking level, and elevation. DNRC also conducts annual insect and pest damage flights, which are used to identify infested stands and possible salvage needs. DNRC rarely uses insecticides to treat stands, but does use the rating system to select and prioritize stands for treatment.

Table 4.2-13 shows the forest acres assigned to high, medium, or low hazard ratings for several common forest insects within the HCP project area. Approximately 42.6 percent of forested trust lands within the HCP project area is at high risk for spruce budworm infestation. A high number of acres are also at medium risk of attack by Douglas-fir beetle (64.9 percent), mountain pine beetle in stands with ponderosa pine (48.6 percent), and mountain pine beetle in stands with lodgepole pine (55.1 percent).

TABLE 4.2-13. FOREST ACRES AT RISK OF INSECT INFESTATION IN THE HCP PROJECT AREA

Insect Hazard Rating	Acres at Risk	Percent of Project Area at Risk
Spruce Beetle		
Medium	89,342	20.0
Low	106,867	24.0
Douglas-fir Beetle		
Medium	289,738	64.9
Low	134,418	30.1
Mountain Pine Beetle in Stands with Ponderosa Pine Present		
Medium	216,634	48.6
Low	38,986	8.7
Mountain Pine Beetle in Stands with Lodgepole Pine Present		
Medium	245,788	55.1
Low	73,118	16.4
Spruce Budworm		
High	189,949	42.6
Medium	161,983	36.3
Low	89,796	20.1

Source: DNRC (2008a).

The acres at risk and insect outbreaks are likely to increase in the foreseeable future on forested trust lands. Due to years of declining forest management on federal lands, fire suppression, and drier conditions associated with ongoing drought, many western forests are at an increased risk of large-scale insect outbreaks.

Diseases

In addition to forest insects, a number of forest diseases also occur in Montana. The primary diseases affecting forested trust lands in Montana include, but are not limited to

- Dwarf mistletoe (*Arceuthobium* spp.)
- Indian paint fungus (*Echinodontium tinctorium*)
- Armillaria root disease (often caused by *Armillaria mellea*)
- Red ring rot (*Phellinus pini*)
- White pine blister rust (*Cronartium ribicola*).

Other occasional disease problems include larch needle cast (*Meria larcicis*) and larch needle blight (*Hypodermella laricis*). Four of the five more common diseases, dwarf mistletoe, Indian paint fungus root disease, and red ring rot, generally affect conifer stands that are dense, older, and multistoried (USFS 1996; Hagle et al. 2003; Sinclair et al. 1987). The primary effects on forest vegetation include reduced tree growth and productivity or susceptibility to windthrow (USFS 1996;

Hagle et al. 2003; Sinclair et al. 1987). Prevention of diseases is achieved by minimizing wounding of trees during other forest management activities, maintaining diverse stands, and limiting overstocking to maintain vigorous tree growth. Common treatments include removing affected trees, thinning young stands to improve vigor and air flow, maintaining younger stands, and in the case of root disease, removing infected root systems and stumps (USFS 1996; Hagle et al. 2003; Sinclair et al. 1987). The other more common disease, white pine blister rust, is a non-native disease that affects five-needle pines, such as western white pine (*Pinus monticola*), whitebark pine (*Pinus albicaulis*), and limber pine (*Pinus flexilis*). Blister rust kills host trees by causing a canker to develop on the stem of the tree that eventually girdles the tree. Management options for this disease include planting rust-resistant stock, pruning the lower crown on young trees, and retaining trees that appear to exhibit natural resistance to blister rust when applying cutting treatments.

Broad-scale comprehensive information about the extent and severity of disease infections on forested trust lands is not available. Local knowledge and information about existing disease levels, however, is used to identify stands for treatment as part of DNRC's annual timber sale planning process.

Similar to trends in insect outbreaks, disease problems on forested trust lands are likely to remain constant or increase in the foreseeable future. Several factors have contributed to this increased level of disease across Montana, including over-mature forest conditions combined with ongoing drought and disease epidemics (DNRC 2004d).

4.2.1.4 Effects of and Trends in Climate Change

This section discusses the effects and trends expected from climate change on vegetation in the planning area. Information regarding plants in general is presented first, followed by additional information specific to timber.

Several types of effects on plants related to a warmer and drier climate have been observed or are expected to occur.

- Distributions of many plants are shifting northward and upward in elevation in response to higher temperatures, and montane species may be more sensitive since their ability to shift their range upward is limited (Karl et al. 2009; Parmesan 2006; Rehfeldt 2004).
- Individual species are responding differently to changing climate conditions, which could lead to changes in community and ecosystem structure and composition (Karl et al. 2009; Running and Mills 2009). Montane forest and grassland communities may expand their distribution at the expense of subalpine, alpine, and arid woodland communities (Rehfeldt et al. 2006).
- Earlier spring onset, by as much as one to two weeks earlier in recent decades (Cayan et al. 2001, Running and Mills 2009), is resulting in shifts in plant life cycles (phenology), such as earlier flowering and leaf-out (Cayan et al. 2001; Karl et al. 2009; Mohr 2008; Saunders et al. 2008; Running and Mills 2009). In the Rocky Mountains, populations of wildflowers are projected to decrease due to reproductive failure caused by buds that used to

be protected by snowpack now more likely to be exposed to frost following earlier snowmelt (Karl et al. 2009).

- Variation in phenological responses between interacting species may result in increasing asynchrony (e.g., loss of plant-pollinator relationships) (Karl et al. 2009; Logan et al. 2003; Saunders et al. 2008).
- There may be an increased risk of plant species extinction due to interactions between effects of climate change and other stressors, such as habitat loss and invasion by weeds (Karl et al. 2009).
- Insect pests, disease pathogens, and invasive weed species have increased, and these increases are likely to continue (Karl et al. 2009). Invasive plants are generally more tolerant of a wider range of growing conditions and tend to spread more quickly than native plants (Karl et al. 2009). Drought-tolerant plants would likely not be as affected by a warmer, drier climate in the planning area.
- Increasing CO_2 is expected to stimulate growth of most plant species (Karl et al. 2009); however, this will likely be tempered by higher temperatures, less available water, and other stressors, such as habitat fragmentation and invasive species.
- The frequency, duration, intensity, and size of wildfires have increased (CIRMOUNT Committee 2006; Karl et al. 2009; Pederson et al. 2009; Westerling et al. 2006). Increasing wildfires may lead to greater loss of habitat for some plants, while providing opportunities for other plants more adapted to growing in disturbed areas.

Forests in the planning area are also experiencing effects of a warming climate. As with other plant species, forest tree species are expected to shift their ranges northward and upward in elevation. Rehfeldt (2004) predicted a widespread reduction in the areal extent of Engelmann spruce as a result of global warming. Such shifts could result in changes in the character of forests and the types of forests that will be most prevalent in different areas (Karl et al. 2009). Climate changes in western United States forests may lead to changes in forest structure, composition, and function (van Mantgem et al. 2009).

Several factors, including an increased concentration of CO_2 in the atmosphere, a longer growing season, and increased deposition of nitrogen from the atmosphere have resulted in increased forest growth in the United States over the past several decades (Karl et al. 2009). In northern Rocky Mountain forests, higher net primary production was observed during the period 1982 through 1999, and this was attributed to higher spring temperatures and a longer growing season (Running and Mills 2009). However, forest productivity is expected to decrease in the western United States, where water is a limiting factor; where droughts increase, forest productivity is expected to decrease and tree death is expected to increase (Karl et al. 2009). Northern Rocky Mountain forests live in a water-limited state, so that the anticipated longer and more intense summer drought period projected for this region is expected to limit any potential positive effects of a longer growing season (Running 2009).

As long-lived plants, individual forest trees are not able to move in response to a changing climate and are consequently exposed to increased temperatures and decreased water availability, which may result in increased stress or mortality. Van Mantgem and others (2009) looked at effects of climate change on unmanaged forests in the western United States from the 1970s to 2006. Their analysis showed that non-catastrophic mortality rates have increased in recent decades and that these changes occurred across elevations, tree sizes, dominant species, and past fire histories. They also found that, while recruitment rates have not changes, forest density and basal area have declined slightly. They concluded that regional warming and resulting increases in water deficits are likely contributing to increased tree mortality rates.

Increasing temperature and/or water stress can leave trees vulnerable to the expanding ranges of pest species and disease. In the last several decades, the mountain pine beetle has moved into areas that were previously climatically unsuitable (Carroll et al. 2003), and it has shortened its life cycle from 2 years per generation to 1 year, allowing large increases in population abundances (Parmesan 2006). In western Montana, the expanded range of the mountain pine beetle to higher elevations and farther east is causing widespread tree mortality (Logan and Powell 2001).

In some areas, the expansion of mountain pine beetle into higher elevations has reached subalpine tree species, including whitebark pine. High-elevation five-needle pines, such as whitebark pine, are not particularly adapted to insect outbreak disturbances; that is, they have not evolved the natural defenses against beetles that lower-elevation pines have (Logan and Powell 2005; Saunders et al. 2008). Whitebark pine is already considered to be “functionally extinct” over a third of its range due to blister rust (Pederson et al. 2009), so additional effects from a changing climate and mountain pine beetle infestation may further reduce its range. Modeling by Warwell et al. (2007) predicted a rapid and large-scale decline in the area occupied by the species’ current climate profile in western North America, leading to a 70 percent decline and an average 333-meter (1,090-foot) shift upward in elevation by 2030 and the loss of more than 97 percent of its current distribution by the end of the century. The decline in whitebark pine is of particular concern in the Greater Yellowstone Ecosystem, where the whitebark pine provides food and cover for several animal species, including the grizzly bear (IGBST 2010; Logan and Powell 2001; Pederson et al. 2009; Saunders et al. 2008).

As discussed above, more frequent, intense, and larger wildfires and increased area burned are expected in the future. Since 1986, longer, warmer summers have corresponded to a fourfold increase of major wildfires and a sixfold increase in the area of forest burned, compared to the period from 1970 to 1986 (Westerling et al. 2006). Area burned in North America may increase by as much as 74 to 118 percent by the end of this century (Eastbaugh 2008). In the Rocky Mountains, annual area burned may increase 175 percent by 2050 (Spracklen et al. 2009). In addition to the warmer, drier, and longer fire seasons that are expected to contribute to this increase, more forest dieback from climatic stress and insect infestation could increase the amount of dry fuel available to burn (Joyce and Birdsey 2000; Karl et al. 2009). Within North America, the northern Rocky Mountain region is projected to experience one of the largest increases in fire severity (Logan and Powell 2001). Since the mid-1980s, the wildfire season in the western United States has increased by an average of 78 days, and the average burn duration of large fires has increased from 7.5 to 37.1 days (Westerling et al. 2006). Due to earlier snowmelt, high-elevation forests (between 1,680 and 2,690 meters [5,510 and 8,820 feet]) are becoming increasingly vulnerable to wildfire (Westerling et al. 2006).

4.2.2 Environmental Consequences

This section discusses the potential direct and indirect effects on forest vegetation of the three proposed action alternatives relative to those anticipated under the no-action alternative over the short and long terms. Cumulative effects of the proposed alternatives are addressed in Chapter 5 (Cumulative Effects). Because representations of the forest attributes are similar in the HCP project area and planning area, only the HCP project area information is presented in this discussion of environmental consequences.

4.2.2.1 Introduction and Evaluation Criteria

To describe how the amount, type, and/or distribution of forest vegetation and associated timber harvest) would be expected to change in the HCP project area under the proposed alternatives, several evaluation criteria were evaluated:

Timber harvest

- Changes in DNRC's annual sustainable yield.

Forest vegetation

- Changes in current cover types and DFCs, size class, age class, and crown cover
- Changes in the timeframe for achieving DFCs
- Changes in size, intensity, and frequency of wildfire in the HCP project area
- Changes in the acres infested by insects or diseases in the HCP project area.

For those attributes listed above as evaluation criteria, for which the forest model or the SLI database was capable of and suitable for providing quantitative data for the comparison of alternatives, these data are presented and used to compare the effects of the alternatives. However, for many of the attributes listed above, neither the forest model nor the SLI database is capable of providing quantitative data for the comparison of alternatives; i.e., the model and database cannot predict the acres of forest within each attribute category. Instead, a qualitative analysis of how the commitments are expected to affect forest attributes is provided. This is based on current conditions, application of the conservation commitments, application of DNRC's stand management objectives and treatments, and ongoing natural processes.

For many of the forest attributes discussed under Section 4.2.1 (Affected Environment), the changes in conservation commitments proposed in the action alternatives would not be expected to result in changes in forest vegetation that are discernable at the landscape scale. However, some changes may be discernable at the localized scale, for example within the Stillwater Core, and these are identified and described below.

This section also addresses issues raised during public scoping, including

- A request by EPA that the EIS address fuel loads, fire risk, forest type, stand densities, and species composition
- A request by the Montana Old Growth Project that the HCP contain provisions for old-growth protections and recruitment.

Regarding the first scoping issue, implementing the HCP is not expected to affect fuel loads or fire risk. The effect of the HCP alternatives on fire frequency and causes is described below under Wildfire. DNRC uses cover type rather than forest type, and this attribute is evaluated below. The HCP commitments are not expected to differentially affect stand densities or species composition in a measurable way at a programmatic scale; thus, these attributes are not further evaluated in this section.

Regarding the second scoping issue, the HCP contains conservation commitments, including habitat commitments, specific to grizzly bears and Canada lynx. The HCP does not specifically contain commitments for old-growth forests, nor does it propose changes in old-growth management as regulated in the ARMs. The effect of the HCP commitments on old growth is qualitatively discussed below under Age Class.

4.2.2.2 Sustainable Yield

The same contractor (Mason, Bruce & Girard [MB&G]) used the same forest management model to determine the 2004 SYC (no-action) ~~to re-calculate the no-action SYC~~ and to determine the annual sustainable yield for all action alternatives. In addition to the constraints specified to model the no-action alternative, constraints associated with the conservation strategies for each HCP alternative were also incorporated into the forest management model. This provided a mechanism to estimate and compare the impacts of each alternative on the annual sustainable yield (Table 4.2-14). DNRC is required to review and re-determine the annual sustainable yield at least once every 10 years; therefore, under all alternatives the annual sustainable yield would be subject to change. Should an action alternative be selected, HCP commitments would be incorporated into future re-calculations of the annual sustainable yield. Also, the current amount of acreage available for harvest could change in the future under the no-action alternative or action alternatives, which include a provision for lands to be added to or removed from the HCP project area through purchases, sales, or exchanges. Information regarding the transition of lands into or out of the HCP project area is provided in HCP Chapter 3 (Transition Lands Strategy) in Appendix A (HCP).

Under Alternative 1, the annual sustainable yield would remain at the current level of 53.2 million board feet per year (Table 4.2-14). The PNV for this alternative is $146.1 million. Under Alternative~~s~~ 2 (Proposed HCP), the annual sustainable yield from forested trust lands statewide would be 57.6 million board feet (Table 4.2-14), and under Alternative 4 (Increased Management Flexibility HCP), the annual sustainable yield ~~from trust lands statewide~~ would be 58.0 million board feet (Table 4.2-14). PNV would be $~~159.1~~156.8 million under Alternative 2 and $160.2 million under Alternative 4. The lower PNV associated with Alternative 2 can be attributed to the timing of implementation of several of the HCP commitments, which would create increased costs early in the planning horizon that affect the PNV. The economics associated with PNV for each alternative are further discussed in Section 4.13 (Socioeconomics).

The increase in sustainable yield under Alternatives 2 and 4 is primarily due to the increase in active management on 39,600 acres located in the Stillwater Core in the Stillwater State Forest that are currently minimally managed. The increase in active management of those acres allows greater flexibility for management activities across the Stillwater Block as a whole, thus increasing the annual sustainable yield.

TABLE 4.2-14. ANNUAL HARVEST (SUSTAINABLE YIELD) IN MILLION BOARD FEET BY LAND OFFICE AND NWLO ADMINISTRATIVE UNIT FOR EACH ALTERNATIVE

	Alternative 1		Alternative 2		Alternative 3		Alternative 4	
Land Office and Administrative Unit	**Annual Harvest**	**Percent of Total Harvest**	**Annual Harvest**	**Percent of Total Harvest**	**Annual Harvest**	**Percent of Total Harvest**	**Annual Harvest**	**Percent of Total Harvest**
NWLO	33.2	62.4	38.7	67.2	33.2	65.6	38.6	66.6
Stillwater Unit	10.1	19.0	14.5	25.2	10.3	20.4	14.9	25.6
Swan Unit	6.7	12.6	6.8	11.8	6.6	13.1	6.8	11.8
Other NWLO Units	16.4	30.8	17.4	30.2	16.2	32.1	17.0	29.3
SWLO	13.6	25.6	12.6	21.9	11.3	22.4	12.9	22.3
CLO	3.9	7.3	4.0	6.9	3.7	7.3	4.1	7.0
Eastern Land Offices	2.5	4.7	2.3	4.0	2.4	4.7	2.3	4.0
Total All Land Offices	**53.2**	**100.0**	**57.6**	**100.0**	**50.6**	**100.0**	**58.0**	**100.0**
Present Net Value (million)	**$146.1**		**$156.8**		**$124.5**		**$160.2**	

Source: DNRC (2008d, 2010).

Under Alternative 3 (Increased Conservation HCP) the sustainable yield from trust lands would be 50.6 million board feet. The PNV for this alternative is $124.5 million.

The lower harvest levels under Alternative 3 compared to Alternatives 2 and 4 are due to retaining the current management approach for the Stillwater Core, which greatly limits DNRC's ability to manage timber in that area, as well as a number of factors that stem from the conservation strategies outlined for this alternative, including wider riparian areas, additional restrictions on springtime activities occurring on scattered parcels in grizzly bear recovery zones, limits on road densities in scattered parcels in grizzly bear recovery zones, and increased requirements for the minimum amount of acres to be set aside as denning habitat in LMAs. While each of these conservation strategies does not remove acreage from management, they may effectively reduce the amount of area available for management activities by making some areas essentially inaccessible (e.g., through wider riparian areas or the inability to create access to an area using roads).

4.2.2.3 Cover Types and Desired Future Conditions

This section presents a qualitative discussion of the differences in cover types and ability to achieve DFC under the no-action and action alternatives.

Under all alternatives, DNRC would continue to manage stands toward a DFC. While this would be expected to result in changes in cover types in some stands at a localized scale, it would not yield discernable differences between the alternatives in cover types across the landscape within the next 50 years. Additional differences that may be seen at the localized scale include changes in cover type in the Stillwater Core under Alternatives 2 and 4, where management would lead to changes in cover type and quicker achievement of DFC compared to Alternatives 1 and 3. About two-thirds of the Stillwater Core is currently not in the designated DFC cover type.

For all alternatives in managed areas, seral cover types dominated by shade-intolerant species, such as ponderosa pine, western larch/Douglas-fir, and western white pine, would be expected to increase in the project area, while late-successional cover types dominated by shade tolerant species, such as mixed conifer and western redcedar, would be expected to decrease. For all alternatives in unmanaged stands, cover types that typically consist of shade-tolerant tree species are expected to increase, whereas cover types that typically consist of shade-intolerant species are expected to decrease.

Figures 4.2-10 and 4.2-11 demonstrate the progress toward DFCs established in the SFLMP that are predicted to be made under each alternative by tracking the presence of two key seral species in two important seral cover types: ponderosa pine and western larch. The amounts of these species in managed and unmanaged stands in ponderosa pine and western larch/Douglas-fir cover types can serve as an indicator of the movement toward or away from the DFC. In these figures, each line represents the percent of a species or species group as a proportion of all species in stands that share a DFC. Each period in these figures represents 5 years.

These figures illustrate the similarity among alternatives in progress toward DFCs, as shown by the shape of the lines for each species through time. These figures also illustrate the positive influence of management on achieving DFCs, as the proportion of ponderosa pine and western larch increase in managed stands, and the proportion of shade-tolerant species decreases. In unmanaged stands, the proportions of shade-tolerant species increase slightly through time, while the proportions of ponderosa pine and western larch remain relatively stable or decrease through time.

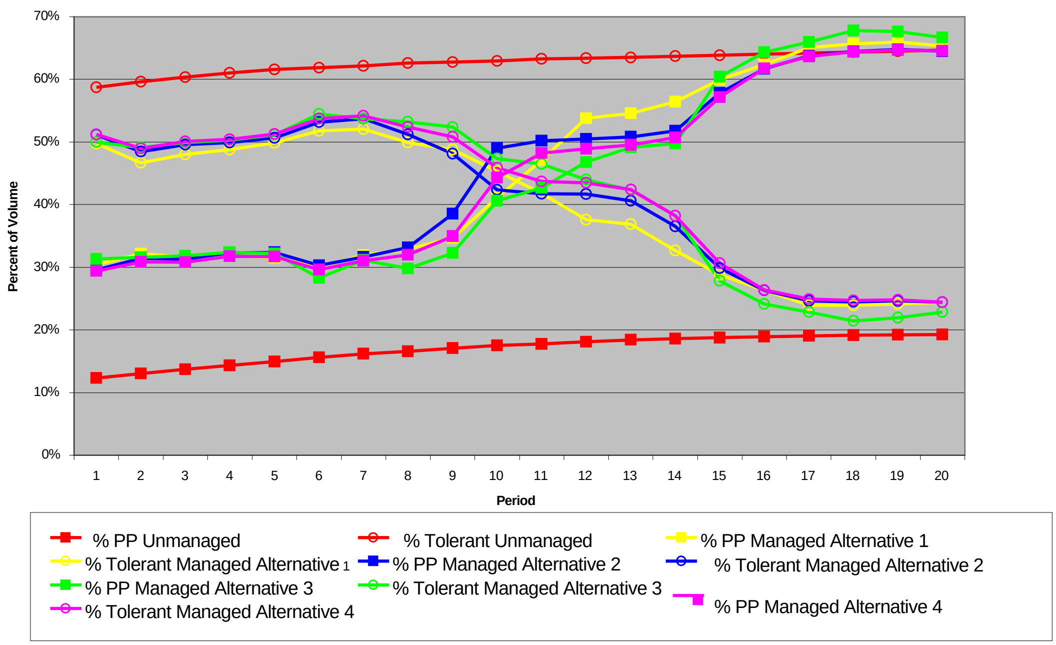

FIGURE 4.2-10. POTENTIAL CHANGES IN EXPECTED VOLUME OF PONDEROSA PINE (PP) AND SHADE-TOLERANT SPECIES IN MANAGED AND UNMANAGED STANDS WITH A DESIRED FUTURE CONDITION OF PONDEROSA PINE BY ALTERNATIVE

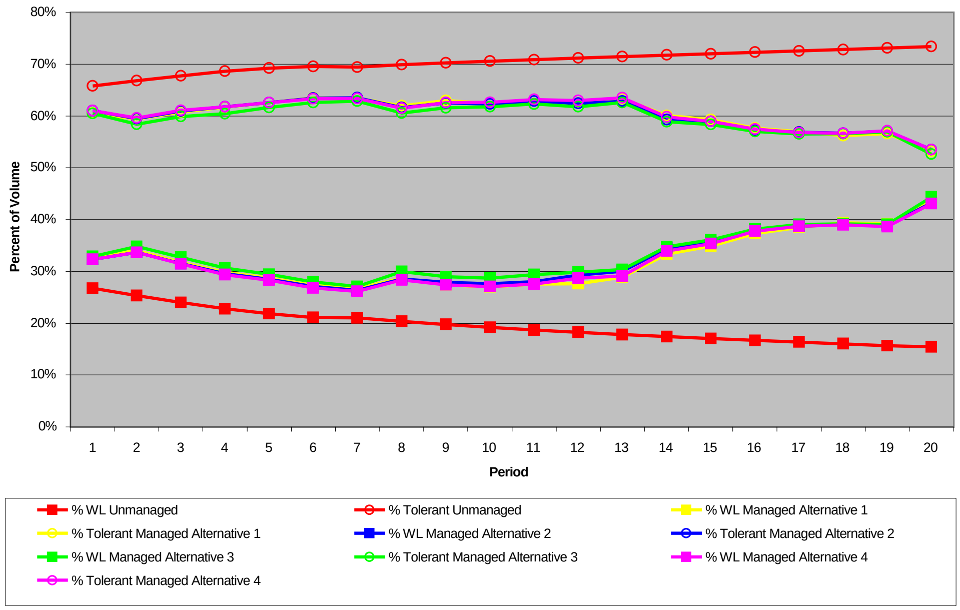

FIGURE 4.2-11. POTENTIAL CHANGES IN EXPECTED VOLUME OF WESTERN LARCH (WL) AND SHADE-TOLERANT SPECIES IN MANAGED AND UNMANAGED STANDS WITH A DESIRED FUTURE CONDITION OF WESTERN LARCH/DOUGLAS-FIR BY ALTERNATIVE

4.2.2.4 Size Class

In general, there are no discernable differences in the effects on size classes across the HCP project area among the four alternatives. As shown in Table 4.2-15, the proportion of acres in each size class is similar for each alternative. Non-stocked areas would occupy about 2 percent of the acres across the HCP project area, the seedling/sapling classes would occupy 21 to 25 percent, the poletimber class would occupy just over 3 percent, the young sawtimber class would be found on about 15 percent, and mature sawtimber, which includes old growth, would be found on 55 to 59 percent of the area.

TABLE 4.2-15. ACRES BY SIZE CLASS FOR HCP PROJECT AREA LANDS UNDER EXISTING CONDITIONS AND FOR ALL ALTERNATIVES AT YEAR 50, POST-PERMIT ISSUANCE

	Existing Condition		Alternative 1 (No Action)		Alternative 2		Alternative 3		Alternative 4	
Structural Stage	**Acres**	**Percent of Total**	**Acres**	**Percent of Total**	**Acres**	**Percent of Total**	**Acres**	**Percent of Total**	**Acres**	**Percent of Total**
Non-stocked forests	17,230	3.9	7,934	1.8	9,302	2.1	8,769	2.0	9,373	2.1
Seedling/sapling	38,360	8.6	98,941	22.2	110,121	24.7	92,664	20.8	110,033	24.7
Poletimber	37,362	8.4	14,853	3.3	14,543	3.3	14,588	3.3	14,463	3.2
Young sawtimber	92,730	20.8	66,831	15.0	68,339	15.3	66,930	15.0	68,107	15.3
Mature sawtimber	260,413	58.4	257,536	57.7	243,790	54.6	263,144	59.0	244,119	54.7
Total	**446,095**	**100.0**	**446,095**	**100.0**	**446,095**	**100.0**	**446,095**	**100.0**	**446,095**	**100.0**

Source: DNRC (2008d).

Alternatives 2 and 4 would yield slightly higher proportions of acres in the seedling/sapling size class and slightly lower proportions of acres in the mature sawtimber size class compared to Alternatives 1 and 3. The increase in seedling/sapling acres and decrease in mature sawtimber across the HCP project area can be attributed to the effects of the increased acreage available for active management in the Stillwater Unit under Alternatives 2 and 4. This results in shifting acreage from the mature sawtimber class to the seedling/sapling class over the 50-year Permit term due to the elevated harvest levels afforded by the increase in available acres to manage, and the fact that most of those acres available for harvest are in the mature sawtimber age class.

Alternative 3 would yield a slightly higher proportion (5 percent) of mature sawtimber than the other alternatives. This can be attributed in part to the wider riparian zones associated with this alternative, but the other conservation strategies for this alternative affect stand size class as well. Increasing the width of riparian zones, while not removing those acres from active management, would preclude management activities in those areas, essentially making them *de facto* set-aside areas where forests would grow and increase in size over the Permit term. Other conservation strategies for this alternative, such as spring restrictions and limited road densities on scattered parcels in grizzly bear recovery zones, and lynx denning habitat requirements, limit activities associated with timber management in certain areas and consequently reduce the annual sustainable yield. While these strategies do not reduce the amount of acres available for harvesting, they result in a delay in harvesting acres that could potentially be harvested under other alternatives, allowing forests on those acres to grow and increase in size.

4.2.2.5 Age Class

This section provides a qualitative analysis of how the age class of stands in the HCP project area may change under each alternative.

As with size class, the differences among alternatives with regard to effects on age class are not discernable. The effects of each alternative on age class would be expected to correlate with the effects of each alternative on size class at the landscape scale. DNRC's harvesting treatments attempt to maintain a distribution of all age classes that would occur under naturally occurring disturbance patterns. As previously mentioned, much of the project area is currently in older age classes. For this reason, harvesting is most likely to occur in the older age classes, particularly in 100- to 150-year-old stands, and to a lesser extent in stands greater than 150 years old. Some stands in the 40- to 99-year range, particularly those on more productive sites, would also see harvesting activity, while stands in the 0- to 39-year range would be unlikely to see commercial harvesting activity.

Because of harvesting, the proportion of stands in the 100- to 150-year age class would be expected to decrease across the project area, as would stands in the 150-year-or-older age class. In turn, an increase in the acreage of 0- to 39-year-old stands across the project area would be expected over the 50-year Permit term due to regeneration harvests in older stands. The proportion of acres in the 40- to 99-year age class would decrease somewhat, as stands currently in that age class would be recruited into the 100- to 150-year age class. Although recruitment from current young stands (0 to 39 years) into the 40- to 99-year age class would also be expected, there are not enough acres available for recruitment from the younger age class to offset the movement of stands currently in the 40- to 99-year age class into the 100- to 150-year age class, resulting in a net decrease in the proportion of acres in the 40- to 99-year age class.

Among the alternatives, Alternatives 2 and 4 would be expected to have a slightly greater decrease in the amount of 100- to 150-year and 150-year-or-older stands, and a greater increase in the amount of 0- to 39-year-old stands when compared to Alternatives 1 and 3. This is due to the greater flexibility for management activities in the Stillwater Unit under Alternatives 2 and 4.

Old Growth

The DNRC's policies and management approach for old-growth stands would not change under the HCP alternatives. DNRC would continue to have the same old-growth management options it currently has as outlined in ARM 36.11.418 – old-growth restoration, old-growth maintenance, and old-growth removal.

Provisions were made in the sustainable yield model for tracking old-growth amounts over the planning horizon to determine whether landscape-level biodiversity objectives in the SFLMP and ARMs were met. At the initiation of the model runs, approximately 11 percent of DNRC's forested ownership met DNRC's old-growth definition. After incorporating DNRC's old-growth management regimes and all relevant constraints into the model, approximately 8 percent of the landscape was intended to be in an old-growth condition at model year 100.

The amount of old growth harvested and the effects of proposed projects on old growth would continue to be analyzed on a project-by-project basis. Under all alternatives, the amount of old growth present on trust lands is expected to decrease because the proportion of lands in the 100- to 150-year and 150-year-or-older age classes is currently high and likely to receive the most harvesting.

The magnitude of the decrease is likely to vary among alternatives, particularly at the localized scale. Under Alternatives 2 and 4, the increased flexibility for management in the Stillwater Unit would result in greater decreases in the amount of old growth in the Stillwater Core compared to Alternatives 1 and 3 as some of those acres are brought into active management.

Under Alternative 3, the decrease in the amount of old growth is likely to be less than other alternatives, at least within riparian areas. The increased riparian area width outlined by the conservation strategies for this alternative would promote the development of old growth in those areas because they are essentially set aside from active management. The decreased annual sustainable yield associated with this alternative would also delay harvesting in some old-growth stands, allowing a greater proportion of old growth to remain on the landscape through the 50-year Permit term than other alternatives.

4.2.2.6 Crown Closure

No discernable difference would be expected among alternatives with regard to crown closure. The types of cutting prescriptions used would not differ under any of the alternatives; therefore, the level of crown cover would not be expected to differ among alternatives. Following harvesting activities, stands would be expected to naturally regenerate and eventually achieve a crown cover level indicative of a fully stocked stand. In cases where natural regeneration is not sufficient to reach desired stocking levels or in situations where on-site seed sources do not exist to provide natural regeneration, DNRC evaluates the need and may implement tree planting to reach the desired stocking level.

4.2.2.7 Wildfire

Under all alternatives, the frequency of wildfire is likely to increase somewhat on forested trust lands through the 50-year Permit term. This is not due to management activities or commitments in the HCP alternatives, but instead to outside factors, such as persistent drought, increasingly warmer and drier summers, and the influence of activities (or the lack of them) on adjacent ownerships.

Among the many factors influencing wildfire, forest management activities are one factor that can reduce the frequency, intensity, or size of a fire. Reduction in the frequency of fires can be achieved by implementing silvicultural treatments that mimic natural disturbance regimes, such as stand-replacement fire, mixed-severity fire, or non-lethal fire. The intensity and possibly the size of fires can be reduced by decreasing fuels in a stand and improving access to stands for quicker suppression in roaded landscapes. DNRC currently uses such practices in its management of forested trust lands, and such prescriptions would continue under all alternatives; therefore, silvicultural practices would not result in discernable differences in the amount of acres burned among alternatives.

The ability to manage additional acres in the Stillwater Unit under Alternatives 2 and 4 may reduce the likelihood of fire not only on those additional acres but also on surrounding managed lands, when compared to Alternatives 1 and 3.

Under all alternatives, road miles across the HCP project area would increase, providing greater access and ability to put out fire starts in a timely manner. While most of these roads would be restricted from public access, increased road miles across the project area could increase the rate of human-caused fires on DNRC lands.

Overall, given the many factors that influence frequency, size, or intensity of fires we are not able to predict how fires will be affected under the action alternatives over the course of the 50-year Permit term. Because all factors contributing to or reducing the potential for fires is similar for all alternatives, no discernible difference is predicted for fires between alternatives.

4.2.2.8 Forest Insects and Disease

This section provides a qualitative analysis of the effects of each alternative on forest insects and diseases.

Section 4.2.1.3 (Current Conditions) presents information about the primary forest insects and diseases found in Montana. Aerial detection flights that DNRC participates in indicate that the amount of acres infested by various insects is generally increasing and the amount of the annual change in acres infested is also increasing (Meyer 2006). This information is useful for determining expected changes in infestation levels and threats associated with the alternatives. Broad-scale information about the current status of diseases in Montana is not currently available, making it difficult to estimate the impacts of each HCP alternative on the future levels of diseases in Montana. However, knowledge of the characteristics of each disease coupled with information about current forest conditions and the drought status in Montana (NRIS 2005a), the level of forest management activities, and expected changes to forests within the project area over the 50-year Permit term can offer some insight into expected outcomes.

In general, the differences among alternatives on insect and disease conditions throughout the project area are not likely to be discernable at the landscape scale. Alternatives 2 and 4 would provide more opportunities to actively manage for insect and disease problems within the Stillwater Unit as needed, but there is likely to be little difference among alternatives in terms of the potential for and acres affected by insect and disease outbreaks in the HCP project area. Overall, the potential for insect and disease outbreaks would likely increase over the project area due to factors outside of DNRC's management activities. Continued trends of warmer and more drought-filled summers, which stress forests, could increase their susceptibility to insect and disease outbreaks. Existing conditions on state and public forests where stands are over-mature and over-crowded, combined with decreasing timber harvest levels on adjacent federal lands, and the resulting continued development of high-density stands composed of shade-tolerant species could also increase the likelihood of insect and disease outbreaks on HCP project area lands. DNRC's management aims to promote healthy and biologically diverse forests on trust lands, and while such management will continue to address forest health problems currently and in the future, that alone is unlikely to offset other factors contributing to the threat or likelihood of forest insects and diseases. Progress toward DFCs and the use of silvicultural systems that mimic natural disturbance regimes and/or directly address insect and disease problems will promote the resistance to and resiliency from insects and diseases. Management activities on trust lands would work to either reduce or keep the threat of an insect or disease epidemic at or near current levels, but outside influences such as ongoing hot, dry summers, as well as drought conditions, would counter these activities, thus increasing the threat of insects and disease on trust lands.

More recently, DNRC has joined a multi-party effort to address a variety of issues where land ownerships are intermingled. A pilot project has been initiated near Butte in the Anaconda Unit to address stream rehabilitation and fish passage issues as well as insect- and disease-infested trees that cover a variety of land ownerships. Such efforts would continue under all alternatives and for these localized areas could reduce or prevent the further spread of insect or disease outbreaks on trust lands and adjacent ownerships.

4.2.2.9 Summary

For Alternative 3, additional constraints associated with the conservation strategies reduce the sustainable yield under that alternative compared to Alternative 1. The greatest vegetation-related difference between alternatives would result from a different approach to conservation of grizzly bear habitat. Currently, in parts of the Stillwater Block, DNRC employs a security core strategy to conserve grizzly bear habitat. In Alternatives 2 and 4, DNRC would move to an approach that incorporates a fixed transportation plan with various annual and seasonal road restrictions, and the area now identified as the Stillwater Core would be more available for management. The extra acres available for management would increase the sustainable yield of timber in Alternatives 2 and 4. Additional constraints associated with the conservations strategies for Alternative 3 would reduce the sustainable yield under that alternative compared to Alternative 1.

The effects on forest stand attributes would be similar and in most cases differences are not discernable among alternatives regarding individual stand attributes. Under all alternatives, progress toward DFCs would continue, with seral forest types increasing and late-successional forest types decreasing compared to current levels.

Across the project area, the acreage in the seedling/sapling size class would increase compared to current conditions, and poletimber, young sawtimber, and mature sawtimber classes would decrease under each alternative. Changes in age class under each alternative would follow trends for size class: the amount of young stands would increase, and the amount of older stands would decrease.

There are no discernable differences at the landscape scale in the potential effects on wildfire or insects and diseases among alternatives. Within the Stillwater Unit, increased management may reduce the chances of wildfire or insect or disease spread in managed stands.

Over the Permit term, changing forest characteristics, as well as increasing risks of wildfires, insect pests, and diseases, due to climate change would be expected under all the alternatives. At a landscape scale, the small differences between forest stand attributes among the alternatives would remain. Under all alternatives, forest management activities that reduce the vulnerability of forested stands to wildfire and insect infestation would likely reduce the potential for timber loss due to the increasing risk of these disturbances as a result of climate change.

4.3 Air Quality

4.3.1 Affected Environment

This section describes the regulatory framework under which air quality is considered, provides a description of air quality conditions in the planning area, and identifies air quality concerns related to timber management activities.

The primary impact of forestland management on air quality in the state of Montana is the emission of particulate matter from wildfires and prescribed burning. Air quality impacts from intentional and naturally occurring fires are a function of a number of factors, including density of fuel (dead fall and vegetation that is available to be burned), moisture content, and atmospheric conditions. The particulate emissions of concern are those particles less than 10 micrometers in diameter, known as PM_{10}, and particles less than 2.5 micrometers in diameter, known as $PM_{2.5}$. These particles are small enough that they can be inhaled into the lungs and cause respiratory problems.

4.3.1.1 Regulatory Framework

Clean Air Act

Federal air quality standards are defined by the National Ambient Air Quality Standards (NAAQS), which were established by the CAA. The NAAQS identify criteria pollutants and establish target pollutant concentrations that are designed to protect human health and welfare. Criteria pollutants include particulate matter, sulfur dioxide (SO_2), nitrogen dioxide (NO_2), ozone, carbon monoxide (CO), and lead. These standards are further broken down into primary and secondary standards. Primary standards are intended to protect against health effects, particularly in sensitive groups such as children and the elderly. Secondary standards are intended to protect against welfare effects, including damage to farm crops, damage to buildings, and aesthetic impacts.

Montana has developed a state implementation plan to adhere to the requirements of the CAA. The state implementation plan is executed through the Montana Department of Environmental Quality (MDEQ). Under MCA 75-2-301, the state allows formation of local air pollution control programs to execute and enforce the state air pollution regulations. The state has developed its own set of air quality standards called the Montana Ambient Air Quality Standards (MAAQS). These standards are at least as stringent as national standards and are designed to be protective of human health.

Wildfires

Wildland fire protection and suppression benefit air quality as well as protect resources and human lives. Wildland fire protection in Montana is accomplished through cooperative efforts between state, federal, and local governments. DNRC is primarily responsible for wildland fire protection on state and private lands, while the five federal land managers in western Montana (United States Bureau of Indian Affairs [BIA], BLM, NPS, USFWS, and USFS) are primarily responsible for protection on federal lands. DNRC has a direct protection program that covers 5.2 million acres of western Montana. In eastern Montana, local government provides fire protection on private and state lands. The lands protected by the different agencies are intermingled throughout the state, and interagency agreements are used to coordinate efforts for fire prevention, detection, and suppression.

The top priorities of DNRC's direct protection program are fuel reduction, rapid initial attack of small fires, control of large fires that have escaped initial attack, and control of all fires on trust lands. DNRC's goal is the protection of lives, property, and resources, and its overall fire suppression strategy is to control 95 percent of wildfires at less than 10 acres. DNRC ensures wildfire protection through coordination with other programs including training, fire prevention, equipment development, communication, engineering, aviation, and technical support activities. Training develops a team of wildland fire suppression and fire management professionals within the state.

In 2007, MCA 76-13-115 established a state fire policy with eight general tenets:

1. Public and firefighter safety is paramount in all wildfire suppression activities.
2. Minimizing property and resources losses from wildfires, as well as costs, through aggressive and rapid initial efforts is a priority.
3. Interagency cooperation is intended and encouraged.
4. Fire prevention, hazard reduction, and loss mitigation are fundamental components.
5. All property in Montana has wildfire protection from a recognized fire protection entity.
6. All property owners (private, state, and federal) have a responsibility to manage resources, mitigate fire hazards, and otherwise prevent fires on their property.
7. Sound forest management activities to reduce fire risk improve forest health and the environment.
8. Development of fire protection guidelines for the wildland-urban interface is critical to improving public safety and for reducing risk and loss (the guidelines are being drafted at this time: http://dnrc.mt.gov/forestry/fire/Prevention/WUIguidelines.asp).

Open Burning Permit

Open burning has the potential to emit large quantities of particulate matter and other pollutants, and therefore is regulated to aid in maintaining compliance with air quality standards. For any agency or company, a major open burning permit is required for any burning that has the potential to emit more than 500 tons of CO or 50 tons of any other regulated pollutant. Thirteen government agencies and private companies currently hold major open burning permits in Montana. For five of the counties in the HCP project area: Yellowstone, Cascade, Lincoln, Flathead, and Missoula and all Native American reservations, permitting has been delegated to their local air pollution control programs. In all other counties, permits are issued through MDEQ. Wildland burning, including burning to eliminate waste from logging practices, is permitted year-round and must implement best available control technologies.

Prescribed Burning

DNRC has land management responsibilities related to prescribed fires, which also have the potential to emit large quantities of pollutants that could contribute to violations of air quality standards if not regulated and managed. Under MCA 77-5-103, DNRC is directed to execute "all matters pertaining to forestry within the jurisdiction of the state; ~~have charge of all fire wardens of the state and direct and aid them in their duties;~~ direct the protection, improvement, and condition of state forests; take such action as is authorized by law to prevent and extinguish ~~forest, brush, and grass fires~~wildland fires; enforce the laws pertaining to forest and ~~brushcover~~non-forest lands and prosecute for any violation of those laws."

To address air quality concerns related to prescribed burning, a memorandum of agreement was signed in 1978 by federal, state, and local agencies and private organizations involved in prescribed burning. The involved parties created the Montana-Idaho Smoke Management Group (later re-named the Montana/Idaho Airshed Management Group) to implement the memoranda of agreement and smoke management programs as contained in their *Montana/Idaho Airshed Group Operating Guide* (Montana/Idaho Airshed Group 2006).

The Montana/Idaho Airshed Group Smoke Management Program has two primary purposes:

1. Minimize or prevent the accumulation of smoke in Montana to such degree as is necessary to maintain compliance with state and federal ambient air quality standards when prescribed burning is necessary for the conduct of accepted forest practices, such as hazard reduction, regeneration, and wildlife habitat improvement. The development of alternative methods shall be encouraged when such methods are practical.

2. Develop a smoke management plan for reporting and coordinating burning operations on all forest and range lands in the state. Guidelines in the plan are based upon the principles of and technical information currently available on smoke dispersion and on state and federal air quality regulations.

MCA 76-13-1 identifies that a permit must be obtained for timber-harvest-related burning activities, and that vehicles operated in forestlands must be equipped with spark arrestors so as to prevent the accidental ignition of fires. When DNRC burns slash from a timber harvest, DNRC applies for and obtains a burning permit.

Historically, smoke from timber harvest activities has rarely been a concern on an individual project or harvest; therefore, detailed BMPs are not routinely mandated or implemented. When DNRC has a concern about the potential for smoke from a specific project, such concerns are typically addressed in the MEPA process with site-specific mitigation measures written specifically for that sale. Burning permits may also include conditions intended to minimize smoke-related impacts. In general, these mitigation measures and burning permit conditions are timing- and/or weather-condition-related restrictions intended to confine burning activities to appropriate seasons (i.e., spring and fall), and to periods when weather conditions are favorable for smoke dispersion. If weather conditions are unfavorable for smoke dispersion, burning must be postponed until weather conditions are more suitable.

4.3.1.2 Existing Air Quality Conditions

Due to a relatively low population, a majority of Montana enjoys good air quality. However, a few parts of the state do not currently meet state and federal air quality standards. These areas are known as non-attainment areas. There are currently a total of 18 non-attainment areas in the state, including 10 for particulate matter. Of the particulate non-attainment areas, nine are within the planning area (Table 4.3-1), and all are associated with urban, rather than rural, areas. Smoke from wildfires and prescribed burning is not the primary cause of any area being classified as non-attainment (Wolfe 2008, personal communication).

TABLE 4.3-1. AIR QUALITY NON-ATTAINMENT AREAS WITHIN THE PLANNING AREA

City	County	Non-attainment Designation and Pollutant	Reason for Non-attainment[1]
Butte	Silver Bow	PM_{10}	Summer-time road dust, wind-blown dust, etc.
Columbia Falls	Flathead	PM_{10}	Summer-time road dust, wind-blown dust, etc.
Kalispell	Flathead	PM_{10}	Summer-time road dust, wind-blown dust, etc.
Libby	Lincoln	PM_{10}, $PM_{2.5}$	PM_{10}: Summer-time road dust, wind-blown dust, etc. $PM_{2.5}$: Winter-time wood stoves
Missoula	Missoula	PM_{10}	Summer-time road dust, wind-blown dust, etc.
Polson	Lake	PM_{10}	Summer-time road dust, wind-blown dust, etc.
Ronan	Lake	PM_{10}	Summer-time road dust, wind-blown dust, etc.
Thompson Falls	Sanders	PM_{10}	Summer-time road dust, wind-blown dust, etc.
Whitefish	Flathead	PM_{10}	Summer-time road dust, wind-blown dust, etc.

[1] Source: Wolfe (2008, personal communication). Wildfires and prescribed burning are not the primary cause of any area being classified as non-attainment. Wood smoke is predominantly $PM_{2.5}$. The only area that is non-attainment for $PM_{2.5}$ is Libby, and the primary cause of exceeding the $PM_{2.5}$ air quality standard is smoke from wood stoves during the winter.

Source: MDEQ (2005a).

4.3.1.3 Air Quality Effects from Forest Management Activities

Fire occurs on forestlands due to wildfires and prescribed burning. Prescribed burning includes slash burning (burning of residual materials from harvesting) and intentional land burning (burning to remove hazardous fuel loads, manage invasive species, improve foraging habitat, and promote biodiversity). Figure 4.2-9 summarizes the amount of land burned annually in the HCP project area, planning area, and statewide, including both wildfires and prescribed burns. These data illustrate that the occurrence and extent of burning in any given year are highly variable. As summarized in Section 4.2 (Forest Vegetation), nearly half of all fires on lands for which DNRC has direct protection responsibilities statewide are human-caused, although lightning-caused fires still burn more acres than human-caused fires.

Smoke emitted from wildfires and prescribed burning is the primary source of air pollutants associated with forest management practices. Smoke contains large quantities of particulate matter, the primary air quality pollutant associated with fires. Much of that particulate matter is small and falls into the range of PM_{10} or $PM_{2.5}$. Particulates in these size ranges are of concern because they are easily ingested deep into the respiratory tract and can cause respiratory illness, particularly in sensitive groups, such as children, the elderly, and people with pre-existing respiratory illnesses. While the effects of fire on humans are often considered negative (health risks, unusable recreation lands, aesthetic impacts, potential impacts on the economy of areas that depend on recreational visitors for income), maintenance of the fire cycle can help maintain habitat needed for fire-dependent plants and wildlife.

The amount of particulate matter emitted per unit of burned area can vary substantially due to a number of factors. A fire that burns hotter will burn more completely, emitting less particulate matter. The density of the burned material can also impact the amount of smoke produced. Larger, denser fuel will tend to smolder longer, emitting more smoke. Fuel loading will also lead to greater emissions, due to a greater amount of material burned per unit area.

The season of burning can also impact the distribution of smoke and particulate matter. During the hot, dry summer months, when a majority of wildfires occur (see subsection Wildfire in Section 4.2.1.3, Forest Vegetation – Current Conditions), dispersion is good, preventing significant deterioration of air quality. In contrast, during the fall and spring, when a majority of prescribed burning takes place, stagnant air leads to poor dispersion and significant deterioration of air quality.

4.3.1.4 Effects of and Trends in Climate Change

Changes in the frequency of and area burned by wildfires affects the amount of smoke generated and particulate matter and other pollutants emitted into the atmosphere. As discussed in Section 4.2 (Forest Vegetation), the western United States has experienced a nearly four-fold increase in major wildfires and a six-fold increase in the area of forest burned compared to 1970 through 1986 (Westerling et al. 2006). Due to anticipated future changes in climate in the western United States, further increases in wildfire frequency, intensity, duration, and area burned are expected (CIRMOUNT Committee 2006; Karl et al. 2009; Pederson et al. 2009; Westerling et al. 2006). Increases in area burned may result in a doubling of carbonaceous aerosol emissions in wildfire smoke by 2050 (Spracklen et al. 2009). Additionally, the fire season is expected to become longer (Pederson et al. 2009; Westerling et al. 2006), extending the time when smoke and other pollutants could be emitted into the atmosphere from wildfires. Smoke and other pollutants generated by a larger number of more intense, longer-lasting, and extensive wildfires would increase the risk of reduced air quality over a longer period of the year.

As noted above, dispersion is good in the hot, dry summer months, which prevents significant deterioration of air quality from a majority of wildfires. However, a warmer climate is projected to increase the frequency and duration of heat waves and associated stagnant air masses (Karl et al. 2009), increasing the risk of deteriorated air quality from wildfires where these conditions occur. With the wildfire season extending both earlier into the spring and later into the fall, as well as the increased frequency and duration of stagnant air masses, the opportunity for prescribed burning may be reduced to avoid significant air quality effects.

4.3.2 Environmental Consequences

This section describes the effects on air quality resulting from changes to forest management activities under the four alternatives.

4.3.2.1 Introduction and Evaluation Criteria

As noted above, the primary effect of forestland management on air quality is the emission of particulate matter (i.e., smoke) from wildfires and prescribed burning. Particulate matter is of concern because it can be inhaled into people’s lungs and cause respiratory problems.

This section evaluates whether air quality conditions, specifically levels of particulate matter from smoke, would be appreciably different under any of the alternatives. Levels of particulate matter from smoke in the air can be affected by changes in the frequency and size of wildfires and changes in prescribed burning. Factors contributing to the frequency and size of wildfires include amounts of fuel available to burn (fuel loading), wildfire suppression policies, and access to wildfires, while factors affecting changes in prescribed burning include changes in policies and expected levels of burning.

To compare changes to air quality resulting from the different alternatives, the following evaluation criteria were used:

- Changes in the amount of older forest (fuel loading)
- Changes in the amount of unmanaged forest (fuel loading)
- Changes in wildfire suppression activities
- Changes in prescribed burning policies and levels of burning.

During public scoping, concern was expressed that changes to DNRC's forest management program could result in exceedances of air quality standards. DNRC's process for evaluating impacts to air quality and meeting air quality standards will not change under any of the alternatives. Consequently, no changes are expected in the potential risk of exceeding air quality standards from DNRC's forest management activities.

4.3.2.2 Comparison of Alternatives

Changes in the amount of older forest over the Permit term from the four alternatives are discussed in subsections Size Class and Age Class in Section 4.2.1.3 (Forest Vegetation – Current Conditions). In general, the amounts of forested trust lands in larger size classes and older age classes would be expected to decrease somewhat over the Permit term because DNRC's harvest activities would be most likely to occur on these lands. However, differences in the amount of decrease among alternatives at the landscape scale are not discernable.

DNRC's management philosophy and strategy is to move its forestlands toward a DFC resulting in a healthier~~, more fire-resistant~~ forest that is better adapted to surviving fires. Treatments would be applied to emulate natural disturbances and remove material that would normally burn. Subsections Current Forest Cover Types and Desired Future Conditions in Section 4.2.1.3 (Forest Vegetation – Current Conditions) provide additional information on changes to forest management practices that would result in a shift to the DFC. However, considering DNRC's forestlands on average, the shift to the DFC would occur very slowly over a long period. No definitive changes in wildfire frequency and intensity or prescribed burning are predictable based on DNRC's intention to shift forestlands to the DFC.

For all the alternatives, DNRC would continue to follow existing management strategies and policies related to wildfire response actions and prescribed burning that would directly and indirectly influence particulate matter generation and air quality. Therefore, implementation of the alternatives would result in no discernable differences in effects on air quality at the regional scale.

Localized changes from management practices in the Stillwater Core may occur, but these would not affect broader regional air quality.

Effects on air quality from much broader general environmental factors would most likely overwhelm or obscure the differences in management of the Stillwater Core under the alternatives. These factors include drought, demographic trends, and technology innovations (industrial, wood stoves, automobiles, etc.). See Section 4.2.2.7 (Forest Vegetation – Wildfire) for additional discussion of the differences between alternatives with respect to wildfire on forestlands.

The amount of smoke from prescribed burning is expected to generally correlate with harvest volumes, which would be determined from forest sustainable yield calculations found in Section 4.2.2.2 (Forest Vegetation – Sustainable Yield) and Table 4.2-14. While localized changes in harvest volumes and locations may occur, no overall, definitive long-term trend is predictable for the amount of timber that would be harvested in future years.

Under Alternatives 2 and 4, the Stillwater Core could potentially be opened to wildfire suppression activities, as well as timber harvest activities and prescribed burning. The net effect on air quality is uncertain because wildfire suppression activities would improve air quality, while prescribed burning would degrade air quality. Overall, the Stillwater Core represents a very small percentage of forested trust lands, and a change in management policy for that area would have little net impact (either positive or negative) when considered in aggregate with all forested trust lands in the HCP project area.

4.3.2.3 Summary

At the landscape scale, ~~there would be no appreciable differences in terms of effects on air quality due to changes in forest management activities among~~effects of DNRC's forest management activities on air quality would not appreciably differ between the ~~four~~no-action and three action alternatives. Any increase in the frequency and size of wildfire on forested trust lands would likely be due to outside factors, such as persistent drought and~~,~~ increasingly warmer and drier summers due to a changing climate, ~~and~~as well as the influence of activities (or the lack of them) on adjacent ownerships.

Localized changes may be observed within the Stillwater Block, however. Under Alternatives 2 and 4, forest management activities within the Stillwater Core could result in additional prescribed burning where it does not currently occur.

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4.4 Transportation

Trust lands support a network of roads that provide access to forested trust lands for the purposes of conducting forest management activities; providing public access to various recreational resources; and providing access to adjacent land ownerships (i.e., USFS or private landowner access to a cabin site). In contrast to these and other benefits, roads and associated maintenance activities can affect many aspects of the natural environment, including stream connectivity, water quality (e.g., increased sedimentation from road surface erosion or mass wasting), habitat quality (e.g., increased fragmentation, avoidance of habitats), and wildlife use (e.g., increased human contact or hunting pressure).

This section describes the affected environment and environmental consequences of the no-action and action alternatives on DNRC's management of its transportation (road) resources. Specific road-related effects on other resources are discussed in Sections 4.5 (Geology and Soils), 4.6 (Water Resources), 4.8 (Fish and Fish Habitat), 4.9 (Wildlife and Wildlife Habitat), and 4.10 (Recreation). The following discussion of affected environment describes the policies, rules, and regulations that guide DNRC's management of roads on its lands, as well as the current status of DNRC-managed roads within the planning and HCP project areas. The subsequent analysis of environmental consequences addresses issues raised during public scoping and describes likely changes to DNRC's road network and its management under the no-action and action alternatives.

4.4.1 Affected Environment

To establish the affected environment for roads, this section describes current policies, rules, and regulations affecting road management on forested trust lands, as well as the current status of the road network in terms of the amount, distribution, and condition of roads in the network, both in the planning area and the HCP project area.

As described in Chapter 2 (Environmental and Procedural Setting), DNRC's road-related activities supporting forest management activities on trust lands include construction, reconstruction, abandonment, reclamation, maintenance, and use. These activities are typically conducted and funded through timber sale contracts, although some road maintenance activities are also partially funded through DNRC's forest improvement program.

4.4.1.1 Regulatory Framework

Road management standards were established in the SFLMP and subsequently adopted as part of the Forest Management ARMs. Key elements of the road management standards (ARM 36.11.421) are listed below.

- Minimize number of road miles.
- When planning the location, design, construction, and maintenance of all roads
    - Comply with BMPs as necessary to avoid unacceptable adverse impacts or, as funding is available, to improve existing roads.
    - Build roads to the minimum standard necessary to best meet current and future management needs and objectives.

- Manage roads to minimize maintenance.
- Relocate existing roads if reconstruction, maintenance, and/or use of those roads would produce greater undesirable impacts than new construction.
- Use existing roads in SMZs only if potential water quality impacts can be adequately mitigated, while primarily considering economic and watershed implications of relocating roads outside SMZs.

- Assess road maintenance needs by inspecting conditions on both open and closed roads every 5 years, and prioritize maintenance operations based on the results of those inspections.

  (Currently, DNRC does not inventory all roads every 5 years. While roads in the Stillwater Block and Swan River State Forest are assessed every 5 years, roads on scattered parcels are assessed during timber sale planning and watershed inventories. DNRC is currently in the process of examining its program to determine how this requirement could be met and, if it cannot, may seek to revise the rules.)

- Consider closure or abandonment of roads accessible to motorized vehicles that are non-essential to near-term future management plans or where unrestricted access would cause excessive resource damage.
- In the Swan River State Forest, plan road closures in accordance with the terms of the Swan Agreement.
- Inspect road closure structures as part of ongoing administrative duties and in response to notice of ineffective road closures received from the public. Inspections are to occur at least every 5 years. Repair or modify effective closures or consider alternative methods of closure. Repairs are to be a high priority when allocating time and budget.

Roads on trust lands may be maintained by DNRC, its cooperators, or third parties as provided by departmental rules, policies, and contracts. DNRC may (1) enter into cost-share agreements with the USFS, (2) exchange easements with the BLM, and/or (3) conduct reciprocal access agreements and easement exchanges with cooperating persons or corporations. Each of these processes addresses construction, use, and maintenance to be performed by DNRC or its cooperators. Further, DNRC may grant easements on trust land as provided by its access road policy, or it may purchase an easement to provide access to trust lands in accordance with the State Purchase Program.

DNRC's policy for reviewing and granting easements is contained in the document *Access Road Easement Policy* (DNRC 2006b). This easement policy requires the applicant to demonstrate that all other options for access have been exhausted. Approval is granted by DNRC only after review and MEPA evaluation are complete, as described in the Policy.

The process of purchasing of road easements on non-trust lands by DNRC is directed by Montana law (MCA 77-2-361 through 77-2-367) and rules (ARMs 36.25.812 through 36.25.817). This process requires DNRC to prepare a financial analysis and determine the financial risks and benefits associated with the acquisition to ensure that it is in the best interest of the affected trusts. Additional information DNRC provides to support the Land Board's decision for an easement includes an inventory of current environmental conditions and identification of any changes in access to other trust lands. An appraisal and due-diligence review are also required. Approval of easement purchases is granted by the Land Board.

To implement the road management standards outlined in the ARMs, DNRC maintains a database of its road network. The database layer is maintained by the FMB Technical Services Section. Information necessary to perform updates to the database is provided by the individual unit offices. Non-DNRC roads (e.g., federal, county, local, and private) that are outside forested trust lands and not needed for trust-related activities (forestry, cabin leases, etc.) are not maintained or updated within the GIS data layer. These roads are not included in the summaries below. Non-DNRC roads located on forested trust lands (e.g., private roads, highways, county roads) are included and maintained in DNRC's GIS roads data layer. The information presented in this section is summarized from the DNRC roads database.

Two of the attributes maintained by DNRC in its GIS roads data layer are access classification and seasonal restrictions. Seasonal restrictions are typically specified by start and end dates depending on the location of the road in the planning area. DNRC currently uses five levels of access classification as defined in the Forest Management ARMs:

- **Open Roads.** Highways, county roads, unrestricted DNRC roads, roads with unknown access restrictions, and roads restricted by non-DNRC owners (either seasonally or year-round).
- **Motorized Use Restricted Seasonally.** Roads that are seasonally restricted to motorized public access but have varying access restrictions for commercial and agency use (open or seasonally restricted).
- **Motorized Use Restricted Year-Round.** Roads that are restricted year-round to motorized public access but have varying access restrictions for commercial and agency use (open or seasonally restricted).
- **Abandoned.** Roads that are no longer used but that have not been restored. Culverts may be present and the road prism is evident; however, these roads are typically in some state of reforestation.
- **Reclaimed.** Includes roads that have been restored to natural conditions so that all structures (i.e., culverts) have been removed and the road prism is no longer evident. These roads are typically in some state of reforestation.

4.4.1.2 Amount of Roads

Miles of road present within an area can provide an indication of the degree of potential environmental impacts. All roads impact the natural environment to some degree; however, open roads receive more traffic than restricted roads and consequently can impact the environment to a greater degree. Tables 4.4-1 through 4.4-3 summarize miles of existing roads on trust lands by land office (as maintained in DNRC's GIS roads data layer). Table 4.4-1 shows total road miles by land office within the planning and HCP project areas. Tables 4.4-2 and 4.4-3 present total road miles by access classification for the planning area and HCP project area, respectively.

TABLE 4.4-1. MILES OF ROAD ON TRUST LANDS BY LAND OFFICE

Land Office	Miles of Road on Trust Lands in the Planning Area[1]	Miles of Road on Trust Lands in the HCP Project Area[1]	Percent of Total Road Miles on Trust Lands in the HCP Project Area[2]
NWLO	1,669.4	1,412.3	84.6
Stillwater Block	362.7	361.3	99.6
Swan River State Forest	226.7	224.2	98.8
Scattered	1080.0	826.7	76.5
SWLO	1,238.9	942.5	76.1
CLO	2,517.8	290.4	11.5
Total	**5,426.1**	**2,645.1**	**48.7**
Blocked	**589.4**	**585.5**	**99.3**
Scattered	**4,836.7**	**2,059.6**	**42.6**

[1] Roads classified as proposed were not included in mileage calculations.
[2] Percentage calculated as miles of road on trust lands in the HCP project area divided by miles of road on trust lands in the planning area.
Source: DNRC (2008a).

TABLE 4.4-2. MILES OF ROAD ON TRUST LANDS WITHIN THE PLANNING AREA BY CLASS AND LAND OFFICE

Land Office	Highway/ County	Open	Restricted Seasonally	Restricted Year-round	Abandoned	Reclaimed	Total
NWLO	44.5	796.5	16.8	736.0	45.5	30.2	1,669.4
Stillwater Block	2.4	123.9	6.4	229.6	0.0	0.3	362.7
Swan River State Forest	7.3	40.1	5.3	164.4	9.3	0.4	226.7
Scattered	92.0	580.4	5.1	342.0	36.2	29.5	1080.0
SWLO	253.1	551.7	18.4	374.9	40.9	18.3	1,238.9
CLO	99.4	2,291.8	13.8	87.7	28.9	9.9	2,517.8
Total	**454.2**	**3,550.6**	**49.0**	**1,198.6**	**115.3**	**58.4**	**5,426.1**
Blocked	**9.7**	**164.0**	**11.7**	**394.0**	**9.3**	**0.7**	**589.4**
Scattered	**444.5**	**3,386.6**	**37.3**	**804.6**	**106.0**	**57.7**	**4,836.7**

Note: Roads classified as proposed were not included in mileage calculations.
Source: DNRC (2008a).

TABLE 4.4-3. MILES OF ROAD ON TRUST LANDS WITHIN THE HCP PROJECT AREA BY CLASS AND LAND OFFICE

Land Office	Highway/ County	Open	Restricted Seasonally	Restricted Year-round	Abandoned	Reclaimed	Total
NWLO	25.5	641.8	16.8	674.2	37.3	16.7	1,412.3
Stillwater Block	1.9	123.4	6.4	229.3	0.0	0.3	361.3
Swan River State Forest	6.9	38.1	5.3	164.2	9.3	0.4	224.2
Scattered	73.9	423.1	5.1	280.8	28.0	15.9	826.7
SWLO	225.0	323.3	14.9	332.9	29.6	16.7	942.4
CLO	10.8	210.3	12.8	22.3	28.4	5.8	290.5
Total	**318.4**	**1,118.2**	**44.5**	**1,029.5**	**95.2**	**39.2**	**2,645.1**
Blocked	**8.8**	**161.5**	**11.7**	**393.5**	**9.3**	**0.7**	**585.5**
Scattered	**309.6**	**956.7**	**32.8**	**636.0**	**85.9**	**38.5**	**2,059.6**

Note: Roads classified as proposed were not included in mileage calculations.
Source: DNRC (2008a).

Planning Area and HCP Project Area

There are approximately 5,426 miles of road on trust lands within the planning area, and 2,645 (49 percent) of these road miles are located on trust lands included in the HCP project area (Table 4.4-1). More than half of the road miles included in the HCP project area are located within the NWLO (1,412 miles). Roads within the NWLO and SWLO comprise nearly 90 percent of all the road miles within the HCP project area. Within the NWLO, about 85 percent of the road miles on trust lands are included in the project area (1,412 of 1,669 miles), while approximately 76 percent are included for the SWLO (942 of 1,239 miles) and about 12 percent are included for the CLO (291 of 2,518 miles).

On all trust lands within the planning area (Table 4.4-2), 4,005 miles of the 5,426 miles of road are classified as open to public access (including highways and county roads), and 1,199 miles are restricted year-round to public access. The remaining road miles are split between seasonally restricted (49 miles), abandoned (115 miles), and reclaimed (58 miles). Within the HCP project area (Table 4.4-3), there are 1,437 miles of open roads (including highways and county roads), 1,030 miles of year-round restricted roads, 45 miles of seasonally restricted roads, 95 miles of abandoned roads, and 39 miles of reclaimed roads.

Stillwater Block

Approximately 363 miles of road are located within the Stillwater Block, and 361 of these are included in the HCP project area (Table 4.4-1). Of those roads included in the HCP project area, 125 miles are open to public access (including highways and county roads), 229 miles are restricted year-round to public access, 6 miles are restricted seasonally, and less than 0.5 mile has been reclaimed (Table 4.4-3). DNRC currently restricts public access, either year-round or seasonally, on nearly 65 percent of the roads within the Stillwater Block.

The Stillwater Core has been managed in the past, so roads, excavated skid trails, and regenerating clearcuts are present. Figure D-4A in Appendix D, EIS Figures, shows the existing locations of roads in the Stillwater Block. Two road systems access this area, which is currently managed as grizzly bear security core – Stryker Basin, which leads to Stryker Lake, and Herrig Basin, which leads to Herrig Lake. While DNRC is using these road systems minimally due to grizzly bear security core restrictions, these road miles are included in the presentation of total road miles in the Stillwater Block contained in Tables 4.4-1 through 4.4-3. Current ARMs dictate that forest management activities conducted during the non-denning season are conducted around the perimeter of the area using methods that do not require roaded access.

Swan River State Forest

The blocked lands within the Swan River State Forest are included in the area covered by the Swan Agreement. Under this agreement, the USFS (Flathead National Forest), Plum Creek, and DNRC coordinate management of their lands as a large contiguous block. The USFWS is also a party to this agreement since the grizzly bear is a federally listed species. This agreement contains habitat management guidelines that affect how DNRC manages roads within the Swan River State Forest (USFWS 1995). The guidelines applicable to road management include the following:

- Reduce open road density with BMU subunits, then maintain lower densities over the long term.
- Limit construction of new roads, and minimize density/mileage of new roads in preferred habitat areas and riparian zones.
- Reclaim existing roads not required for short-term management.
- Relocate roads needed for ongoing primary access when reasonable.

All but about 3 of the 227 miles of road located on blocked Swan River State Forest lands are included in the HCP project area (Table 4.4-1) (Figure D-5A in Appendix D, EIS Figures). Of all the Swan River State Forest roads in the HCP project area, 45 miles are open to public access (including highway and county roads), 164 miles are restricted year-round to public access, 5 miles are restricted seasonally, 9 miles are abandoned, and less than 0.5 mile has been reclaimed (Table 4.4-3). More than 75 percent of the road miles on blocked HCP project area lands within the Swan River State Forest are closed to public access either seasonally or year-round.

Scattered Parcels

Outside the Stillwater Block and Swan River State Forest, which are both located in the NWLO, trust lands within the rest of the HCP project area are scattered throughout the planning area and generally not contiguous. Of the 5,426 miles of road on trust lands within the planning area, 4,837 (89 percent) are on scattered parcels. While nearly all roads located within blocked trust lands are included in the HCP project area, less than half (43 percent) of all roads located on scattered parcels are included (Table 4.4-1). Within the HCP project area, 2,060 of the 2,645 miles (78 percent) are located on scattered parcels (Table 4.4-1). Of these 2,060 miles, more than half (1,266 miles) are open to public access year-round (including highways and county roads), more than 30 percent (669 miles) are restricted seasonally or year-round, and about 6 percent (124 miles) have been either abandoned or reclaimed (Table 4.4-3).

Roads located on scattered parcels within the NWLO total 1,080 miles, and 827 miles (77 percent) of these roads are included in the HCP project area (Table 4.4-1). Within both the planning area and HCP project area, more than half the road miles on scattered parcels in the NWLO (580 and 423, respectively) are open to public access year-round (Tables 4.4-2 and 4.4-3). For the remaining roads on NWLO scattered parcels in the HCP project area, about 35 percent (286 miles) are restricted either seasonally or year-round (Table 4.4-3).

Within the SWLO, roads located on trust lands total 1,239 miles (Tables 4.4-1 and 4.4-2), while those located on HCP project area lands total about 942 miles (Table 4.4-3). Of those roads on HCP project area lands in the SWLO, more than half (548 miles) are open to public access year-round (including highways and county roads), and about 37 percent (348 miles) are restricted either seasonally or year-round.

There are approximately 2,518 miles of road on trust lands within the CLO (Tables 4.4-1 and 4.4-2), and about 290 miles (12 percent) of these roads are included in the HCP project area (Table 4.4-3). These 290 miles of road constitute about 14 percent of all road miles on scattered parcels included in the HCP project area. About 72 percent of the HCP project area roads in the CLO (210 miles) are maintained as open to public access year-round (Table 4.4-3).

4.4.1.3 Distribution of Roads

While miles of road, as discussed above, provides a measure of total potential impacts, road density (mi/mi^2) measures road impacts relative to the amount of land covered by those roads. A higher road density within an area generally indicates a higher potential for effects on that area. The density of open roads measures the level of roads in an area receiving the heaviest use relative to the total amount of land area accessed by those roads.

Tables 4.4-4 and 4.4-5 summarize existing total and open road density on trust lands by land office for the planning area and HCP project area, respectively. These densities were calculated using DNRC's GIS roads data layer. Additionally, linear road densities were calculated for all trust lands within each category summarized in the tables, rather than for individual parcels.

Planning Area and HCP Project Area

The total road density for trust lands in the HCP project area is substantially higher than for trust lands within the planning area (3.1 mi/mi^2 versus 1.9 mi/mi^2). Because nearly all roads in the blocked lands are included in the HCP project area, this difference is primarily due to the inclusion of scattered parcels that tend to be more heavily roaded as a result of forest management activities (Tables 4.4-4 and 4.4-5).

Stillwater Block

For planning area and HCP project area lands within the Stillwater Block, the total road densities are similar (2.6 mi/mi^2 and 2.5 mi/mi^2, respectively), and open road densities are the same (0.9 mi/mi^2) (Tables 4.4-4 and 4.4-5). Lower open road densities for the Coal Creek and Stillwater State Forests reflect DNRC's road management strategy for blocked lands. Coal Creek and Stillwater State Forest roads are managed at a landscape level to meet threatened and endangered species, big game, sensitive species, and biodiversity resource management standards when

TABLE 4.4-4. MILES AND LINEAR DENSITY OF ROAD ON TRUST LANDS WITHIN THE PLANNING AREA BY LAND OFFICE

Land Office	Trust Land Area (Acres)	Trust Land Area (Square Miles[5])	Miles of Road[6]	Linear Road Density[7]
NWLO	**316,255**	**494.1**	**1,669.4**	**3.4**
Stillwater Block[1]	**90,802**	**141.9**	**362.7**	**2.6**
Highway/County/Private[2]			2.4	0.0
Open[3]			123.9	0.9
Restricted Seasonally[3]			6.4	0.0
Restricted Year-Round			229.6	1.6
Abandoned/Reclaimed			0.3	0.0
Swan River State Forest	**39,833**	**62.2**	**226.7**	**3.6**
Highway/County/Private[2]			7.3	0.1
Open/Restricted Seasonally[4]			45.4	0.7
Restricted Year-Round			164.4	2.6
Abandoned/Reclaimed			9.7	0.2
Scattered Parcels	**185,620**	**290.0**	**1,080.0**	**3.7**
Highway/County/Private[2]			92.0	0.3
Open/Restricted Seasonally[4]			580.4	2.0
Restricted Year-Round			342.0	1.2
Abandoned/Reclaimed			65.7	0.2
SWLO (Scattered Parcels)	**234,744**	**366.8**	**1,238.9**	**3.4**
Highway/County/Private[2]			253.1	0.7
Open/Restricted Seasonally[4]			551.7	1.5
Restricted Year-Round			374.9	1.0
Abandoned/Reclaimed			59.2	0.2
CLO (Scattered Parcels)	**1,262,530**	**1,972.7**	**2,517.8**	**1.3**
Highway/County/Private[2]			99.4	0.1
Open/Restricted Seasonally[4]			2,291.8	1.2
Restricted Year-Round			87.7	0.0
Abandoned/Reclaimed			38.8	0.0
Project Area Total	**1,813,529**	**2,833.6**	**5,426.1**	**1.9**

[1] Includes the Coal Creek State Forest and the blocked portion of the Stillwater State Forest.
[2] The Highway/County/Private category contains those roads over which DNRC has no ownership.
[3] For the Stillwater Block, the Open and Restricted Seasonally road categories are displayed separately.
[4] For the Swan River State Forest and scattered parcels, the Open/Restricted Seasonally category primarily represents open roads, because there are very few seasonally restricted roads in these road systems under current conditions.
[5] Square miles of trust lands calculated as acres of trust lands divided by 640.
[6] Proposed roads were not included in mileage calculations.
[7] Density calculated as miles of total roads on trust lands divided by square miles of trust lands.
Source: DNRC (2008a).

TABLE 4.4-5. MILES AND LINEAR DENSITY OF ROAD ON TRUST LANDS WITHIN THE PROJECT AREA BY LAND OFFICE

Land Office	Trust Land Area (Acres)	Trust Land Area (Square Miles[5])	Miles of Road[6]	Linear Road Density[7]
NWLO	**273,400**	**427.2**	**1,412.3**	**3.3**
Stillwater Block[1]	**90,720**	**141.8**	**361.3**	**2.5**
Highway/County/Private[2]			1.9	0.0
Open[3]			123.4	0.9
Restricted Seasonally[3]			6.4	0.0
Restricted Year-Round			229.3	1.6
Abandoned/Reclaimed			0.3	0.0
Swan River State Forest	**39,699**	**62.0**	**224.2**	**3.6**
Highway/County/Private[2]			6.9	0.1
Open/Restricted Seasonally[4]			43.4	0.7
Restricted Year-Round			164.2	2.6
Abandoned/Reclaimed			9.7	0.2
Scattered Parcels	**142,981**	**223.4**	**826.7**	**3.7**
Highway/County/Private[2]			73.9	0.3
Open/Restricted Seasonally[4]			428.2	1.9
Restricted Year-Round			280.8	1.3
Abandoned/Reclaimed			43.9	0.2
SWLO (Scattered Parcels)	**161,927**	**253.0**	**942.4**	**3.7**
Highway/County/Private[2]			225.0	0.9
Open/Restricted Seasonally[4]			338.2	1.3
Restricted Year-Round			332.9	1.3
Abandoned/Reclaimed			46.3	0.2
CLO (Scattered Parcels)	**113,182**	**176.8**	**290.5**	**1.6**
Highway/County/Private[2]			10.8	0.1
Open/Restricted Seasonally[4]			223.1	1.3
Restricted Year-Round			22.3	0.1
Abandoned/Reclaimed			34.2	0.2
Project Area Total	**548,509**	**857.0**	**2,645.1**	**3.1**

[1] Includes the Coal Creek State Forest and the blocked portion of the Stillwater State Forest.
[2] The Highway/County/Private category contains those roads over which DNRC has no ownership.
[3] For the Stillwater Block, the Open and Restricted Seasonally road categories are displayed separately.
[4] For the Swan River State Forest and scattered parcels, the Open/Restricted Seasonally category primarily represents open roads, because there are very few seasonally restricted roads in these road systems under current conditions.
[5] Square miles of trust lands calculated as acres of trust lands divided by 640.
[6] Proposed roads were not included in mileage calculations.
[7] Density calculated as miles of total roads on trust lands divided by square miles of trust lands.
Source: DNRC (2008a).

conducting forest management activities. This includes managing roads within this block to minimize the amount of land with open road densities greater than 1.0 mi/mi^2 (ARM 36.11.432). As shown in Tables 4.4-4 and 4.4-5, the open road density within this entire block is currently less than the 1.0 mi/mi^2 threshold for both the planning area and HCP project area.

Swan River State Forest

Under the Swan Agreement, DNRC, the USFS, and Plum Creek cooperatively manage roads on their lands in the Swan River Valley at a landscape level to meet Swan Agreement requirements. In the Swan River State Forest, the total and open road densities on trust lands are the same (3.6 mi/mi^2 and 0.7 mi/mi^2, respectively) for both the planning area and HCP project area (Tables 4.4-4 and 4.4-5). Total road density within this block is higher than for the NWLO as a whole in both the planning area and HCP project area (3.6 mi/mi^2 versus 3.4 mi/mi^2), while open road density is lower than for the Stillwater Block and NWLO scattered parcels in both the planning area and HCP project area (Tables 4.4-4 and 4.4-5).

Scattered Parcels

Linear road densities for scattered parcels within the HCP project area are generally similar to those for scattered parcels in the planning area. Most differences in linear road densities on scattered parcels between the planning area and the HCP project area are small (higher or lower by 0.1 to 0.3 mi/mi^2) (Tables 4.4-4 and 4.4-5).

For scattered parcels in the HCP project area, total road densities range from 1.6 mi/mi^2 for the CLO to 3.7 mi/mi^2 for the NWLO and SWLO. Open road densities are generally low, ranging from 1.3 to 1.9 mi/mi^2 (Table 4.4-5). For scattered parcels in both the NWLO and SWLO, open road densities in the HCP project area are slightly lower than those in the planning area. Conversely, the open road density for scattered parcels in the CLO is slightly higher in the HCP project area than in the planning area (Tables 4.4-4 and 4.4-5).

The lowest total road density for scattered parcels within the planning area is found within the CLO (1.3 mi/mi^2) (Table 4.4-4). The CLO also has the lowest total road density for scattered parcels in the HCP project area (1.6 mi/mi^2) (Table 4.4-5). The lower densities in the CLO reflect a lower level of available timber for commercial harvest (as compared to the NWLO and SWLO), which requires road networks to access lands for harvest.

4.4.1.4 Effects of and Trends in Climate Change

While changes in climate are not expected to affect the amount and distribution of roads in the planning area, some changes may affect the condition and maintenance needs of some roads, as well as access and road placement and design. As noted in Section 4.1 (Climate), more severe weather events, such as heat waves, droughts, and heavy rainfall are expected. Such events could cause damage to existing roads, including heat-related damage, flooding, and mass movements (where land forms and conditions are conducive to these events) (Karl et al. 2009). Road damage from extreme weather events could restrict or prevent access until repairs are made. Conversely, reduced snow and earlier spring snow-melt could increase access to some roads typically inaccessible due to snow (Karl et al. 2009). Accounting for extreme weather events may also require design changes for some roads, including larger culverts to pass higher, short-term flows from heavy rainfalls, placement farther from lake and river shorelines, or increased drainage structures to handle more precipitation falling as rain instead of snow or more rapid snowmelt.

4.4.2 Environmental Consequences

This section describes the effects of the no-action alternative and the three action alternatives on transportation management issues relating to the current and future road networks on trust lands. Effects discussed in this section include potential short- and long-term direct and indirect effects anticipated under the proposed action alternatives relative to what is expected to occur under the no-action alternative over the Permit term.

4.4.2.1 Introduction and Evaluation Criteria

Roads provide (1) access to forested trust lands for the purposes of conducting forest management activities, (2) public access to various recreational resources, and (3) access to adjacent land. In contrast, roads and associated maintenance activities can affect many aspects of the natural environment, including stream connectivity, water quality (e.g., increased sedimentation from road surface erosion or mass wasting), habitat quality (e.g., increased fragmentation, avoidance of habitats), and wildlife use (e.g., increased human contact or hunting pressure). While the types of road-related effects specific to these resources (geology and soils, water, fisheries, wildlife, and recreation) are addressed in their respective sections, changes in levels of road-related effects on these resources between alternatives depend on changes to the road network and how it is managed. This section, therefore, describes how the current road network would be expected to change across the landscape during the Permit term under the various alternatives.

Changes in the road network are evaluated in terms of amount, distribution (density and location), and condition of roads. The specific evaluation criteria used for this analysis are

- Expected changes to road management
- Expected changes in amount of road (miles)
- Expected changes in distribution (density and location) of roads.

To support this evaluation, existing miles of road by classification were determined using DNRC's GIS roads data layer (as described in Section 4.4.1, Affected Environment), and miles of road present at the end of the Permit term under each alternative were estimated using methods described by DNRC (2007b, 2007c). DNRC estimated the miles of road needed to access manageable forest stands over the Permit term in two ways.

1. For blocked lands (Stillwater, Coal Creek, and Swan River State Forests), DNRC staff used a combination of field reconnaissance and GIS mapping to delineate future roads necessary for accessing timber stands over the next 50 years. Additionally, DNRC staff identified the appropriate restrictions on administrative and public use of each road segment in the transportation plan based on road management under both existing rules and the proposed HCP (Alternative 2).
2. For scattered parcels, DNRC estimated the amount of road miles it would need to build based on project-level road building since the determination of the Annual Sustainable Yield in 2004. DNRC used this type of projection because the road data for scattered parcels is not accurate enough to establish a mapped transportation plan for each parcel as was done for the blocked lands.

Roads classified as highway, county, or private do change over time. However, DNRC has no ownership of these roads and any changes over time in these roads could not be predicted. An additional class (proposed roads) was added to the data layer. Proposed roads include roads not yet constructed but proposed for construction under each alternative. DNRC also uses temporary roads, which are reclaimed after use. They do not appear in the GIS layer due to their short life span. Expected changes to DNRC's road network are described within each area of blocked lands (Stillwater Block and Swan River State Forest) and at the landscape level for scattered parcels throughout the rest of the HCP project area.

It should be noted, however, that the classifications for abandoned and reclaimed roads would be modified somewhat under the action alternatives. For these three alternatives, abandoned roads would include those roads made impassable and effectively closed using gates or other barriers, with drainage structures maintained. Reclaimed roads would be defined as roads that are impassable due to effective closure and not used for low-intensity or commercial forest management activities. These roads would be stabilized, with any culverts and other structures removed, but the road prism may remain.

This section also addresses concerns raised during public scoping, including

- Access to trust lands (e.g., for recreation)
- Access to private and other public lands through trust lands
- Restricted access to lands due to road closures
- Effects of the HCP on existing roads
- Minimization of new road construction to reduce adverse environmental impacts
- Identification of road management strategies to reduce adverse environmental impacts (e.g., minimizing new road construction and correct sizing of culverts and bridges)
- Access to closed roads for administrative uses (e.g., maintaining existing drainage structures)
- Active management of roads (open for a defined number of years, then closed for a specific period of time)
- DNRC's ability to control timing and use of cost-share road systems.

4.4.2.2 Alternative 1 (No Action)

<u>Road Management</u>

Under Alternative 1, at the program level, DNRC would continue to direct road management according to ARM 36.11.421. Generally, DNRC would aim to minimize the extent of roads and impacts of roads on resources.

Within grizzly bear recovery zones, DNRC would examine and repair road closures on the Stillwater Block and Swan River State Forest annually as required under ARM (36.11.432(j)) with no schedule specified, however), but would not do so on scattered parcels. DNRC would continue to consider environmental impacts from easements using its *Access Road Easement Policy* (DNRC 2006b). On the scattered parcels in recovery zones, DNRC would not allow any permanent increases in open road densities for parcels already exceeding 1.0 mi/mi^2 but would not require documentation of rationale for not restricting or closing open roads. Total road density would be reduced when compatible with other agency goals and objectives. DNRC's GIS roads data layer would be updated only through project implementation.

In the Stillwater Block, there would be no long-term transportation commitments; however, there would continue to be no net increase from 1996 baseline in the proportion of BMUs with road densities exceeding 1.0 mi/mi^2 without FMB chief approval. Under the existing policy, the Stillwater Core would receive minimal management, and the two existing major road systems in this area (Stryker Basin and Herrig Basin) would continue to be restricted year-round to motorized public access. Seasonal closures and activity restrictions to mitigate for proposed actions would be developed on a case-by-case basis.

In the Swan River State Forest, the transportation system would continue to be managed in accordance with the Swan Agreement. Under this agreement, DNRC would continue to keep open road densities below 1.0 mi/mi^2 on at least 33 percent of BMU subunits, but there would be no limit on new permanent or temporary road construction (closed to public access) or traffic limits on DNRC restricted-use roads.

Within the Stillwater Block and Swan River State Forest, road maintenance needs would continue to be identified and prioritized within the required 5-year cycle, and ineffective road closures would be monitored annually and repaired within one operating season. For roads on scattered parcels, road maintenance needs and ineffective road closures may not be identified for more than 5 years if DNRC remains unable to meet the 5-year requirement or revises the rules to extend the cycle for these roads. Under existing practices on scattered parcels, maintenance activities and repairs would not be required to be completed within any specified timeframe. Road maintenance needs could remain unidentified for up to five years in the Stillwater Block and Swan River State Forest, and five or more years on scattered parcels, potentially causing adverse effects to other resources during this time and until these sites are addressed.

In NROH, DNRC would consider public access, wildlife habitat, and needs of adjacent landowners in managing existing roads and building new roads.

To minimize sediment delivery from roads, existing BMPs would be implemented and construction of new roads would be prohibited in SMZs, except where stream crossings are needed. DNRC's ongoing sediment delivery road inventory would continue, but no completion date would be specified. DNRC would complete sediment delivery road inventory during timber sale planning, design, and environmental assessment. Roads would be brought up to BMP standards on a project-by-project basis where feasible and when funding is available. While not required by the ARMs, a DNRC water resource specialist typically reviews proposed road management activities in watersheds with sensitive fish species and makes recommendations to reduce the risk of sediment delivery.

For any new road construction or maintenance of existing roads, DNRC would incorporate appropriate fish passage designs at all stream crossings on fish-bearing streams as specified in

MCA 87-5-501 and the Montana Stream Protection Act (124 permits). All information on fish passage at road crossings would be maintained in the existing DNRC fish passage inventory and connectivity assessment. However, the timeframe for retrofitting existing stream crossings with fish-passable structures would be undetermined and instead based on road construction and maintenance schedules. Additionally, new or repaired structures would only need to be designed to meet hydraulic conditions, rather than taking into consideration HCP fish species passage and connectivity.

Amount of Roads

Under Alternative 1, the mileage of road is expected to increase from the existing 2,645 miles of road on HCP project area lands to 4,053 miles, including miles of road that would be abandoned or reclaimed, by Year 50 (Table 4.4-6). This represents a 53 percent increase in total road mileage compared to existing conditions. Approximately 1,079 miles of newly constructed road would be restricted year-round to public access, while 41 miles would be open or restricted seasonally. About 94 percent of the new road mileage is projected to occur on scattered parcels within the three land offices. The NWLO would have the greatest increase in new road mileage, with approximately ~~731~~507 miles added. Approximately 89 miles of new road would occur in the Stillwater Block and Swan River State Forest combined, all of which would be restricted year-round to public access. In the Swan River State Forest, there would be no increase in open road miles due to limitations established in the Swan Agreement. By the end of the 50-year Permit term, the SWLO and CLO would have ~~473~~424 and ~~204~~190 miles of new road, respectively.

Distribution of Roads

Table 4.4-7 provides estimates of road densities (including abandoned or reclaimed roads) expected by the end of the Permit term. For the entire HCP project area, total road density would increase from 3.1 to 4.7 mi/mi^2. Excluding abandoned and reclaimed roads, net total road density in the HCP project area would increase from 2.9 to 4.2 mi/mi^2.

Net t~~T~~otal road density on all scattered parcels would increase from ~~3.6~~3.0 to ~~6.6~~4.5 mi/mi^2, largely due to increases in densities of roads restricted year-round to public access. Total road density on these lands would be reduced when compatible with other agency goals and objectives. On the scattered parcels in recovery zones and in the CYE, DNRC would not allow any permanent increases in open road densities for parcels already exceeding 1.0 mi/mi^2 but would not require documentation of rationale for not restricting or closing open roads.

Within the NWLO, net total road density is expected to increase from ~~3.3~~3.2 to ~~5.0~~4.4 mi/mi^2. Most of this increase would occur from additional roads on the scattered parcels within this land office. The open road density for scattered parcels in the NWLO would increase slightly from 1.9 to 2.0 mi/mi^2.

Under Alternative 1, net total road density in the SWLO is expected to increase from ~~3.7~~3.5 to ~~5.6~~5.2 mi/mi^2 and, in the CLO, from ~~1.6~~1.4 to ~~2.8~~2.5 mi/mi^2. As in the NWLO, most of these increases would result from additional roads restricted year-round to public access. Open road density would increase slightly in the SWLO (1.3 to 1.4 mi/mi^2) and remain unchanged in the CLO (1.3 mi/mi^2).

TABLE 4.4-6. PREDICTED LINEAR MILES OF ROAD BY ROAD CLASS ON DNRC BLOCKED LANDS AND SCATTERED PARCELS IN THE HCP PROJECT AREA, BY ALTERNATIVE, AT 50 YEARS FOLLOWING PERMIT ISSUANCE

		Alternative			
Land Office	Current Condition	1 No Action	2 Proposed HCP	3 Increased Mitigation Measures	4 Increased Management Flexibility
NWLO	**1,412.3**	**2,143.6**	**2,132.8**	**2,087.3**	**2,132.8**
Stillwater Block[1]	**361.3**	**378.9**	**380.5**	**378.9**	**380.5**
Highway/County/Private[2]	1.9	1.9	1.9	1.9	1.9
Open[3]	123.4	123.4	105.1	123.4	105.1
Restricted Seasonally[3]	6.4	6.4	54.0	6.4	54.0
Restricted Year-Round	229.3	246.9	219.2	246.9	219.2
Abandoned/Reclaimed	0.3	0.3	0.3	0.3	0.3
Swan River State Forest	**224.2**	**295.7**	**295.7**	**295.7**	**295.7**
Highway/County/Private[2]	6.9	6.9	6.9	6.9	6.9
Open/Restricted Seasonally[4]	43.4	43.4	66.5[5]	66.5[5]	66.5[5]
Restricted Year-Round	164.2	234.5	211.4	211.4	211.4
Abandoned/Reclaimed	9.7	10.9	10.9	10.9	10.9
Scattered Parcels	**826.7**	**1,469.0**	**1,456.6**	**1,412.7**	**1,456.6**
Highway/County/Private[2]	73.9	73.9	73.9	73.9	73.9
Open/Restricted Seasonally[4]	428.2	448.0	435.6	435.6	435.6
Restricted Year-Round	280.8	679.8	679.8	635.8	679.8
Abandoned/Reclaimed	43.9	267.4	267.4	267.4	267.4
SWLO (Scattered Parcels)	**942.4**	**1,414.9**	**1,408.2**	**1,389.4**	**1,408.2**
Highway/County/Private[2]	225.0	225.0	225.0	225.0	225.0
Open/Restricted Seasonally[4]	338.2	353.8	347.0	347.0	347.0
Restricted Year-Round	332.9	741.4	741.4	722.6	741.4
Abandoned/Reclaimed	46.3	94.8	94.8	94.8	94.8
CLO (Scattered Parcels)	**290.5**	**494.5**	**491.4**	**490.4**	**491.4**
Highway/County/Private[2]	10.8	10.8	10.8	10.8	10.8
Open/Restricted Seasonally[4]	223.1	229.1	226.0	226.0	226.0
Restricted Year-Round	22.3	206.3	206.3	205.3	206.3
Abandoned/Reclaimed	34.2	48.2	48.2	48.2	48.2
Project Area Total	**2,645.1**	**4,053.0**	**4,032.5**	**3,967.1**	**4,032.5**

[1] Includes the Coal Creek State Forest and the blocked portion of the Stillwater State Forest.
[2] The Highway/County/Private category contains those roads over which DNRC has no ownership; thus the mileages remain constant throughout the Permit term because DNRC cannot predict how those road mileages may change over time.
[3] For the Stillwater Block, increases in the Open and Restricted Seasonally road categories are displayed separately. Unlike the other road systems in the HCP project area, there are several miles of seasonally restricted road under Alternatives 2 and 4.
[4] For the Swan River State Forest and scattered parcels, the Open/Restricted Seasonally category primarily represents open roads, because there are very few seasonally restricted roads in these road systems under current conditions and all alternatives.
[5] The estimated total of 66.5 miles of open road in the Swan River State Forest under the action alternatives reflects a worst-case scenario.

NOTE: Predicted linear miles of road include estimates of future temporary roads.
Source: DNRC (2008a).

TABLE 4.4-7. PREDICTED ROAD DENSITY BY ROAD CLASS USING LINEAR CALCULATION OF MILES PER SQUARE MILE ON DNRC BLOCKED LANDS AND SCATTERED PARCELS IN THE HCP PROJECT AREA, BY ALTERNATIVE, AT 50 YEARS FOLLOWING PERMIT ISSUANCE

Land Office	Current Condition	Alternative 1 No Action	Alternative 2 Proposed HCP	Alternative 3 Increased Mitigation Measures	Alternative 4 Increased Management Flexibility
NWLO	**3.3**	**5.0**	**5.0**	**4.9**	**5.0**
Stillwater Block[1]	**2.6**	**2.7**	**2.7**	**2.7**	**2.7**
Highway/County/Private[2]	0.0	0.0	0.0	0.0	0.0
Open[3]	0.9	0.9	0.7	0.9	0.7
Restricted Seasonally[3]	0.0	0.0	0.4	0.0	0.4
Restricted Year-Round	1.6	1.7	1.5	1.7	1.5
Abandoned/Reclaimed	0.0	0.0	0.0	0.0	0.0
Swan River State Forest	**3.6**	**4.8**	**4.8**	**4.8**	**4.8**
Highway/County/Private[2]	0.1	0.1	0.1	0.1	0.1
Open/Restricted Seasonally[4]	0.7	0.7	1.1[5]	1.1[5]	1.1[5]
Restricted Year-Round	2.6	3.8	3.4	3.4	3.4
Abandoned/Reclaimed	0.2	0.2	0.2	0.2	0.2
Scattered Parcels	**3.7**	**6.6**	**6.5**	**6.3**	**6.5**
Highway/County/Private[2]	0.3	0.3	0.3	0.3	0.3
Open/Restricted Seasonally[4]	1.9	2.0	1.9	1.9	1.9
Restricted Year-Round	1.3	3.0	3.0	2.8	3.0
Abandoned/Reclaimed	0.2	1.2	1.2	1.2	1.2
SWLO (Scattered Parcels)	**3.7**	**5.6**	**5.6**	**5.5**	**5.6**
Highway/County/Private[2]	0.9	0.9	0.9	0.9	0.9
Open/Restricted Seasonally[4]	1.3	1.4	1.4	1.4	1.4
Restricted Year-Round	1.3	2.9	2.9	2.9	2.9
Abandoned/Reclaimed	0.2	0.4	0.4	0.4	0.4
CLO (Scattered Parcels)	**1.6**	**2.8**	**2.8**	**2.8**	**2.8**
Highway/County/Private[2]	0.1	0.1	0.1	0.1	0.1
Open/Restricted Seasonally[4]	1.3	1.3	1.3	1.3	1.3
Restricted Year-Round	0.1	1.2	1.2	1.2	1.2
Abandoned/Reclaimed	0.2	0.3	0.3	0.3	0.3
Project Area Total	**3.1**	**4.7**	**4.7**	**4.6**	**4.7**

[1] Includes the Coal Creek State Forest and the blocked portion of the Stillwater State Forest.
[2] The Highway/County/Private category contains those roads over which DNRC has no ownership; thus the mileages remain constant throughout the Permit term because DNRC cannot predict how those road mileages may change over time.
[3] For the Stillwater Block, increases in the Open and Restricted Seasonally road categories are displayed separately. Unlike the other road systems in the HCP project area, there are several miles of seasonally restricted road under Alternatives 2 and 4.
[4] For the Swan River State Forest and scattered parcels, the Open/Restricted Seasonally category primarily represents open roads, because there are very few seasonally restricted roads in these road systems under current conditions and all alternatives.
[5] The estimated total of 66.5 miles of open road in the Swan River State Forest under the action alternatives reflects a worst-case scenario.

NOTE: Predicted linear miles of road (Table 4.4-6) used to calculate road densities include estimates of future temporary roads.
Source: DNRC (2008a).

Locations of new roads constructed under Alternative 1 would be determined on a project-by-project basis. However, these roads would be subject to requirements and restrictions existing under the current regulatory framework. While the road management ARM (36.11.421) includes landscape-level transportation planning, as well as directives to minimize new road construction and in some areas, maintain low open road densities, DNRC would not commit to a specific transportation plan for the Permit term under Alternative 1. DNRC's GIS roads data layer would be updated only through project implementation.

4.4.2.3 Alternative 2 (Proposed HCP)

Road Management

Under Alternative 2, implementation of the HCP would result in many of the same commitments as Alternative 1 at the program level, such as minimizing total roads, implementing BMPs, improving stream crossings, and reducing sediment delivery. For this alternative, however, additional elements related to road management have been added to these and other commitments. The proposed HCP also includes transportation management plans for the Stillwater Block and Swan River State Forest.

As part of its grizzly bear conservation strategy proposed under Alternative 2, DNRC would commit to 50-year transportation management plans for the Stillwater Block (commitment GB-ST1) and Swan River State Forest (commitment GB-SW1). These plans are summarized below, and detailed descriptions are provided in HCP Chapter 2, Conservation Strategies (Appendix A, HCP).

Stillwater Block Transportation Management Plan

DNRC's transportation management plan for the Stillwater Block includes identification of road miles by class, restriction type under current management strategies and estimated under this alternative, and permanent routes needed but not yet constructed by DNRC to fulfill agency responsibilities for the Permit term (see Table 2-2 in Appendix A, HCP). In developing the Stillwater Block transportation plan, DNRC identified situations where greater opportunities exist to provide conservation through consideration of the federal ESA conservation obligations of major adjoining landowners (e.g., USFS, industrial private, or rural and/or residential private). The plan is designed to take advantage of situations where ownership characteristics are likely to provide greater conservation opportunities. Most of the HCP project area within the Stillwater Block is adjacent to federal ownership, where active recovery efforts are occurring; industrial private ownership, where efforts are designed to avoid or minimize take; or rural and/or residential private ownership, where grizzly bears face increases in human activity.

Within the NCDE recovery zone for grizzly bears, this transportation management plan would commit DNRC to a static road system. This transportation plan would minimize the number of new permanent roads and rely on operational equipment that does not require extensive road systems. Having a fixed system would provide for seasonal security associated with habitat value, particularly in the spring period when secure habitat is likely to be most limiting.

The Stillwater Block transportation plan would facilitate management of large blocks of forested trust lands adjacent to USFS lands (subzones) on a schedule of 4 years of management and 8 years of rest. Construction of additional permanent roads in these areas would be prohibited for the Permit term. The fixed transportation system, along with seasonal restrictions and management of the subzones in rest, is a departure from the existing ARMs that require no net increase in open or total road density and no net decrease in grizzly bear security core from the 1996 DNRC baseline road inventory. Under this alternative, the concept of security core would evolve from habitat being located in fixed areas on the landscape to one of providing seasonal security on the forest and providing 8-year rest periods on subzones adjacent to USFS lands classified as security core.

Swan River State Forest Transportation Management Plan

If the Swan Agreement is terminated during the Permit term, the Swan River State Forest would not be able to rely on cooperative road access management, but would continue to implement similar measures as specified in the grizzly bear conservation strategy included in the proposed HCP (Appendix A, HCP). The ability of trust lands alone to provide for linkage would be appreciably compromised if the Swan Agreement is terminated because DNRC would have reduced control of access due to existing easements and loss of cooperative access management with Plum Creek and the USFS. The strategy presented in the proposed HCP is a worst-case scenario for open roads in the area and would not necessarily preclude DNRC participation in future access management agreements. If the Swan Agreement is terminated, land ownership patterns and access options on other ownerships are uncertain. The Swan River State Forest commitments in the proposed HCP would apply to DNRC's HCP project area and roads over which it has full control. This commitment is described in more detail in HCP Chapter 2 (Conservation Strategies) in Appendix A (HCP), including identification of road miles by class, restriction type under the current Swan Agreement and estimated under this alternative, and permanent routes needed but not yet constructed by DNRC to fulfill agency responsibilities for the Permit term (see Table 2-3 in Appendix A, HCP). This plan also limits new road construction by decade (see Table 2-4 in Appendix A, HCP).

Other Commitments Affecting Road Management

Under Alternative 2, road construction and maintenance would differ from Alternative 1 in terms of limiting new open road construction, increasing rates of and prioritizing road inventory and maintenance to reduce sediment delivery from roads, and increasing rates of and specifying structural requirements for stream crossing improvements on roads for which DNRC has legal access and sole ownership or cost-share or reciprocal agreements.

Under Alternative 2, DNRC's commitment to minimize total roads would be the same as Alternative 1. However, under this alternative, DNRC would minimize open road construction in riparian areas and avalanche chutes (commitment GB-PR4) to protect potential grizzly bear habitat.

Within grizzly bear recovery zones, DNRC would examine all primary road closures on an annual basis and repair ineffective closures within 1 year of identification (commitment GB-RZ3). DNRC would also avoid granting existing or new access across HCP project area lands where possible, except for reciprocal access and cost-share agreements. DNRC would evaluate and condition easements with grizzly bear mitigation measures and work with existing and future reciprocal access grantees to avoid or mitigate impacts to grizzly bears (commitment GB-RZ2).

In NROH, DNRC would minimize construction of new open roads but not establish targets or caps on total road densities (commitment GB-NR1). DNRC would also discourage granting of new easements that relinquish DNRC control of roads (commitment GB-NR2).

Road management on the scattered parcels in grizzly bear recovery zones would consist of three primary components (commitment GB-SC1). First, DNRC would evaluate the potential for reducing open roads at the project level and would be required to document rationale for not restricting or closing open roads. Second, at the administrative unit level, open road length would be kept below the HCP analysis baseline. Lastly, DNRC would continually update its GIS roads data layer. In the CYE, all three components would apply, and for the first component, DNRC would address open road density in an expedited manner (commitment GB-CY4).

Unlike Alternative 1's more general guidelines for reducing sediment delivery from existing roads, Alternative 2 would result in a standardized approach to classifying and prioritizing road segments in need of corrective actions. According to commitment AQ-SD2, DNRC would inventory roads for which it has legal access and sole ownership or cost-share or reciprocal road agreements for sediment delivery in bull trout watersheds within 10 years and westslope cutthroat trout (westslope cutthroat trout) and Columbia redband trout watersheds within 20 years. Corrective actions at sites with high risk of sediment delivery in bull trout watersheds would be completed within 15 years and within 25 years for westslope cutthroat trout and Columbia redband trout watersheds. This alternative would also require that moderate-risk sediment delivery roads in watersheds with HCP fish species be corrected on a project-by-project basis. On roads with shared ownership, DNRC would work with other cooperators to address moderate- and high-risk sediment delivery road segments.

According to commitment AQ-FC1 item (10), any road work would be subject to standard requirements to further minimize impacts to HCP fish species. These requirements would include performing all in-water work within designated construction work windows, excluding fish from affected stream segments during construction, and salvaging fish entrapped by construction activities. Additionally, a DNRC water resource specialist would be required to review all road management activities associated with forest management activities within watersheds supporting HCP fish species and recommend actions to reduce risk of sediment delivery (commitment AQ-SD3). This is in contrast to Alternative 1, under which such review would be expected to typically occur, as it does currently, but would not be required.

According to commitment AQ-FC1 items (1) and (2), DNRC would provide connectivity on streams supporting HCP fish species along roads where DNRC has legal access and sole ownership, cost-share agreements, or reciprocal road agreements. Structures would be designed to emulate streambed form and function for low to bankfull flows to minimize adverse effects to bull trout, westslope cutthroat trout, and Columbia redband trout. Selection of new and replacement structures would be dictated by stream conditions, cost, sediment risks, and anticipated use and would be subject to permit approval under commitment AQ-FC1 item 9). This measure generally would require DNRC to install larger culverts or bridges than would be required for just hydraulic considerations. DNRC would continually update the fish passage assessment to inventory and assess connectivity for all existing stream crossings so that road-stream crossing improvements could be prioritized for streams with HCP fish species based on connectivity, HCP fish species presence and status, and population conservation goals. Under commitment AQ-FC1 items (5), (6), and (7), DNRC would complete connectivity improvements for streams with HCP fish species within 15 years for bull trout streams and 30 years for westslope cutthroat trout and Columbia redband trout streams, with some allowances. Commitment AQ-FC1 item (8) would require that, every 5 years, one-sixth of all sites not meeting fish connectivity conservation strategy objectives be improved to meet the strategy, or at least have final plans and designs completed for improvement.

Amount of Roads

Under Alternative 2, the miles of new road constructed by year 50 (~~1,387~~1,100 miles) would be approximately 21 miles lower than Alternative 1, which represents a 1.5 percent reduction (Table 4.4-6). The NWLO, SWLO, and CLO would have 11, 7, and 3 fewer miles of new permanent road, respectively, compared to Alternative 1. Total road miles in the Stillwater Block would be approximately 2 miles higher than under Alternative 1. Miles of new road in the Swan River State Forest would be the same as under Alternative 1, but as many as 23 miles could be reclassified as open or restricted seasonally from restricted year-round if the Swan Agreement ~~dissolves~~is terminated during the Permit term (Table 4.4-6).

Under Alternative 2, a relatively low amount of road construction would occur in the Stillwater Block (11 new roads totaling approximately 19 miles), but these roads would be closed to the public year-round. Some of these roads would provide additional access within the Stillwater Core, but DNRC would primarily improve existing roads that are currently closed. Overall in the Stillwater Block, open roads would be reduced by approximately 18 miles and these roads would be reclassified as closed year-round. Roads closed to motorized public access but open to unrestricted DNRC use would be reduced overall by approximately 29 miles and distributed into other road classes that also restrict DNRC use. Roads seasonally restricted from motorized public access and subject to varying degrees of DNRC use would increase by approximately 54 miles (see Table 2-2 in Appendix A, HCP).

Under this alternative, DNRC would construct approximately 70 miles of new road in the Swan River State Forest (Table 4.4-6). These new roads would become part of the permanent road system but not open for public use. Some slight variation in precise road locations, versus those specified in the transportation plan, would be needed to better accommodate BMPs and logging system design. New temporary roads would be limited to no more than 5 miles per year. DNRC would limit traffic on DNRC restricted-use roads to "low use" (less than 1 vehicle per day) except roads used for commercial forest management activities.

Classifications of roads in the Swan River State Forest would vary depending on whether the Swan Agreement stays in effect or is terminated. The estimated miles of road by type shown in Table 4.4-6 reflect the worst-case scenario should the Swan Agreement be terminated. If this happens, or if neighboring lands change ownership, as many as approximately 28.4 miles of road originally classified as restricted (either seasonally or year-round) in existing reciprocal access agreements could change to open under subsequent reciprocal access agreements. The total miles of open road would increase from 43.4 miles to as much as 66.5 miles, depending on the status of access agreements with adjacent landowners and the timing of individual landowners' decisions to pursue access across parcels of trust land. Additionally, all existing roads without reciprocal access agreements (approximately 41.4 miles) would then be managed under the proposed HCP and acquire greater restrictions on commercial and DNRC access for forest management activities.

However, if the Swan Agreement remains in effect, no changes in miles of open road would be expected. Under either scenario, no new restrictions would be placed on any roads currently classified as open to public access.

Distribution of Roads

Road densities by year 50 under Alternative 2 would be similar to those estimated for Alternative 1 (Table 4.4-7). For the entire HCP project area, total and net total road density would also reach 4.7 and 4.5 mi/mi^2, respectively, by the end of the Permit term. Road densities at Year 50 on scattered parcels in the SWLO and CLO would be the same as those estimated for Alternative 1, although slight differences in actual road miles would occur (Table 4.4-6). For both the Stillwater Block and Swan River State Forest, Alternative 2 would result in higher open road densities (including seasonally restricted roads) and lower year-round restricted road densities as compared to Alternative 1. The increase in open road density in the Swan River State Forest would be worse-case should the Swan Agreement dissolve; otherwise, this density would be the same as under Alternative 1. For scattered parcels in the NWLO, net total road densities would be same as for Alternative 1 (4.5 mi/mi^2) based on slightly lower actual new road miles, and open road densities would be slightly lower than for Alternative 1 (~~6.5 versus 6.6 mi/mi^2 and~~ 1.9 versus 2.0 mi/mi^2, respectively).

For the Stillwater Block, DNRC would implement a 50-year transportation plan, which defines a fixed transportation system and limits or prohibits road construction in certain areas. Under this alternative, DNRC would commit to the locations and classifications of roads identified in this plan (Figure D-4B in Appendix D, EIS Figures). Should the Swan Agreement ~~dissolve~~be terminated, DNRC would also implement a 50-year transportation plan for the Swan River State Forest. This plan would also define a fixed transportation system to be implemented over the 50-year Permit term (Figure D-5B in Appendix D, EIS Figures).

4.4.2.4 Alternative 3 (Increased Conservation HCP)

Road Management

HCP commitments related to road management under Alternative 3 would be similar to those under Alternative 2. Additional restrictions and shorter timeframes for completing some commitments would result in lower risk for road-related effects. Within the Stillwater Block, however, a transportation management plan would not be adopted as would occur under Alternative 2.

Road management on the scattered parcels in grizzly bear recovery zones would be the same as Alternative 2, with the additional restriction of no net increase in baseline total road density for forest management projects at the administrative unit level.

While Alternative 2 would require all ineffective road closures to be repaired within 1 year, Alternative 3 would require that all ineffective closures be repaired within the same operating season, unless time, manpower, or contracting funds are limited in a particular year due to the need to address multiple closures. In such a case, Alternative 3 would require DNRC to prioritize closures, repair as many as possible within the same season, and repair all closures within 1 year of their identification. Under this alternative, most closures would likely be repaired sooner than would be required under Alternative 2, reducing the potential for effects from unauthorized use prior to repair.

Under this alternative, DNRC would inventory roads for sediment delivery in bull trout watersheds within 5 years and in westslope cutthroat trout and Columbia redband trout watersheds within 10 years. DNRC would also complete corrective actions on high-risk sites in bull trout watersheds within 10 years and in westslope cutthroat trout and Columbia redband trout watersheds within 20 years. All these timeframes are 5 to 10 years shorter than specified under Alternative 2 and would result in quicker identification and repair of high-risk sites, thereby reducing the sediment delivery from these sites sooner than would happen under Alternative 2.

Fish connectivity improvements would be completed within 10 years for bull trout streams and within 20 years for westslope cutthroat trout and Columbia redband trout streams. Compared to Alternative 2, bull trout stream connectivity improvements would be completed 5 years sooner and westslope cutthroat trout and Columbia redband trout stream connectivity improvements would be completed 10 years sooner.

Amount of Roads

Alternative 3 would result in the lowest total miles of new road in the HCP project area (~~1,322~~1,035 miles) of any alternative (Table 4.4-6). The amount of total and new road miles in the Stillwater Block would be the same as Alternative 1, and for the Swan River State Forest, the total and new road miles would be the same as Alternatives 1 and 2. However, in the scattered parcels, miles of new road constructed by year 50 would be approximately 64 miles lower than Alternative 2, resulting from fewer new roads classified as restricted year-round. However, most of the overall increase in total road miles would still be from roads classified as restricted year-round.

Distribution of Roads

Except for the Stillwater Block and roads restricted year-round on scattered parcels in the NWLO, road densities by year 50 under Alternative 3 would be the same as those estimated under Alternative 2 (Table 4.4-7), although slight differences in actual road miles would occur (Table 4.4-6). In the Stillwater Block, road densities would be the same as those under Alternative 1. For roads restricted year-round on scattered parcels in the NWLO, density would increase to 2.8 mi/mi^2 instead of 3.0 mi/mi^2, as would occur under Alternatives 1 and 2. For the entire HCP project area, total and net total road density would be slightly lower than for Alternatives 1 and 2 by the end of the Permit term (4.6 and 4.4 mi/mi^2, respectively), and this would primarily be due to the lower density of roads restricted year-round on scattered parcels in the NWLO.

As under Alternative 1, the Stillwater Core would remain relatively unmanaged, and not be opened up to active forest management activities during the Permit term. A transportation plan would not be adopted for the Stillwater Block, so locations and classifications of new roads would not be fixed as they would be under Alternative 2.

4.4.2.5 Alternative 4 (Increased Management Flexibility HCP)

Road Management

Alternative 4 commitments related to road management would be similar to those under Alternative 2. However, some commitments would be less restrictive or specify longer timeframes for completion, resulting in higher risk for road-related effects.

Examination and repair of road closures would be the same as Alternative 2, except that primary closures on scattered parcels would be examined every 2 years instead of annually. Repair of ineffective closures would still be required within 1 year, however. This would result in an increased risk of effects from unauthorized road use on scattered parcels for up to an additional year until ineffective closures are identified and repaired. Although inspections would occur on a slower schedule than Alternative 2 for scattered parcels, this rate of road closure and inspection for the Stillwater Block, Swan River State Forest, and scattered parcels in recovery zones would be faster than would occur under Alternative 1.

To address sediment delivery reduction under Alternative 4, DNRC would inventory roads for sediment delivery in bull trout watersheds within 15 years, and in westslope cutthroat trout and Columbia redband trout watersheds within 25 years. These two timeframes are 5 years longer than specified under Alternative 2 and 10 to 15 years longer than Alternative 3. While Alternatives 2 and 3 specify timeframes for completing corrective actions on high-risk sites, Alternative 4 would only require that corrective actions be completed on a project-by-project basis, similar to what would occur under Alternative 1 when high-risk sites are identified during inventory for timber sale planning, design, and environmental assessment. While the rate of completing corrective actions would be the same as under Alternative 1, Alternative 4 would still implement the same approach as Alternatives 2 and 3 to inventory and prioritize corrective actions based on sediment delivery risk, so that higher-risk sites could be repaired sooner than they would be under Alternative 1.

For fish connectivity improvements, Alternative 4 would be the similar to Alternative 1. No timeframe would be specified for completing connectivity improvements for streams with HCP fish species; instead, they would be completed on a project-by-project basis. Consequently, this alternative could result in stream crossings potentially posing risks to other resources for extended periods as opposed to Alternatives 2 and 3. However, as under Alternatives 2 and 3, every 5 years one-sixth of all sites not meeting fish connectivity conservation strategy objectives would have to be improved to meet the strategy, or at least have final plans and designs completed for improvement.

Amount of Roads

Alternative 4 would result in the same total new road miles and road management classifications in the HCP project area as Alternative 2 (Table 4.4-6).

Distribution of Roads

For the entire HCP project area, Alternative 4 would result in the same road densities as for Alternative 2 (Table 4.4-7). As for Alternative 2, Alternative 4 would also result in the adoption of a 50-year transportation plan and active forest management activities within the Stillwater Core, including road construction, reconstruction, maintenance, and use.

4.4.2.6 Summary

By the end of the Permit term, all four alternatives would result in more roads on trust lands within the HCP project area. At the land office scale, as well as for scattered parcels, new road miles would be highest under Alternative 1 and lowest under Alternative 3. Miles of new road would be the same for Alternatives 2 and 4 and would fall between Alternatives 1 and 3. In the Stillwater Block, Alternatives 2 and 4 would result in more new road miles than Alternatives 1 and 3, reflecting an increase in roads to support forest management activities in the Stillwater Core (Table 4.4-6). Road densities would reflect the same differences as those noted for road miles, although smaller differences in road miles are not reflected in the densities shown in Table 4.4-7.

Within the Stillwater Block, there would only be slight differences in new road miles among the four alternatives, and these differences would primarily be due to changes in access classifications. Alternatives 1 and 3 would result in no change in miles of road classified as open or seasonally restricted as compared to current conditions. Only roads classified as restricted year-round would increase. Under a 50-year transportation plan, Alternatives 2 and 4 would result in a decrease in roads open year-round and roads restricted year-round, while miles of road restricted seasonally would increase. Public access to roads, at least on a seasonal basis, would increase under Alternatives 2 and 4 (Table 4.4-6).

If the Swan Agreement remains in effect for the entire Permit term, there would be no differences in road miles and classifications between the four alternatives for the Swan River State Forest. If this agreement is terminated, road management for these blocked lands under Alternatives 2, 3, and 4 would be subject to a 50-year transportation management plan. Up to 23 miles of road could be converted from restricted year-round to open year-round or seasonally restricted, depending on DNRC's ability to negotiate reciprocal access agreements after land ownership changes or termination of the Swan Agreement (Table 4.4-6).

On scattered parcels in the HCP project area, most new roads under all four alternatives would be classified as restricted year-round. Alternative 3 would result in the fewest new road miles, while Alternative 1 would result in the most new road miles. The largest increases in roads open to the public, at least on a seasonal basis, would occur under Alternative 1, while miles of open roads would be the same between Alternatives 2, 3, and 4. Miles of road restricted year-round would be the same for Alternatives 1, 2, and 4, and lower for Alternative 3 (Table 4.4-6).

During the Permit term, differences in road conditions between the four alternatives would primarily result from varying rates of identifying and completing repairs to road segments with high risk of delivering sediments to streams, stream crossing structures affecting fish passage, and ineffective road closures. Alternative 3 would result in the highest rate of inspection and repair, following Alternatives 2, 4, then 1. Consequently, road conditions would likely be improved quickest under Alternative 3, followed by Alternative 2. Both Alternatives 2 and 3 require improvements for sediment delivery reduction and fish connectivity to be completed by the end of the Permit term, similar timeframes would not be applied under Alternatives 1 and 4. For these two alternatives, improvements would be completed on a project-by-project basis.

Anticipated climate changes over the Permit term may increase effects of the alternatives. With milder winter temperatures and more precipitation falling as rain instead of snow, as well as longer periods of summer-like weather, public access to and use of project area roads may increase during unrestricted periods, and unauthorized use may increase on roads with ineffective closures. Increased intense rainfall events in the planning area could increase occurrences of road problems, further differentiating potential effects of the alternatives in terms of how quickly road problems would be identified and repaired.

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4.5 Geology and Soils

This section describes the affected environment and environmental consequences on geology and soils from changes to DNRC's forest management program under the no-action and action alternatives. Maintaining soil productivity is important to sustaining long-term forest growth and long-term trust revenues.

4.5.1 Affected Environment

The following description of affected environmental for geology and soils in the planning area includes discussions of the current regulatory framework under which DNRC considers and protects geologic and soils resources as part of its forest management program (Section 4.5.1.1), existing land features (Section 4.5.1.2), effects of forest management activities on soils (Section 4.5.1.3), ~~and~~ gravel sources (Section 4.5.1.4), and effects of and trends in climate change (Section 4.5.1.5).

Potential effects of forest management activities on soils include accelerated rate of erosion, compaction, and displacement, and subsequent adverse effects on the long-term productivity of the soil resource. Soil erosion caused by forest management activities can result in sediments reaching waterbodies and potentially adversely affecting water quality and fish. The effects of sediments on water quality are discussed in Section 4.6 (Water Resources), while effects on fish are discussed in Section 4.8 (Fish and Fish Habitat).

4.5.1.1 Regulatory Framework

DNRC's forest management activities are subject to multiple rules and regulations intended to avoid or mitigate effects of these activities on geologic and soil resources. Table 4.5-1 summarizes these rules and regulations, most of which are part of the Forest Management ARMs and based on the management philosophy and direction provided in the SFLMP (DNRC 1996).

As part of its forest management activities, DNRC incorporates various formal operational requirements contained in the Forest Management ARMs (ARMs 36.11.410, 414, and 421 through 427), SMZ Law, Montana Stream Protection Act, and all applicable Montana Forestry BMPs. Montana Forestry BMPs contain a broad range of specific practices addressing road planning and location, road drainage, road construction, road maintenance, stream crossing design, stream crossing installation, and harvest design. In addition, DNRC currently uses information from many different sources (including the Flathead Basin Commission monitoring committee, Plum Creek, the USFS, and MFWP) as part of a suite of decision tools for planning and implementing sediment reduction activities.

The following subsections provide additional detail on DNRC's regulatory framework regarding soil productivity, soil stability and erosion, gravel sources, and monitoring.

TABLE 4.5-1. APPLICABLE EXISTING RULES AND REGULATIONS RELATED TO GEOLOGIC AND SOIL RESOURCES

Rule or Regulation	Purpose
Biodiversity – Nutrient Retention (ARM 36.11.410)	Requires DNRC to minimize the removal of fine branches and leafy material during treatments
Biodiversity – Coarse Woody Debris (ARM 36.11.414)	Requires DNRC to leave adequate CWD on site to facilitate nutrient conservation and cycling
Road Management (ARM 36.11.421)	Provides specific guidelines for road design, construction, use, inspection, and maintenance, including compliance with BMPs
Watershed Management (ARM 36.11.422)	Requires incorporation of BMPs into project design and all forest management activities
Watershed Management – Cumulative Effects (ARM 36.11.423)	Requires assessment and minimization of cumulative watershed effects
Watershed Management - Monitoring (ARM 36.11.424)	Requires monitoring to assess watershed impacts and the effectiveness of mitigation measures, including BMP audits
Watershed Management – Streamside Management Zones and Riparian Management Zones (ARM 36.11.425)	Establishes SMZs and RMZs, and regulates timber harvest, including road-related activities within them.
Watershed Management - Wetland Management Zone (ARM 36.11.426)	Establishes WMZs, and regulates timber harvest, including road-related activities within them.
Fisheries (ARM 36.11.427)	Requires DNRC to minimize impacts to fish populations and habitat
SMZ Law (MCA 77-5-301 and ARMs 36.11.301 through 313)	Regulates timber harvest, including road-related activities, near streams and other waterbodies
Montana Stream Protection Act (MCA 87-5-501 and 87-5-509)	Regulates activities that may affect the natural and existing shape and form of any stream or its banks or tributaries (124 Permits)
Grazing on Classified Forest Lands (ARM 36.11.444)	Regulates grazing practices on classified forested trust lands to maintain or improve range condition and minimize loss of riparian and streambank vegetation and structural damage to stream banks
Montana Opencut Mining Act (MCA-82-4-4 and ARMs 17.24.201 through 225)	Regulates open-cut operations for sand, gravel, and other mine minerals

Soil Productivity

Soil productivity directly influences forest growth by providing a healthy growing medium, including nutrients, which are replenished over time by the decay of plant and animal matter. To maximize tree growth, and thus long-term return to trust beneficiaries, DNRC is required to maintain soil productivity. For timber harvest activities, ARMs 36.11.410 and 36.11.414 require DNRC to leave behind fine branches and leafy material, as well as adequate CWD, after treatment to retain nutrients on site.

To maintain soil productivity on classified forest trust lands with grazing licenses, ARM 36.11.444 requires DNRC to determine appropriate types of livestock, stocking levels, and grazing periods. This ARM also directs DNRC to regularly inspect range conditions to ensure maintenance or improvement of range conditions.

Soil compaction can also affect productivity and reduce tree growth. DNRC implements Montana Forestry BMPs to minimize soil compaction and avoid soils that are easily compacted. BMPs for harvest design, logging systems, yarding systems, slash treatment and site preparation, and winter harvest activities address soil compaction.

Slope Stability and Erosion

Timber harvest, including road-related activities, cause soil disturbance that can potentially affect slope and soil stability and lead to mass movement or surface erosion. The road management ARM (36.11.421) provides DNRC with specific guidelines for road design, construction, use, inspection, and maintenance. This ARM also requires DNRC to comply with applicable BMPs, including those that address road use management, planning and locating, construction, drainage control, grading, maintenance, and closures to reduce the likelihood of road-related mass movement and road surface erosion. DNRC also complies with BMPs designed to reduce the likelihood of mass movement and surface erosion associated with timber harvest and reforestation activities.

The SMZ Law and ARMs 36.11.425 through 427 also regulate timber harvest, including road-related activities, conducted immediately adjacent to streams, lakes, and other waterbodies to provide effective sediment filtration to maintain high water quality. The SMZ Law prohibits the construction of roads in an SMZ except when necessary to cross a stream, and it prohibits depositing road fill material within an SMZ during road construction, except as necessary to construct a stream crossing. However, the SMZ Law does not determine, or provide a means to determine, when it is necessary to construct a stream crossing. The SMZ Law also prohibits the side-casting of road material during maintenance into a stream, lake, wetland, or other waterbody.

Under the Montana Stream Protection Act (MCA 87-5-501 and 87-5-509), DNRC is required to apply for and obtain a 124 permit from MFWP before initiating any activities that may alter the bed or banks of any stream in the state. DNRC obtains these permits for all installations and removals of stream crossing structures. A 124 permit may require specific designs, operating restrictions, or other mitigation measures, and it may also require DNRC to obtain a short-term exemption from Montana water quality standards. These permits are called 318 authorizations, and are obtained from MDEQ. A 318 authorization may also require specific designs, operating restrictions, or other mitigation measures.

Gravel Sources

Occasionally, road construction or improvement projects require large amounts of fill or road surface material, requiring the development of nearby borrow sites or gravel pits. Large sources of gravel or fill (those removing more than 10,000 cubic yards of material) are subject to the rules and regulations (ARMs 17.24.201 through 225) governing the Montana Opencut Mining Act (MCA 82-4-4), which is administered by MDEQ. Operations of this size are subject to permitting, which requires submission of a detailed operating plan and reclamation plan. The operating plan must include measures to protect on-site and off-site surface and ground water. Additionally, the Montana Forestry BMPs require DNRC to minimize sediment production from borrow pits and gravel sources through proper location, development, and reclamation of those sites.

Monitoring

The DNRC forest management program developed a comprehensive approach to monitor and evaluate forest management effects on soil erosion, soil physical properties, and sediment delivery risk and practices to mitigate these impacts (DNRC 2003b, 2004e). This program includes monitoring of the implementation and effectiveness of Montana Forestry BMPs, as required by the watershed management ARM (36.11.424). DNRC is also currently required to assess and prioritize road maintenance needs by inspecting the condition of both open and closed roads every 5 years (ARM 36.11.421(12)). Under the watershed monitoring program (ARM 36.11.424), DNRC has been conducting a systematic inventory of watershed conditions of forested trust lands since 1998, particularly as they relate to roads and road crossings. Most of the watershed inventories conducted to date have been completed on forested trust lands included in the HCP project area.

4.5.1.2 Land Features

The geology and soils of western and central Montana are highly variable and complex. The planning area includes a diverse range of landforms exhibited by a dramatic mix of mountains, hills, and valley bottoms across the area.

The NWLO and SWLO are located within the Northern Rocky Mountains physiographic province, which consists mostly of high mountains separated by broad to narrow valleys. Valley elevations typically are between 3,000 and 5,000 feet surrounded by mountains with elevations ranging from 8,000 to 10,000 feet. Many of these highlands were glaciated during the Pleistocene Epoch 2.5 million to 10,000 years ago, forming rugged glacial landforms. Mountain ranges in the NWLO, include the Cabinet and Purcell Mountains and the Whitefish, Flathead, Lewis, Swan, Mission, and Salish Ranges, which are closely spaced with narrow valleys. The Bitterroot Range, Sapphire Mountains, Garnet Range, and part of the Mission Mountains and Swan Range are located in the SWLO.

The CLO contains a wide variety of land types and climate zones, with the Continental Divide forming its western boundary. This land office includes portions of several physiographic provinces: Northern Rocky Mountains, Middle Rocky Mountains, and the Great Plains. The Great Plains region is generally flat or gently rolling, and the glaciated northern portion has many lakes, while the unglaciated south is somewhat drier and less dissected. Elevations range from about 4,000 feet at the edge of the Rocky Mountains down to about 2,000 feet on the eastern side of the CLO. Mountains within the CLO include the Abasoroka Range, Beartooth Range, Bitterroot Range, Pioneer Mountains, Beaverhead Mountains, Tobacco Root Mountains, Madison Range, Gravelly Range, Snow Crest Range, Bridger Range, and Big Belt Mountains. Montana's highest point, the 12,799-foot Granite Peak, is located in the Beartooth Range. In the eastern portion of the CLO, smaller mountain ranges, which are outliers of the Rocky Mountains, include the Crazy Mountains, Little Belt Mountains, and Sweet Grass Hills.

<u>Geology</u>

The dramatic landscapes of Montana are formed by the ancient and ongoing forces of mountain building that have been eroded over millions of years by numerous erosional processes, including continental and alpine glaciations, wind and water transport, and mass movements. Starting about 1.5 billion years ago, thick deposits of sand, silt, clay, and marine sediments began to accumulate in what is now the western one-third of Montana. These deposits were metamorphosed by deep burial to form thick formations of quartzite, amphibolites, and marble that were then uplifted by a period of mountain building called the Laramide orogeny. This period started in western North America about 70 to 80 million years ago and ended 35 to 55 million years ago. It created the Belt

Formation, which underlies much of northwestern and parts of southwestern Montana and includes the Rocky Mountains.

Much later, local areas of sedimentary and volcanic rocks and igneous intrusions also formed part of the bedrock of the region. Uplift and faulting formed these rock units into the mountains that are constantly modified by surface erosion, mass movements, rivers, and glaciers. During the ice ages, glaciers flowed out of British Columbia and also formed in the higher elevation mountains of Montana. Much of northwestern and parts of southwestern Montana were covered by ice or large lakes in valleys blocked by these glaciers. The glaciers sculpted the mountains, widened the valleys, and left behind glacial tills, outwash, and lake deposits. The variety of parent materials, climatic conditions, and glacial modifications of the mountains and valleys of the region formed the wide variety of surface materials and soils now found in the project area.

Soils

Surface and soil conditions are a function of the geologic materials from which they formed, the topography and slope conditions, vegetation, climate, and biological factors. Summary soils information was obtained for the planning area from the State Soil Geographic Database (USDA 1995). This database provided generalized information and depicts the dominant soils and attributes comprising the landscape. The State Soil Geographic Database was designed primarily for landscape-scale resource planning, management, and monitoring, which is appropriate for this programmatic EIS analysis.

Northwestern Land Office

Forest growth potential is high in northwestern Montana because of the precipitation and productive soil types that support forest growth. Soils in the NWLO were formed from glacial deposits and weathered Belt Formation rocks. These include shallow and deep soils formed from glacial tills, outwash, lake deposits, and residual soils formed from weathered bedrock. Most of these soils are relatively young and poorly developed because glaciers disrupted, covered, or modified older, pre-glacial soils. Gravelly loam and gravelly silt loam soil textures are common, and volcanic ash also caps many of the soils. Volcanic ash is a productive soil component that helps form adequate soil nutrient and water retention. Valley soils include alluvium, glacial outwash, and lake deposits; these soils are commonly used for agricultural, residential, and urban areas.

Southwestern Land Office

Soils in the SWLO are mostly residual soils formed from diverse bedrock types, along with more limited soils formed in glacial soils at higher elevations. About a quarter of the soils in the land office include volcanic ash influences. Valley soils include alluvium, glacial outwash and till, and lake deposits. As in the NWLO, these soils are commonly used for agricultural, residential, and urban areas. Many soils in the southwest region of Montana are typically less productive because of lower precipitation and droughty soil conditions, as well as nutrient pools.

Central Land Office

Unlike the NWLO and SWLO, the CLO has more diverse soil types due to the variety of bedrock and more varied climate conditions within the area. Many soils are similar to those in southwestern Montana, but with more high elevation and climate limitations. More productive soils are typically located in local moist areas, such as riparian zones, wetlands, and valley bottoms, which frequently consist of alluvium washed from the hills and mountains.

4.5.1.3 Effects of Forest Management Activities on Soils

Over the past century, rates of soil compaction, displacement, and erosion have been accelerated and soil productivity has been degraded by a number of factors, including fires; forest practices; mining; agriculture; dams; transportation and utility routes; recreation; residential, commercial, and industrial development; and many other development-related influences.

By removing large amounts of woody material, timber harvest may reduce the organic matter available to enrich soils and increase compaction of the soil, both of which can reduce soil productivity. Additionally, timber harvest and forest roads may increase mass movement and surface erosion above natural levels by disturbing soils and vegetation, reducing interception and infiltration of precipitation, and increasing surface runoff (Swanson et al. 1987). Increased erosion related to forest practices can increase sediment delivery to stream channels, lakes, and wetlands where it can negatively affect aquatic resources (Bisson et al. 1987). Effects of sediment delivery from forest management on aquatic resources are discussed in Sections 4.6 (Water Resources) and 4.8 (Fish and Fish Habitat).

Prior to adoption of BMPs in 1987 and the SFLMP in 1996, historical forest harvest and road construction and maintenance often did not use practices that minimized short- or long-term adverse impacts to soils and that were protective of water quality and stream habitats. As a result, poor road construction and logging practices sometimes or often led to excessive levels of soil compaction, displacement, and accelerated rates of soil erosion on forested landscapes. Most of the sites where soils have been affected by poor historical logging practices have recovered and are re-vegetated and considered relatively stable. Many existing problem sites require upgrades, frequent maintenance, and in some cases, abandonment. Surface erosion from roads and stream crossings are the majority of identified problem sites remaining from historical forest management activities. Identifying and prescribing practical and effective solutions for problem sites on forested trust lands and the present road networks takes experienced foresters, forest hydrologists, soil scientists, and forest road engineers familiar with the region.

Currently, all DNRC forest management projects reference available soils information and implement designs and management practices that maintain or improve soil productivity, emphasizing conservation over restoration. While DNRC currently has no guidelines for maximum acceptable impacts to soils related to timber harvest activities, it has taken a conservative approach by assuming that soil productivity is maintained when detrimental soil impacts (severe compaction, displacement, and erosion) are limited to 15 percent or less of a harvest area. However, actual levels of impacts on tree growth vary by soil and site (DNRC 2004e).

From 1988 through 2004, DNRC monitored 74 sites in areas harvested during past DNRC non-salvage timber sales to validate the effectiveness of harvest design measures to protect soils. All of the 74 soil monitoring sites were located within the HCP planning area, and 65 (88 percent) of the sites were located on timber harvest projects within the HCP project area. This soil monitoring was prioritized on areas where the risk of soil impacts (compaction, displacement, and erosion) was high. On these 74 sites, DNRC found that total detrimental soil impacts ranged between 3 and 44 percent of harvest area, with 35 of these sites (47 percent) having less than 10 percent impacted area, 13 sites having 15 to 20 percent impacted area, and 12 sites (16 percent) having more than 20 percent impacted area. All the sites with more than 20 percent impacted area were harvested between 1987 and 1989, just as BMPs were being adopted. Also, sites with the largest impacted area occurred on fine-textured soils and steep slopes with parent materials of lacustrine (Lake Missoula silts), loamy glacial tills, and tertiary sediments (DNRC 2004e).

The following subsections specifically discuss the effects of forest management activities on soils with respect to soil productivity (nutrient cycling, compaction, and displacement), slope stability, and erosion. Additional findings from DNRC's soil monitoring report (DNRC 2004e) are also summarized. These discussions are followed by a summary of DNRC's ongoing monitoring of implementation and effectiveness of BMPs.

Soil Productivity

Maintaining soil productivity by preserving rich, organic topsoil layers is critical for long-term forest growth. Natural processes such as fire, surface erosion, and mass movement (i.e., landslide), and the forest management activities of yarding, road construction, and vegetation removal can adversely impact soil productivity by changing surface runoff amounts and drainage patterns, soil saturation, soil compaction, displacement, surface permeability, aeration, and nutrient supply. Minimizing areas of soil disturbance and retaining coarse and fine woody material (nutrient management) are the main ways DNRC mitigates soil productivity impacts.

Breakdown of organic matter is the primary source of forest soil nutrients, along with long-term weathering of surface materials. The removal of large volumes of both coarse and fine woody material through timber harvesting reduces the amount of organic matter and nutrients available for nutrient cycling, and this can affect the long-term productivity of a site. As part of its forest management program, DNRC minimizes the removal of fine branches and leafy material and retains adequate volumes of CWD on site after harvest for nutrient cycling.

Forest management activities can result in compaction and displacement of soils, which can also prevent the recovery of vegetation following forest practices. Roads, landings, and gravel and rock quarrying often lead to long-term damage to surface soils and may preclude them from future forest production. Roads are needed to access areas for management and fire response, and construction permanently impacts surface soils within the road prism and typically removes vegetation from the roadbed and cutslopes. Skid trails, cable corridors, and temporary roads also impact surface soils, but to a lesser degree and for shorter time periods, so that these soils are not precluded from future forest production.

Generally, the more acres harvested and the steeper the slopes on which harvest occurs, the greater the potential for soil disturbance, compaction, displacement, and nutrient loss. The amount of disturbed soils from harvest also varies by method and harvest intensity, with ground-based logging systems compacting and disturbing more soils than cable and helicopter logging (Graham et al. 1991; Beschta and Boyle 1995). Landwehr (1992) and the USFS (1993) found that ground-based methods disturb about 8 percent of harvest area, while cable/skyline methods disturb about 6 percent and helicopter methods disturb about 1 percent. Most logging on forested trust lands uses conventional ground-based skidders.

In addition to ARMs 36.11.410 and 36.11.414, which require retention of fine and coarse woody debris on site after harvest, DNRC also designs harvest plans that account for site conditions and season of operation and include applicable BMPs to minimize soil compaction and displacement. Additionally, a DNRC water resource specialist typically reviews proposed forest management activities in watersheds with sensitive fish species and makes recommendations to reduce the risk of sediment delivery.

Although DNRC has adopted harvest practices and BMPs to minimize effects from harvest activities on soil productivity, some impacts still occur. On the 74 sites monitored by DNRC from 1988 through 2004, severe soil compaction ranged from 0 to 56 percent of the harvest area, with 67 of the sites (90 percent) having less than 10 percent severely compacted area and four sites (5 percent) having 19 percent or more. Based on this monitoring, DNRC found that harvest on gentle slopes on fine-textured soils generally produced the most compaction, harvest in wet conditions produced greater areas of severe compaction, harvest in dry or frozen conditions reduced areas of severe compaction, and severe compaction most commonly occurred on sites that also showed displacement (DNRC 2004e).

During its monitoring, DNRC also found that displacement ranged from 0 to 43.5 percent on the 74 sites. For 50 of the sites (68 percent), less than 10 percent of the harvest area had displaced soil, while 13 sites (18 percent) had more than 15 percent soil displacement in the harvest area. DNRC also found that sites with the highest displacement of soils were located on steep slopes and dozer-piled sites (DNRC 2004e).

There are currently 391 individual classified forest trust land parcels with grazing licenses in the HCP project area, and these cover nearly 165,000 acres (DNRC 2008a), or about 30 percent, of the 548,500-acre HCP project area. Grazing by livestock can cause some degree of damage to soil structure, primarily in concentrated use areas, including salting areas, areas around watering troughs, stock trails, and dispersed camping sites. Soil compaction, displacement, and erosion can occur in concentrated use areas; however, these can vary based on the intensity, duration, and timing of the concentrated use. DNRC minimizes grazing-related impacts to soils and other resources through licenses that specify livestock carrying capacity, allowable season of use, and stipulations for addressing any problems or corrective actions necessary to prevent or mitigate previous or existing impacts. DNRC also monitors resource conditions through detailed grazing inspections prior to license renewal and at midterm, which is typically year 5 of a 10-year license.

Slope Stability

Timber harvest and associated road-related activities can potentially decrease slope stability by increasing water yields, road surface drainage concentrations, and exceedance of soil strength. Decreased slope stability can lead to mass movement, which is the downslope motion of earth materials under the influence of gravity. Types of mass movement include rock falls, soil creep, earth flows, debris flows, and slumps. Landslides, a general term for a variety of mass movements, involve the sliding, toppling, falling, or spreading of relatively large and often fairly intact masses along a failure surface (Gray and Leiser 1982; Gray and Sotir 1996). These events can occur rapidly or over a period of hours, weeks, or even years. The geologic processes and mechanics of landslides are well-understood, but the site-specific conditions of individual slides can be quite variable (Swanston 1974; Burroughs et al. 1976; Varnes 1978; Swanson et al. 1987; Chatwin et al. 1991; Selby 1993; Montgomery et al. 1998; Washington Department of Ecology 2005).

All types of gravity-induced down-slope movement of surface materials occur naturally on slopes, including tree falls, surface erosion, and landslides. The three main processes related to forest harvest and access roads are runoff-related surface erosion, washouts of road stream crossings, and various types of landslides. Landslides are typically not very common on forested trust lands, except for smaller slumps on steeper terrace faces and stream banks. Streambank stability and erosion from road surfaces and road stream crossings are discussed in later subsections.

Portions of the landscape with a higher probability of slope instability and erosion hazard can be estimated based on the geology, landforms, topographic position and shape, soil types, surface and shallow groundwater locations, vegetation conditions, and other site factors. Steep slopes are one of the main factors leading to landslides and increased erosion hazard, and they are often used as a first-level screening for identifying landslide or erosion hazard areas (Burroughs 1985).

Slopes less than about 15 percent (9 degrees) generally have a low probability of instability, and they are typically less susceptible to problems caused by timber harvest and roads, except near surface waters. Slopes in the range of about 15 percent to 49 percent (9 to 26 degrees) can have more management issues, especially when located at low-permeability geologic contacts, springs, or near shallow groundwater sources such as road cuts. Generally, problems within this slope range can be avoided or minimized by building fully engineered roads, use of BMPs, and regular monitoring and maintenance.

Slopes over 67 percent (34 degrees) are generally classified as high-risk landslide hazard areas for roads, and slopes over about 72 percent (36 degrees) are very high risk for roads and forest harvest and can cause a significant increase in landslides and erosion problems if disturbed (Swanston 1997; Gray and Sotir 1996; Dunne and Leopold 1978). Many surface soils on slopes over about 67 percent slope (34 degrees), or about 49 percent slope (26 degrees) for weaker soils, do not have enough soil strength to remain stable after harvest, road construction, or other ground or vegetation disturbance. Additional soil strength from vegetation, well drained surface conditions, and especially deep and dense roots helps keep slopes intact (Swanston 1997; Gray and Sotir 1996; Dunne and Leopold 1978). Vegetation reduces shallow groundwater by interception and evapotransporation, and it forms an interwoven web of roots that reinforces the soil. Loss of this additional strength due to ground or vegetation disturbance from forest roads or harvest on steeper slopes can lead to increased surface erosion or landslides depending on site conditions.

To minimize the potential for landslides caused by roads, DNRC implements applicable BMPs. These BMPs direct DNRC to minimize the number of roads, including the use of existing roads where practicable, and cooperation and planning with adjacent landowners. Additional BMPs require DNRC to locate roads on stable geology and avoid unsuitable areas, such as slumps and slide-prone areas characterized by steep slopes. Additional BMPs are implemented by DNRC during construction and maintenance.

DNRC also implements applicable BMPs in project designs to minimize the risk of landslides resulting from timber harvest. These BMPs include planning timber harvests using economically feasible logging systems that best fit site characteristics and season of harvest, while minimizing soil disturbance. Ground-based harvest is best suited for slopes less than 40 percent, while slopes up to about 65 percent are more suited for cable/skyline harvest methods. Over about 65 percent slope, potential slope instability is greater, and helicopter harvest methods are typically employed on these slopes.

Table 4.5-2 summarizes slope characteristics within the entire planning area, on trust lands within the planning area, and in the HCP project area. For both the entire planning area and trust lands within the planning area, low-gradient land (0 to 10 degrees slope) makes up a much larger portion of the CLO, as compared to the NWLO and SWLO. This is due to the flatter land features present east of the Rocky Mountains. However, in the HCP project area, the proportions of low-gradient land and lands with 10 to 30 degrees slope are similar across the three land offices, reflecting the similarity of lands across the three land offices that support timber. Lands with steeper slopes (30 degrees or greater) make up a small percentage of total lands in all three land offices (Table 4.5-2).

TABLE 4.5-2. AREA OF SLOPE CLASSES FOR THE PLANNING AREA, TRUST LANDS WITHIN THE PLANNING AREA, AND THE HCP PROJECT AREA

Slope Class (Degrees)	CLO		NWLO		SWLO			
	Acres	% of Total	Acres	% of Total	Acres	% of Total	Total Acres	% of Total
Planning Area (All Ownerships)								
0 – 10	14,403,965	62.9	2,992,263	32.9	2,471,348	33.3	19,867,576	50.4
10 - 30	7,421,636	32.4	4,911,790	54.1	4,186,971	56.3	16,520,398	41.9
> 30	1,070,623	4.7	1,179,851	13.0	773,972	10.4	3,024,445	7.7
Total	**22,896,225**	**100.0**	**9,083,903**	**100.0**	**7,432,291**	**100.0**	**39,412,419**	**100.0**
Trust Lands in the Planning Area								
0 – 10	937,888	74.3	135,536	42.9	109,631	46.7	1,183,055	65.2
10 - 30	311,027	24.6	158,069	50.0	114,264	48.7	583,360	32.2
> 30	13,531	1.1	22,680	7.2	10,857	4.6	47,068	2.6
Total	**1,262,446**	**100.0**	**316,286**	**100.0**	**234,752**	**100.0**	**1,813,484**	**100.0**
HCP Project Area								
0 – 10	33,010	29.2	107,850	39.4	61,264	37.8	202,123	36.8
10 - 30	74,242	65.6	143,664	52.5	92,358	57.0	310,264	56.6
> 30	5,962	5.3	21,908	8.0	8,319	5.1	36,189	6.6
Total	**113,214**	**100.0**	**273,422**	**100.0**	**161,940**	**100.0**	**548,576**	**100.0**

Source: DNRC (2008a).

Streambank Stability

A site-specific form of mass movement and surface erosion is found along stream banks and involves the same processes as those found on slopes, except with the added influence of channel flow and flood energy on streambank stability. As noted in Section 4.1 (Climate), flash floods are probably the most common form of flooding and result from locally heavy rainstorms in the spring and summer. The stability of stream banks is largely determined by the size, type, and cohesion of bank material, vegetation cover, and the amount of bedload carried by the channel (Sullivan et al. 1987). The web of roots, trunks, and down trees provided by dense riparian vegetation helps bind soil together, making it more resistant to erosion and slope failure (Wu and Sidle 1995). Dense riparian vegetation also provides hydraulic roughness that dissipates stream energy during high flows, which reduces bank erosion. Vegetation growing out of the stream bank and immediately adjacent to a stream channel is important in maintaining the present bank integrity (FEMAT 1993). Additionally, in migrating channels, vegetation within the CMZ is important in minimizing future bank erosion and providing complex hydraulic and habitat conditions over longer periods.

Road- and harvest-related slides, and especially those that occur near streams or on steep slopes above streams, often can deliver substantial sediment to streams and can increase in size from smaller features to larger ones delivering sediment over many years. While channel alterations from landslides are a natural part of hillslope and channel processes in mountainous areas, the frequency of shallow landslides is elevated in areas of forest harvest and especially in areas of increased road densities because of ground disturbance and changes to runoff (Swanston and Swanson 1976; Benda and Dunne 1997). Key factors related to forest practices that may affect streambank stability are changes in the amount and location of runoff, increased supply of fine and coarse sediment, modification of bank vegetation, and volume and supply of LWD. Channel conditions may change because of riparian zone harvest and channel or bank erosion from modified flow and sediment supply.

To conduct timber harvest and related road activities near streams, DNRC adheres to the SMZ Law and Montana Stream Protection Act. These acts require additional measures to minimize the risk of mass movement along stream banks beyond what is specified by the Forest Management ARMs and applicable BMPs. DNRC incorporates these additional measures into its project plans. A DNRC water resource specialist typically reviews project plans and may identify additional site-specific measures to reduce the potential for mass movement and sediment delivery.

Erosion

Erosion is the displacement and movement of soil particles by water, wind, ice, and gravity (DNRC 2004e). DNRC identifies three common types of erosion. Sheet erosion occurs when a shallow uniform layer of soils is removed from the land surface by runoff water. Rill erosion is a process in which multiple small shallow channels (up to a few inches deep) are formed by runoff water, while gully erosion occurs when water accumulates in narrow channels and quickly removes soil from these channels to a depth of 1 foot or greater (DNRC 2004e). Sheetwash erosion is common on hillslopes and roads, while rill and gully erosion forms where surface runoff is concentrated by the slope shape and road drainage. Erosion can also be caused by road drainage problems.

Precipitation, as rain or snowmelt, is the primary factor driving erosion. Raindrops cause rainsplash erosion on exposed areas. If rainfall intensity and duration are large enough, water cannot soak into the ground fast enough, and overland flow accumulates and starts to erode exposed surfaces. With enough rainfall, overland flow will concentrate and form rills and eventually gullies that further concentrate runoff. As noted in Section 4.1 (Climate), flash floods are probably the most common form of flooding and result from locally heavy rainstorms in the spring and summer. Snowmelt on disturbed areas (roads, landings, and skid trails) accumulates on those compact, unvegetated surfaces and generates runoff that can also cause erosion.

Base erosion rates are highly variable and primarily influenced by the amount of precipitation and soil texture (Gray and Sotir 1996). Vegetation condition and slope drainage length can also influence erosion, varying over several orders of magnitude (Gray and Sotir 1996). The loose surface duff layer and small local depressions protect the surface from erosion and temporarily store precipitation, thereby delaying or preventing surface runoff. Vegetation and the related surface duff layer are among the main factors controlling erosion. Interception of rainfall by the canopy and ground cover protects the soil surface from rainsplash, reducing and often eliminating overland flow. Therefore, a common erosion control approach is to minimize the area of vegetation and duff layer disturbance or stabilize the disturbed area until vegetation can re-establish.

The potential erodibility of surface soils is summarized in soil surveys using the K factor, which is a useful index for comparing erosion potential of various surface soils. The K factor indicates the susceptibility of a surface soil to sheet and rill erosion. It is an experimentally derived measure of soil erodibility under standard soil conditions based primarily on the percentage of silt, sand, and organic matter in the soil; soil structure; and permeability. For undisturbed sites, soil erodibility factors vary by about an order of magnitude. The K factor typically varies from 0.02 to 0.64, with a higher number indicating more susceptibility for surface soil erosion and a low K factor indicating a soil that is not very susceptible to erosion in an undisturbed condition. Soils with low susceptibility to erosion have K factors up to about 0.2, while moderately susceptible soils have K factors between 0.2 and 0.4. The most erodible soils tend to have K factors greater than 0.4 (Michigan State University 2002).

Table 4.5-3 summarizes K factors for surface soils in the entire planning area, on trust lands in the planning area, and in the HCP project area. Overall, the HCP project area has proportionately more land area with lower erosion susceptibility (a K factor of 0.20 or lower). Within the planning area, about 63 percent of the lands have surface soils with a low K factor, while surface soils on about 34 percent of trust lands within the planning area have a low K factor. About 79 percent of HCP project area lands have a lower K factor. Very few lands in the HCP project area (1.2 percent) have surface soils that are highly susceptibility to erosion (Table 4.5-3).

Road Surface Erosion

Research over the past 60 years clearly demonstrates that forest roads are a major source of sediment and soil erosion in forested watersheds (Grace and Clinton 2006). Surface runoff and the erosion it causes can deliver fine sediment, sand, and sometimes coarse sediment to surface waters, thereby degrading water quality, channel conditions, and aquatic habitat. Of the suite of DNRC management practices, erosion generated from road-stream crossings and surface erosion from valley bottom roads have been found to be the greatest contributors to sediment in surface waters (DNRC 2006c).

Surface erosion from roads tends to be a chronic source of fine sediment to the drainage network that can adversely impact the physical habitat of the aquatic system and degrade water quality for other water uses. Road-related surface erosion is affected by the road use level, road surface material, maintenance level, the intensity and amount of precipitation, weather conditions during hauling, and other factors (Megahan and Kidd 1972; Reid and Dunne 1984; Montgomery 1994;

Burroughs 1990). Forest roads are known to be significant areas of sediment erosion (Megahan and Kidd 1972; Cederholm and Reid 1987; Chamberlin et al. 1991; Harr and Nichols 1993; Best et al. 1995; Nolan and Janda 1995; Bolda and Meyers 1997; Reid and Dunne 1984). Road surface erosion can dramatically increase with greater traffic levels, especially during wet periods (Reid 1981).

TABLE 4.5-3. EROSION SUSCEPTIBILITY (K FACTOR) OF SURFACE SOILS IN THE PLANNING AREA, TRUST LANDS WITHIN THE PLANNING AREA, AND THE HCP PROJECT AREA BY LAND OFFICE

	CLO		NWLO		SWLO			
Erosion Susceptibility (K Factor)	**Acres**	**% of Total**	**Acres**	**% of Total**	**Acres**	**% of Total**	**Total Acres**	**% of Total**
Planning Area (All Ownerships)								
< 0.02 - 0.2	11,697,477	54.4	6,596,056	77.1	5,030,042	69.9	23,323,576	62.6
0.2 - 0.4	8,688,090	40.4	1,602,115	18.7	2,040,553	28.4	12,330,757	33.1
0.4 - 0.64	1,036,153	4.8	302,306	3.5	91,959	1.3	1,430,418	3.8
No Value	68,589	0.3	53,320	0.6	33,660	0.5	155,569	0.4
Total	**21,490,308**	**100**	**8,553,799**	**100**	**7,196,213**	**100**	**37,240,320**	**100**
Trust Lands in the Planning Area								
< 0.02 - 0.2	251,440	20.0	225,665	71.5	139,318	59.7	616,422	34.1
0.2 - 0.4	533,699	42.4	77,335	24.5	69,860	29.9	680,895	37.6
0.4 - 0.64	474,173	37.6	11,557	3.7	23,876	10.2	509,605	28.2
No Value	131	0.0	1,276	0.4	418	0.2	1,825	0.1
Total	**1,259,442**	**100**	**315,832**	**100**	**233,472**	**100**	**1,808,746**	**100**
HCP Project Area								
< 0.02 - 0.2	95,768	84.6	217,983	79.7	120,083	74.2	433,833	79.1
0.2 - 0.4	16,130	14.3	51,669	18.9	38,763	23.9	106,562	19.4
0.4 - 0.64	1,147	1.0	2,630	1.0	2,660	1.6	6,437	1.2
No Value	131	0.1	1,162	0.4	418	0.3	1,711	0.3
Total	**113,176**	**100**	**273,443**	**100**	**161,925**	**100**	**548,545**	**100**

Note: K factor generally ranges from 0.02 to 0.64. A low value indicates surface soils not very susceptible to erosion in an undisturbed condition
Source: DNRC (2008a).

Roads commonly intercept shallow stormflow groundwater at low-permeability rock or soil units and at small swales or drainages that often only flow during wet periods (LaMarche and Lettenmaier 2001; Bowling and Lettenmaier 2001). Road cuts and the need to drain the road bed concentrates this water, and it is often directed in ditches to minimize cross drains. The increased flow during storms causes more rilling and gullies in the ditches or on the slopes across which the water is discharged. Additional cross drains, water bars, and grade dips help keep the water dispersed and reduce potential for erosion and delivery of sediment to surface waters.

Erosion occurs from four main processes: freeze-thaw cycles, rainsplash, sheetwash, and channel flow. Rainsplash and sheetwash erode the exposed road surfaces, and ruts and ditches concentrate it into channel flow. During rainstorms and snowmelt periods, the compact, unvegetated road surface generates runoff that erodes the sand, silt, and clay from the road surface. If the road runoff crosses steep, loose, unvegetated fill, additional erosion occurs forming rills in the fill material and farther down slope. Roadside ditches or ruts on long steep slopes are common sources of erosion because the drainage area can be substantial and the runoff is often concentrated on steep grades with resultant high-erosion energy. Consequently, one of the most common erosion control methods controls drainage by dispersing runoff to avoid concentrated flow.

The potential for soil erosion from road areas is greatest immediately after construction and lessens with time (Grace 2000). Work conducted by Megahan and Kidd (1972) indicates that, for cutslope erosion, the first winter's erosion rate is about five times the rate during the following years. After construction or repairs and maintenance, vegetation starts to stabilize cutslopes, but the weakest, most vulnerable portions often have already failed during the first wet season. DNRC has observed more frequent small-scale and problematic failures from fillslopes. While re-vegetation after construction or repair and maintenance can also reduce the risk of fillslope erosion, other factors can increase the risk of failure. These factors include the use of vegetative debris in the fill portion of the road prism, disturbance or removal of trees and shrubs at the toe of the fillslope, and concentrated surface runoff from the road.

Road crossings of streams encroach into the channel and floodway and CMZ, thereby modifying the passage of water, especially floods and low flows, sediment passage, and channel migration processes. Road stream crossings typically include fill placed across the stream floodway, CMZ, and most of the active channel, with a culvert or bridge centered on the original channel. Culverts and bridges are sized to pass typical estimated flows, but do not allow for passage of large floods or sediment and woody debris that move during floods. Overtopping of a culvert occurs when flows are greater than culvert capacity or when plugging occurs. A reduced floodway makes a road crossing vulnerable to failure during floods, leading to failure and washing out of part or all of the road fill. Road stream crossings also introduce additional sediment to streams from the road surface of the approaches and fill. These sediments are easily delivered to streams because of the proximity and lack of room for a buffer or sediment trap.

The most substantial erosion and sediment delivery problems with road crossings are chronic sediment delivery from poor culvert armoring and rill erosion of fill material and, less frequently, failure of the crossing structure (DNRC 2006d). When road crossing failures occur, they are likely to deliver fine- and coarse-grained sediment directly to channels until repaired. Road crossings often fail when the flood volume is far greater than the culvert can pass during larger storms or when bedload sediment and woody debris are transported from the streambed and block the culvert. The historical use of undersized culverts (those with inadequate capacity due to size, damage, or plugging) or the partial or total plugging of a culvert causes the road fill to function like a dam. The subsequent seepage of water through the road fill or excessive erosion of the fill by water flowing over the top of the road substantially increases the failure potential. Consequently, crossings with large volumes of fill and steep upstream channel segments have a greater potential for failure. Areas with an increased frequency of large storms or increased stream flows resulting from large road surface areas or extensive harvest densities are also more likely to have stream crossing failures.

The current approach DNRC uses to minimize the amount of potential sediment delivery from new road construction, reconstruction, maintenance, abandonment, reclamation, and use is based on the SMZ Law (MCA 77-5-301 through 307), the road management ARM (ARM 36.11.421), and applicable Montana Forestry BMPs. DNRC builds roads to the minimum standard necessary to best meet current and future management needs and objectives and to minimize necessary maintenance. Relocation of an existing road is considered when reconstruction, maintenance, and/or use of that existing road would produce greater undesirable impacts than relocation. DNRC avoids use of existing roads in SMZs when potential water quality impacts cannot be adequately mitigated. DNRC also considers closing or abandoning roads that are non-essential to near-term future management plans, or where unrestricted access would cause excessive resource damage. DNRC also maintains drainage structures and other resource protection measures on both restricted and open roads.

Where possible and feasible, DNRC plans road systems cooperatively with adjacent landowners and considers yarding systems that minimize road needs. DNRC also attempts to minimize the number of stream crossings necessary for project objectives. DNRC road use agreements, including rights-of-way, incorporate road maintenance requirements proportional to road use. These requirements are enforced during the administration of those agreements. For cost-share and reciprocal access roads, DNRC works with its cooperators to address road maintenance and any erosion problems.

Comprehensive road management planning, including determining which roads to build, improve, maintain, close, abandon, or obliterate, is usually completed during project-level analysis. When planning the location, design, construction, and maintenance of all roads, DNRC complies with BMPs necessary to avoid unacceptable adverse impacts. A DNRC water resource specialist and/or soil scientist reviews most DNRC timber sales and timber permits involving substantial levels of new road construction or reconstruction. General and site-specific BMP designs and other mitigation measures recommended by specialists are incorporated into timber sale EAs and contracts. DNRC timber sale contracts include detailed information, standards, and specifications for implementing site-specific BMPs, mitigations, and other resource protection measures. The timber sale contracts also contain road construction, road improvement, and road maintenance specifications, specification drawings, and detailed road logs.

DNRC typically implements actions aimed at reducing or eliminating identified or potential sources of sediment from existing roads at the project level and as funding is available. These actions usually consist of various road improvements, road maintenance activities, and road upgrades that have been identified within the project area. These actions are generally intended to bring the existing roads up to a standard that complies with BMPs. In some cases, a particular road or segment of road cannot be brought up to acceptable standards due to location, road conditions, or other factors. In those cases, the road or portion of the road may be relocated, abandoned, or obliterated. DNRC generally determines which roads to close, abandon, or reclaim during project-level analysis. Abandoned and reclaimed roads are left in a condition providing adequate drainage and stabilization without requiring periodic maintenance.

DNRC administers all road construction and road improvement projects to ensure that activities are conducted as specified in contracts and that resource protection requirements are being met. Adjustments are made in cases where operations fail to meet requirements, unforeseen circumstances are encountered, or when operating conditions may require design modifications. Projects are typically monitored through weekly inspections. Results of contract inspections are documented through the completion of written contract inspection reports. Every 5 years, DNRC compiles the results of all contract inspection reports and includes a summary of the information in a monitoring report completed for the Land Board.

Research on the effectiveness of BMPs for reducing surface runoff and erosion shows they can reduce sediment yield and delivery to surface waters when properly applied and maintained (Grace and Clinton 2007). Appropriate BMPs can reduce sediment yield from roads by 40 to 85 percent (Burroughs 1990; Burroughs and King 1989; Burroughs and King 1985; Grace et al. 1998; Grace 2002; Grace et al. 1999; Madej 2001). Common measures include adding cross drains or drainage dips; re-vegetating ditch slopes, fillslopes, and cutslopes; adding rock check dams to the ditch or road surface; placing slash or berms along the road edge; diverting drainage to areas with wide streamside buffers; and limiting road traffic to dry or frozen periods.

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 employs several different approaches to conduct these road assessments on forested trust lands. Within the Stillwater Block and Swan River State Forest, DNRC currently identifies and prioritizes road maintenance needs and ineffective road closures on a 5-year cycle, as required by ARM 36.11.421. Road on scattered parcels are assessed on a less regular frequency during timber sale planning and watershed inventories. DNRC is currently in the process of examining its program to determine whether the ARM requirement to assess all roads every 5 years can be met, especially on scattered parcels. Under the watershed monitoring program (ARM 36.11.424), DNRC has been conducting a systematic inventory of watershed conditions of forested trust lands since 1998. Coordinated by the FMB, these inventories are conducted statewide and include comprehensive evaluations of existing road systems, stream crossing structures, and other potential sources of erosion and subsequent sediment delivery to streams. This information is used to characterize existing road conditions, determine maintenance needs, and prioritize necessary improvements. Watershed assessment and analysis completed for timber sale projects typically include a similar level of comprehensive road evaluation, specifically for existing road conditions and maintenance needs within the project planning area. Other road improvement needs are identified through casual observations or reports made by DNRC field staff during the normal course of carrying out their administrative duties.

Between 1998 and 2001, DNRC inventoried about 405 miles of road in selected watersheds managed by DNRC (DNRC 2006c) (Figure 4.5-1). These watershed inventories addressed all road networks in the predefined project area and current conditions of all crossing sites (both wet and dry). The inventory identified high-risk road sediment delivery and drainage problems, along with general maintenance needs for various road features. The 405 miles of road represent the data used in the inventory analysis and is different than the 763 miles of road reported by DNRC to have been included in watershed inventories to date (DNRC 2005b). This difference is due to the lack of summary data available for some internal inventories. The 1998 through 2001 inventory accounts for 15 percent of the roads within the HCP project area, and provides a statistically significant sample of road problems that are commonly seen on forested trust lands (DNRC 2006c).

For the 1998 through 2001 inventory, the average road width was 13.8 feet, road grades ranged from 1 to 15 percent, and the average problem road segment lengths found was 629 feet (DNRC 2006c). Problems with a high risk of sediment delivery identified in the inventory were used to compile a table of high-risk road problems associated with the 365 road features evaluated (Table 4.5-4). Each high-risk problem identified by the inventory was associated with one of 13 feature categories. These feature categories were used to identify road features that were either solely responsible for direct delivery of sediment or posed a high risk of delivery in the future. Examples of the feature categories included are stream crossing culverts, drain dips, and relief corrugated metal pipes (CMPs). A relief CMP is a crossdrain structure for an inboard ditch on a road segment.

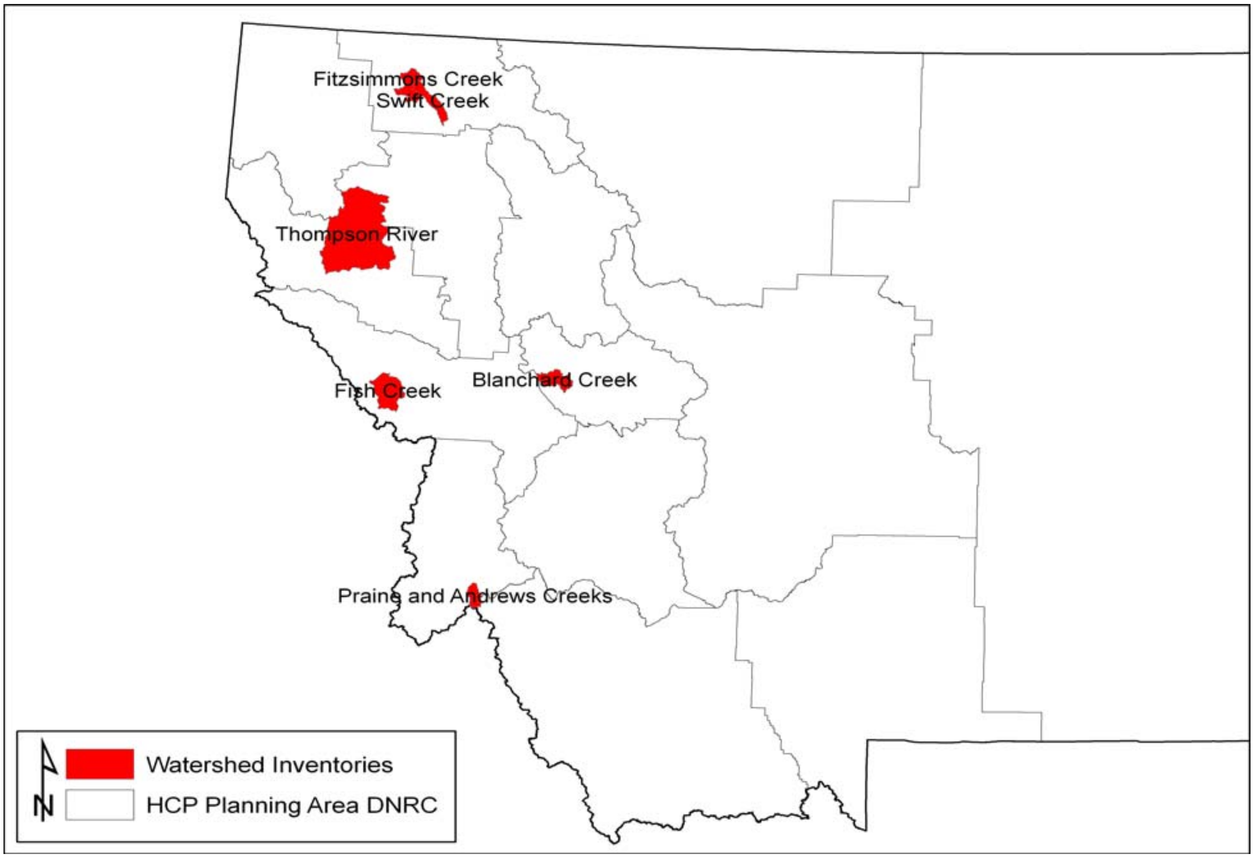

FIGURE 4.5-1. WATERSHEDS INCLUDED IN DNRC'S 1998 THROUGH 2001 INVENTORY

The results of the inventory are contained in Table 4.5-4. Road features associated with stream crossings were found to be a major source of erosion and direct delivery of sediment to surface waters in the area inventoried, representing 196 of the 365 (54 percent) problems identified (DNRC 2006c,d). Of the 196 stream crossing features identified as high-risk problems, 168 (46 percent of all features inventoried) were associated with stream CMPs. For these features, the most common problems were capacity/plugged (28 percent of stream CMPs), alignment/grade (24 percent), and energy control/armoring (20 percent). Forty-six percent of all features were associated with inadequate road surface drainage. The most common road surface drainage features identified as high-risk problems were relief CMPs (20 percent) and drain dips (15 percent). More than half of the relief CMPs (57 percent) had capacity/plugged issues, while 85 percent of the drain dips had surface drainage problems. Only one high-risk problem was associated with mass wasting, which was due to issues of energy control, road fill eroding, and/or armoring.

TABLE 4.5-4. SUMMARY OF PROBLEMS ASSOCIATED WITH ROAD FEATURES IDENTIFIED DURING DNRC'S 1998 THROUGH 2001 ROAD INVENTORY

Road Features					Problems Associated with Each Road Feature Category								
Feature Category ID	**Feature Category**	**Number of Features with High-risk Problems Identified**	**Percent of Sample**	**Average Number of Problems Associated with Feature**	**Alignment/ Grade (% of Features)**	**Capacity/ Plugged (% of Features)**	**CMP Needed (% of Features)**	**Energy Control/ Road Fill Eroding/ Armoring (% of Features)**	**Filtration (% of Features)**	**Structure Damage (% of Features)**	**Surface Drainage (% of Features)**	**Direct Delivery (% of Features)**	**Total Number of Problems**
Features Related to Stream Crossings													
1	Bridge	3	0.8	2.00	0.0	50.0	0.0	16.7	16.7	0.0	16.7	0.0	**6**
5	Ford	3	0.8	2.00	0.0	0.0	33.3	16.7	16.7	16.7	16.7	0.0	**6**
7	Native Material Crossing	16	4.4	1.65	0.0	18.5	0.0	25.9	18.5	14.8	22.2	0.0	**27**
8	Native Material/Fill Crossing	6	1.6	1.54	0.0	22.2	11.1	22.2	0.0	33.3	11.1	0.0	**9**
12	Stream CMP	168	46.2	1.31	24.2	28.0	0.0	19.5	11.4	0.4	14.0	2.5	**236**
Total		**196**	**53.8**		**57**	**76**	**3**	**57**	**34**	**9**	**42**	**6**	**284**
Features Related to Road Surface Drainage													
2	Ditch	3	0.8	1.30	0.0	25.0	25.0	50.0	0.0	0.0	0.0	0.0	**4**
3	Drain Dip	53	14.6	1.00	0.0	0.0	0.0	15.1	0.0	0.0	84.9	0.0	**53**
4	Dry CMP	7	1.9	1.57	9.1	27.3	9.1	36.4	18.2	0.0	0.0	0.0	**11**
9	Road Segment	30	8.2	1.08	0.0	0.0	14.3	53.6	0.0	0.0	21.4	10.7	**28**
10	Relief CMP	71	19.5	1.16	11.9	57.1	4.8	9.5	3.6	4.8	7.1	1.2	**84**
11	Seeps	3	0.8	1.00	0.0	0.0	66.7	0.0	0.0	0.0	0.0	33.3	**3**
13	Water Bar	1	0.3	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	**1**
Total		**168**	**46.1**		**11**	**52**	**12**	**37**	**5**	**4**	**57**	**5**	**183**
Other Features													
6	Cutslope Failure	1	0.3	1.00	0.0	0.0	0.0	100.0	0.0	0.0	0.%	0.0	**1**
Total		**1**	**0.3**		**0**	**0**	**0**	**1**	**0**	**0**	**0**	**0**	**1**
Sum		**365**			**68**	**128**	**15**	**95**	**39**	**13**	**99**	**11**	**468**
%			**100.0**		**14.5**	**27.4**	**3.2**	**20.3**	**8.3**	**2.8**	**21.2**	**2.4**	

Source: DNRC (2006c).

Erosion from Timber Harvest

Harvest area soil disturbance includes detachment, compaction, and erosion, mostly related to skid trails and landings. Effects of harvest on soil compaction and displacement were also discussed above under Soil Productivity. Tractor logging skid trails and landings disturb and compact surface soils and can concentrate runoff in ruts. Cable logging using partial suspension methods form ruts along drag lines and can concentrate surface runoff depending on the degree of log suspension. Clearcuts create the greatest area of soil disturbance (Hermann 1978), but ground disturbance from felling, yarding, and skid trails in partial cuts also causes ground disturbance and compaction. Levels of soil disturbance in clearcut and partial cut areas can be comparable in some areas because of the need for equivalent access through a harvest unit (Cromack et al. 1978). Most of the areas harvested by DNRC are well buffered from surface waters (i.e., in riparian areas); consequently, local surface erosion is buffered and typically does not reach streams or other waterbodies.

To minimize erosion from harvest, as well as slash treatment and site preparation, DNRC implements applicable BMPs in project designs. These designs use economically feasible logging systems and slash treatment and site preparation methods that best fit site characteristics and season of harvest, while also minimizing soil disturbance. A DNRC water resource specialist typically reviews project plans and may identify site-specific measures to further reduce the risk of erosion.

Of the 74 harvest sites monitored by DNRC from 1988 through 2004, observed surface erosion only occurred on skid trails at four (5 percent) of the sites. Soil impacts on these sites ranged from 0 to 3 percent of harvest area, but there was no delivery of sediment to surface waters. Observed erosion on fire salvage sales ranged from low to high and occurred on both logged and unlogged monitoring sites (DNRC 2004e). Watershed monitoring by DNRC indicates the delivery of sediment from harvest area erosion to surface waters is limited, particularly compared to the delivery of sediment from roads (DNRC 2006c).

Post-harvest site preparation may include scarification to expose mineral soil for seedling establishment and to reduce plant competition. Scarification promotes natural conifer regeneration from seeds of nearby trees, and many of the harvest sites monitored by DNRC had a silvicultural goal for scarification on 30 to 40 percent of harvest area. DNRC defines scarification as the mechanical removal of competing vegetation and debris and considers it slight disturbance of the soil surface. Slight disturbance ranged from 0 to 60 percent of harvest area on the 74 monitored sites, with only 16 sites having more than 30 percent of the area slightly disturbed (DNRC 2004e). Slight disturbance is not considered a detrimental soil impact.

Streambank Erosion

Forest practices affect levels of surface erosion primarily by changing sediment yield and delivery to surface waters. However, not all material that erodes from roads or slopes is transported to surface waters. Streamside buffers allow road or hillslope surface runoff to infiltrate, and the eroded and transported sediment to deposit in the buffer, before it reaches surface waters. Buffer width, slope, soil conditions, and vegetation density are primary factors controlling how much eroded sediment can be removed from the runoff volume and prevented from entering a stream. Dense vegetation and loose non-disturbed soils are required to effectively remove eroded sediment during storm runoff periods.

Buffers are substantially more effective at removing coarse-grained material (gravel and coarse sand) than finer-grained material (fine sand, silt, and clay) (Rashin et al. 1999). Runoff from road surfaces includes a high percentage of fines, so they often are the biggest contributor of sediment to streams (Grace 2004). Roads and drainage ditches are important components affecting erosion because they are typically bare, erodible dirt after construction or cleaning. The road surface, cutslopes and fillslopes, and ditches can all increase and concentrate surface runoff, which can erode and transport sediment directly to surface waters. If there is a wide buffer between surface waters and the road or the road cross drains, most or all of the eroded sediment typically deposits within the buffer area, minimizing sediment delivery to the stream.

The primary harvest area erosion risks occur from harvest activities within SMZs and RMZs that can degrade the effectiveness of the buffer zone to remove sediments. However, the overall risk appears to be relatively small. The existing SMZ Law, Forest Management ARMs, Montana Forestry BMPs, and DNRC forest management policies are generally effective at minimizing the soil disturbance activities (DNRC 2005b). In addition, existing harvest methods and procedures minimize soil disturbance, and existing riparian buffers provide adequate filtration of sediments.

Streamside buffers can substantially reduce coarse and fine sediment that is transported over land (Rashin et al. 1999). The filtering capacity of buffers is affected by timber harvest activities within the buffer area. Soil and vegetation disturbance generally increase the sediment delivery potential, and the addition of obstructions on the forest floor from tree limbs and limb-free trunks associated with partial logging, can somewhat offset the diminished filtration (Burroughs and King 1989). These factors influence the ability of buffers to trap sediment by controlling the infiltration rate, flow path length, and velocity of overland flow.

Studies in various regions show that one size of buffer does not fit all situations (Rashin et al. 1999). Johnson and Ryba (1992) prepared a summary of recommended buffer widths based on an extensive literature review. For sediment control, these buffers ranged from 10 to 300 feet, depending on site conditions. In a study of exposed soils and sediment delivery from various harvest methods, Rashin et al. (1999) found that in areas with no stream buffers, BMPs were not effective in preventing sediment from reaching streams. They determined that buffers at least 30 feet wide were needed for effective filtering of sediment under the limited rainfall conditions of the study.

The potential for reducing in-stream effects of road-related mass movement and surface erosion with buffers is most critical where roads are close to surface waters. Some legacy roads (those historical roads constructed prior to BMP development and implementation) were built right along creeks to avoid steep valley wall slopes and where roads approach and cross streams. Table 4.5-5 summarizes miles of road within 100 feet and 300 feet of streams on all ownerships in the planning area, trust lands within the planning area, and HCP project area lands. For roads within 100 feet of streams in the planning area, only about 6 percent are on trust lands, while only 5 percent of planning area roads within 300 feet of streams are on trust lands. However, more than half the roads within 100 feet and 300 feet of streams on trust lands within the planning area are also included in the HCP project area (Table 4.5-5). Given the large proportion of high-risk problem sites identified from DNRC's watershed inventory due to road surface drainage (46 percent of documented sites, Table 4.5-4), management of near-stream roads and their vegetated buffer zones is important to address delivery of sediment to streams and subsequent effects on water quality and aquatic habitat conditions.

TABLE 4.5-5. MILES OF ROAD WITHIN 100 FEET AND 300 FEET OF STREAMS IN THE PLANNING AREA, ON TRUST LANDS WITHIN THE PLANNING AREA, AND IN THE HCP PROJECT AREA BY LAND OFFICE

Forest Road Streamside Buffers	CLO		NWLO		SWLO		Total Road Miles
	Road Miles	% of Total	Road Miles	% of Total	Road Miles	% of Total	
Planning Area (All Ownerships)							
Road Miles within 100 Feet of Streams	2,187	31.4	1,927	27.7	2,844	40.9	6,958
Road Miles between 100 and 300 Feet of Streams	8,272	35.7	6,604	28.5	8,288	35.8	23,164
Total Road Miles within 300 Feet of Streams	**10,459**	**34.7**	**8,532**	**28.3**	**11,132**	**37.0**	**30,122**
Trust Lands in the Planning Area							
Road Miles within 100 Feet of Streams	138	35.0	121	30.7	136	34.3	395
Road Miles between 100 and 300 Feet of Streams	487	38.7	414	32.9	359	28.5	1,260
Total Road Miles within 300 feet of streams	**626**	**37.8**	**535**	**32.3**	**495**	**29.9**	**1,656**
HCP Project Area							
Road Miles within 100 Feet of Streams	24	10.2	103	43.5	110	46.3	238
Road Miles between 100 and 300 Feet of Streams	73	10.3	358	50.3	280	39.4	712
Total Road Miles within 300 Feet of Streams	**98**	**10.3**	**462**	**48.6**	**390**	**41.1**	**950**

Note: Numbers are summarized by land office; consequently, they do not match those presented in Table 4.8-7, which are based on EIS aquatic analysis unit.
Source: DNRC (2008a).

Monitoring Implementation and Effectiveness of BMPs

Montana Forestry BMPs contain a broad range of specific practices addressing road planning and location, road drainage, road construction, road maintenance, stream crossing design, stream crossing installation, and harvest design. The proper application of appropriate BMPs has been repeatedly demonstrated to minimize sediment transport and delivery from roads (Burroughs and King 1989; Cook and King 1983; DNRC 2004c; Rothwell 1983; Seyedbagheri 1996). Montana Forestry BMPs are designed to ensure that forestry activities meet state water quality standards. In fact, under the *State of Montana: Nonpoint Source Management Plan* (MDHES 1991; MDEQ 2006), Montana Forestry BMPs are recognized as the primary mechanism to enable achievement of water quality standards.

All road construction, reconstruction, maintenance, use, abandonment, and reclamation associated with DNRC forest management activities are designed to implement appropriate and applicable BMPs (ARMs 36.11.421(3) and 36.11.422(2)). DNRC complies with BMPs as necessary to avoid unacceptable adverse impacts. BMPs appropriate for a given project or situation are generally determined during project development and environmental analysis.

DNRC has participated in monitoring the implementation and effectiveness of Montana Forestry BMPs since 1988. DNRC participates in statewide forestry BMP audits conducted by interdisciplinary teams with representatives from federal and state agencies, private landowners, and conservation groups. The statewide BMP audits 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 also conducts internal BMP audits on ongoing and recently completed DNRC timber sales. Water resource specialists from both the FMB and DNRC area land offices conduct these audits. The DNRC internal BMP audits use the same methods and rating systems used for the statewide BMP audits. Additionally, DNRC 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.

Overall, DNRC's use of BMPs and mitigation measures to minimize detrimental soil impacts from compaction, displacement, and erosion on harvest areas has been effective. Since the inception of the statewide BMP audits in 1990, DNRC has consistently ranked among the highest of all ownership groups in both BMP application and effectiveness (DNRC 2000b, 2002a, 2004c, 2005b, 2006e). These local results and other BMP effectiveness studies indicate the risk of water quality impacts from forest roads can be reduced with proper use of BMPs (NACASI 1979, 1994a,b; Cook and King 1983; Burroughs and King 1989; Rashin et al. 1999). Internal BMP audits on 83 DNRC timber sales found that BMPs were applied 97 to 98 percent of the time, and these results were comparable to statewide audits (DNRC 2005b).

4.5.1.4 Gravel Sources

Another potential source of erosion is borrow sites and gravel pits. Gravel and rock sources are sometimes used to supply materials for road maintenance and new road construction on trust lands. Covered forest management activities include gravel pit and borrow site development, use, and reclamation for the purposes of mining or borrowing material used in forest road construction, reconstruction, and maintenance. In general, most gravel operations associated with DNRC forest management road activities are relatively small borrow sites where native materials are excavated and used as fill or surfacing material without further processing. These sites are generally associated with road cuts and are less than 0.1 acre of additional disturbance (DNRC 2007d). While borrow sites may extend the width of the roadway and disturb a greater area than a normal road segment, the effects are usually localized and are adequately addressed under BMPs, the SMZ Law, and the Forest Management ARMs (DNRC 2007d).

A medium gravel pit is a source of gravel or rock that may involve 1 to 4.9 acres of disturbed area. Medium pits receive intermediate levels of use and may be activated periodically to serve as sources for multiple road maintenance and/or construction projects in any given year or across multiple years. The majority of these sites serve as pit run sites (a truck enters, gets what it needs, and leaves), and no further processing of materials occurs onsite. However, medium pits may also involve crushing, sorting, and/or asphalt operations.

Infrequently, DNRC initiates major forest road construction or improvement projects that require large amounts of cleaned, sorted, and, in some cases, crushed gravel. These larger gravel developments may involve extensive gravel processing operations, larger areas of disturbance, and detailed reclamation plans (DNRC 2007d). They include sorting and/or crushing operations and removal of more than 10,000 cubic yards of material. Pits involving the excavation of more than 10,000 cubic yards of material are subject to the rules and regulations (ARMs 17.24.201 through 225) governing the Montana Open Cut Mining Act (MCA 82-4-4) administered by MDEQ. Operations of this size are subject to permitting, which requires submission of a detailed plan of operation and reclamation plan, as well as posting of a reclamation bond. The operating plan must include measures to protect onsite and offsite surface and ground water.

There are currently a limited number of gravel pits in the HCP project area, and most are typically medium pits and operated for specific projects. Once these projects are completed, the gravel pits are typically reclaimed or intermittently operated to support local road maintenance activities. The recent trend in the SWLO and CLO has been to order gravel and rock from private sources and have it delivered to the DNRC project area.

4.5.1.5 Effects of and Trends in Climate Change

As discussed in Section 4.5.1.3, Effects of Forest Management Activities on Soils, soil productivity can be affected by fire, surface erosion, and mass movements (where soils and landforms are prone to these types of events), as well as forest management activities, by changing surface runoff amounts and drainage patterns, soil saturation, soil compaction, displacement, surface permeability, aeration, and nutrient supply. Precipitation, as rain or snowmelt, is the primary factor driving erosion, while mass movements can result from decreased slope stability caused by several factors, including increased water runoff or loss of soil strength due to vegetation removal such as tree falls. In addition to these factors, streambank erosion is also affected by changes in channel flow and flood energy.

Several effects of climate change that have been observed and are expected to continue within the planning area (Section 4.1, Climate) may increase the potential for effects on soil productivity and increased risk of surface erosion, mass movements, and streambank erosion. These include increases in the amount of precipitation falling as rain instead of snow, earlier spring snowmelt, increases in the frequency of extreme events such as intense downpours and windstorms, and longer, hotter, and drier summers. Increased peak winter flows have been documented in the western United States (Saunders et al. 2008), and these, as well as the potential for flooding, are expected to increase in the future (Field et al. 2007).

These changes in weather patterns may also increase the risk of surface erosion and mass movements (where soils and landforms are prone to these types of events) caused by forest management activities. For example, more frequent intense rainfall events may be more likely to cause washouts of road stream crossings, road surface or harvest area erosion, or mass movements along roads. Additionally, fewer days of below-freezing temperatures, reduced snowpacks, and earlier spring snowmelt may decrease opportunities for DNRC to employ some harvest methods during frozen or snow-covered conditions to reduce soil compaction and displacement.

4.5.2 Environmental Consequences

This section discusses and compares the potential differences in effects on soil productivity, slope stability, erosion, and gravel sources from changes to DNRC forest management program under the four EIS alternatives. Effects of sediment delivery on water quality and aquatic life from changes in slope stability and erosion are discussed in Sections 4.6 (Water Resources) and 4.8 (Fish and Fish Habitat).

4.5.2.1 Introduction and Evaluation Criteria

Soil productivity, slope stability, and erosion are affected by land-disturbing activities, including forest management activities. Changes in DNRC's forest management program could increase or decrease potential risks of adverse effects on soil productivity, slope stability, and erosion. Both the amount of land-disturbing activities and any program policies addressing effects from such activities on the soil resource can influence the potential risk of adverse effects on soils. The following evaluation criteria were identified to support the comparison of changes in effects on soils between the alternatives:

Soil Productivity (compaction and displacement)

- Changes in miles of new road
- Changes in level of harvest (annual sustainable yield)
- Changes in grazing management policies.

Slope Stability

- Changes in miles of new road
- Changes in rates of road stream crossing repairs
- Changes in levels of harvest
- Changes in management policies to identify and avoid or protect unstable areas, as well as monitor and mitigate any areas where failures occur.

Erosion

- Changes in miles of new road
- Changes in rates of road stream crossing repairs
- Changes in levels of harvest
- Changes in management policies to avoid, control, or mitigate sediment production and delivery to streams.

The development, management, and availability of gravel sources are dependent on DNRC's management policies for that resource. The alternatives are compared based on any changes in DNRC's management policies for gravel sources.

Mass movements, or landslides, are not considered a major sediment source related to forest practices on HCP project area lands, except for some steep terrace faces, steep or high road cuts or fills, and high stream banks. DNRC implements applicable BMPs to avoid steep slopes and minimize the risk of sediment delivery from potential mass movement. As mentioned in Section 4.5.1 (Affected Environment), DNRC has consistently ranked among the highest of all ownership groups in both BMP application and effectiveness. Forest management activities adjacent to streams and on stream banks are also restricted by the SMZ Law and Montana Stream Protection Act. Consequently, slope stability is not discussed further in this evaluation of alternatives.

With respect to road-related erosion, the timing of road inventories and implementation rate of corrective actions, through the use of BMPs, monitoring, and upgrades to roads, are the primary factors that vary between the alternatives. All of the alternatives include minimizing miles of road, implementing appropriate BMPs, and prohibiting roads within SMZs except where needed to cross streams.

To compare erosion from stream crossings between alternatives, DNRC used data collected from its inventory of a portion of the HCP project area between 1998 and 2001. From this inventory, DNRC identified 127 problematic stream crossing sites, which are summarized in Table 4.5-6. Corrugated metal pipe diameter and length data collected during the inventory were used to estimate the volume of sediments that would be delivered to the streams at each crossing should a catastrophic failure occur (Table 4.5-6). The failure rate was determined using 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. This analysis estimated an average failure probability (over the Permit term) of 52 percent for the identified problem CMPs, and an average at-risk sediment volume of about 57 cubic yards (Table 4.5-6). 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 to catastrophic failures.

TABLE 4.5-6. SUMMARY OF THE FAILURE POTENTIAL AT PROBLEM STREAM CROSSING SITES IDENTIFIED FROM 1998 THROUGH 2001 DURING DNRC WATERSHED INVENTORIES

Watershed	Total Sediment Volume (cubic yards)	Number of Sites	Average Sediment Volume per Site (cubic yards)	Average Probability of Failure in 50 Years (percent)
Blanchard	188	6	31	84
Fish Creek	512	10	51	69
Fitzsimmons	232	6	39	63
Lower Swift	3,974	29	137	64
Lower Thompson	716	11	65	72
Middle Swift	1,251	28	45	33
Praine/Andrews	33	1	33	1
Upper Thompson	827	13	64	72
West Fork Swift	1,141	23	50	11
Total/Average	**8,874**	**127**	**57**	**52**

Source: DNRC (2008e).

Site-specific upgrades, maintenance, and applications of BMPs are expected to minimize stream crossing failures on forested trust lands. These upgrades are applied based on the schedule or strategy specific to each alternative. As high-risk crossings are upgraded, they are less likely to fail, reducing the cumulative potential for erosion of sediment into HCP project area streams. Therefore, the alternatives are compared based on how fast the high-risk culverts are upgraded.

4.5.2.2 Alternative 1 (No Action)

Under Alternative 1, DNRC would continue its forest management activities subject to current program policies defined by the Forest Management ARMs, the SFLMP, and other applicable regulatory framework as described in Section 4.5.1.1. Changes to the program may occur in the future; however, the nature of possible changes is not known and cannot be evaluated.

Under Alternative 1, the annual sustainable yield would be 53.2 million board feet statewide and 50.7 million board feet within the HCP project area (Table 4.2-14), which is the same as the current levels. Because the level of harvest would be the same as under the current program, the risk of effects on soil productivity would likely also be the same, although site-specific conditions would result in some variation in levels of disturbance. DNRC would continue to implement BMPs designed to avoid or minimize soil compaction and displacement and retain fine and coarse woody debris to support nutrient cycling. DNRC would also continue to follow the SMZ Law, which restricts equipment use in SMZs to minimize soil compaction from harvest-related activities.

DNRC's current program policies also include monitoring grazing licenses prior to granting a new license or license renewal and at midterm (typically every 5 years). These monitoring events provide an opportunity for DNRC to identify potential adverse effects to soil productivity in areas of concentrated use and implement corrective actions if necessary. For each license, DNRC also specifies livestock use levels, season of use, and other applicable stipulations to minimize the risk of effects on soils.

<u>Erosion</u>

Road-related Erosion

Under Alternative 1, an estimated 1,408 additional miles of road (including abandoned and reclaimed roads) would be ~~constructed~~present on the HCP project area landscape, including about 1,121 miles of new road construction, by year 50 (Table 4.4-6)~~, and road densities in the HCP project area would increase by approximately 1 percent (Table 4.4-7)~~. Because DNRC would construct the~~se~~ new roads using all applicable BMPs, the risk of erosion would be minimized. However, as noted in Section 4.5.1 (Affected Environment), the risk of erosion is higher for the first few years after construction until disturbed areas, such as cutslopes and fillslopes, have revegetated and stabilized. As roads are built throughout the Permit term and previously constructed roads require repair, the risk of erosion would likely increase.

For existing roads, DNRC would continue to be required to assess open and closed roads every 5 years and prioritize problems. However, the current program does not specify how problems would be prioritized or provide a timeline for fixing identified problems. Also, it is uncertain whether DNRC can meet the 5-year assessment requirement for roads on scattered parcels, and this may remain the case under Alternative 1 during the Permit term.

Although some existing roads would be abandoned and reclaimed and others would be upgraded to at least the current standards, these would not necessarily occur in the areas presenting the greatest erosion potential. Corrective actions to bring roads up to BMP standards would continue, but as part of each harvest project only when funding is available. As is currently the case, a DNRC water resource specialist would typically review proposed road activities in watersheds with sensitive fish and make recommendations to reduce sediment delivery; however, this is not specifically required under Alternative 1.

Alternative 1 would continue implementation of existing laws, regulations, and BMPs that are generally effective at minimizing erosion of road surfaces, as well as upgrading existing problem road areas. This alternative would also continue to minimize construction of new roads and avoid new road construction within SMZs and RMZs, except where stream crossings are needed.

Over the Permit term, DNRC would continue to build new roads to current standards using BMPs and upgrade existing roads to meet current BMP standards. As a result, forest road conditions would improve over time under Alternative 1, resulting in an overall reduction of surface erosion and subsequent sediment delivery to HCP project area streams over the long term as the pool of remaining problem areas is reduced through upgrades.

Erosion from Stream Crossings

Over time, most of the existing culverts in the HCP project area would be removed or replaced. This would result in a gradual reduction in the risk of culvert failure. However, Alternative 1 would not necessarily result in the timely replacement of the most problematic culverts, or a consistent schedule for replacement. The replacement rate would be based on the actual need for the road for forest management activities and on available funding.

Harvest-related Erosion

The overall level of harvest in the HCP project area is estimated to result in an annual sustainable yield of 50.7 million board feet, contributing to a statewide total of 53.2 million board feet. Harvest area soil disturbance would be expected to continue to be minimized by following existing harvest management laws and regulations and applicable BMPs, which are generally effective at reducing erosion effects of harvest activities.

As discussed in Section 4.5.1 (Affected Environment), the primary harvest-related erosion risks occur from harvest activities within SMZs and RMZs, and these areas would be protected under existing SMZ and RMZ rules. Harvest-related erosion potential in SMZs could occur under Alternative 1 because partial harvest would still be allowed. Because each SMZ extends from the stream bank to between 50 and 100 feet landward, erosion, soil compaction, or displacement are more likely to result in sediment delivery to project area streams during storm runoff periods than from harvest in areas outside of SMZs. Alternative 1 also does not incorporate a CMZ, so actively migrating channels could easily diminish SMZ buffer areas and potentially increase erosion risk and subsequent sediment delivery over the long term.

Gravel Sources

Gravel pit operations are expected to continue to be relatively small under Alternative 1, and typically would be distributed along the roadway alignments. These operations would continue to be sited away from streams and riparian areas, according to existing rules and regulations, and with no specific restrictions on the number of actives sites. Borrow sites and medium pits developed for a specific project would typically be reclaimed soon after project completion. DNRC would continue to implement applicable BMPs to avoid or minimize the risk of erosion from activities at these sites.

4.5.2.3 Alternative 2 (Proposed HCP)

Under Alternative 2, annual sustainable yield would be higher and miles of new road lower than under Alternative 1, but DNRC would implement additional resource protection measures to reduce the risk of forest management activities affecting soil productivity and erosion. Also under this alternative, forest management activities would increase in the Stillwater Core.

Soil Productivity

Under Alternative 2, approximately 1,387 additional miles of ~~new~~ road (including abandoned and reclaimed roads) would be ~~constructed~~present on the HCP project area landscape at the end of the Permit term, including about 1,100 miles of new road construction. These totals are~~, which is~~ about 21 miles fewer than under Alternative 1 (Table 4.4-6). While this alternative would result in a lower level of permanent soil productivity loss due to fewer roads being constructed, the reduction would not be substantial at the landscape scale. DNRC would continue to implement applicable BMPs to minimize risks to soil productivity from compaction and displacement from road-related activities.

The annual sustainable yield under Alternative 2 would be ~~58.0~~57.6 million board feet, which is an ~~9~~8 percent increase over Alternative 1 (Table 4.2-14). With a higher level of harvest predicted, a comparable increase in the amount of soil disturbance would also likely occur, increasing the risk of impacts to soil from compaction or displacement. Unlike Alternative 1, this alternative would include active forest management within the Stillwater Core, resulting in soil disturbances that would not occur in this area under the no-action alternative. However, DNRC would continue to implement applicable BMPs to avoid or minimize soil compaction and displacement from harvest-related activities.

DNRC would also continue to follow the Forest Management ARMs regarding retention of woody debris. However, ~~additional~~larger pieces of CWD may be left in some units under this alternative to meet lynx habitat requirements for potential den sites (commitment LY-HB2), which could result in higher levels of nutrient retention in these areas.

For Class 1 streams and Class 1 streams with HCP fish species, commitments AQ-RM1 and AQ-SD4, respectively, would reduce levels of soil disturbance in areas adjacent to these streams by increasing restrictions on forest management activities and equipment use in areas adjacent to those streams. RMZs established under Alternative 2 would be the same width as under Alternative 1, but under Alternative 2, no harvest would typically be permitted within the first 50 feet. For other streams, risks of effects on soil productivity adjacent to those streams would be the same under this alternative as they would be under Alternative 1 because there would be no changes in policy for these streams.

Under Alternative 2 (commitment AQ-GR1), DNRC would maintain the 5-year monitoring cycle for grazing licenses, but enhance the level of monitoring conducted at midterm and renewal. DNRC would also commit to a process for correcting verified grazing problems, prioritizing and setting time limits for correcting problems for grazing licenses affecting streams with HCP fish species, and monitoring completed improvements. Commitment AQ-GR1 would also require DNRC to prepare monitoring reports at 1- and 5-year intervals. These enhancements to the grazing program would help to identify and address any problems affecting soil productivity in a more timely and thorough manner compared to current policies that would continue under Alternative 1. Within grizzly bear recovery zones, DNRC also would not authorize new, or conversion to, small livestock grazing licenses or initiate establishment of new grazing licenses (commitment GB-RZ4). Implementation of this commitment could reduce the amount of land within the recovery zones affected by small livestock grazing and reduce the risk of effects on soil productivity from small livestock use.

Erosion

Road-related Erosion

Unlike Alternative 1, Alternative 2 (commitment AQ-SD2) would commit DNRC to reducing erosion from existing roads for which DNRC has legal access and sole ownership. Also under Alternative 2, DNRC would work with cooperators to address reduction of erosion on roads with shared ownership. DNRC would commit to completing a road sediment delivery inventory within 10 years for bull trout watersheds and within 20 years for watersheds with westslope cutthroat trout or Columbia redband trout. Based on prioritizations established through the inventory process, corrective actions for DNRC-owned roads with high risk of sediment delivery would be completed within 15 years in bull trout watersheds and within 25 years for westslope cutthroat trout and Columbia redband trout watersheds. Alternative 2 would also address roads with moderate sediment delivery risk on a project-by-project basis. On cost-share and reciprocal use roads, DNRC would work with other cooperators to address moderate- and high-risk road segments. Compared to Alternative 1, the faster timeframe for corrective actions with Alternative 2, primarily through BMP upgrades, would reduce the risk of road-related erosion impacts because the most problematic areas would be identified and upgraded sooner.

Alternative 2 would result in about 1,387 additional miles of ~~new~~ road and about 1,100 miles of new road, both of which ~~is~~are 21 miles fewer than Alternative 1 at the end of the Permit term (Table 4.4-6). For new roads, commitment AQ-SD3 item (1) would require a DNRC water resource specialist to review proposed road activities in watersheds with HCP fish species and make recommendations to reduce sediment delivery. Commitment AQ-SD3 item (3) would require DNRC to design site-specific measures to reduce risk of failure when roads are constructed or reconstructed on unstable slopes. While these actions typically occur under the current program (Alternative 1), and would likely continue to occur, they are not required or assured. As under Alternative 1, these additional new roads would increase the risk of erosion, especially during the first few years following construction. While erosion potential would continue to increase over time as new roads are built and previously constructed roads require repair, these increases would likely be smaller than Alternative 1 due to the additional commitments under Alternative 2 for identifying and correcting road problems with high risk of sediment delivery to streams and the additional attention paid to roads in high risk sites.

Erosion from Stream Crossings

While Alternative 2 would not commit DNRC to completing more stream crossing improvements than Alternative 1, it would commit DNRC to completing improvements faster. Under this alternative, commitment AQ-FC1 item (3), DNRC would update its existing fish passage assessment to inventory and assess connectivity for all existing stream crossings on known and presumed bull trout, westslope cutthroat trout, and Columbia redband trout habitat. Alternative 2, commitment AQ-FC1 item (4), calls for prioritizing streams with HCP fish species and commitments AQ-FC1 items (5), (6), and (7) require improving existing crossings within 15 years for bull trout watersheds and 30 years for westslope cutthroat trout and Columbia redband trout watersheds. Alternative 2, commitment AQ-FC1 item (8) would also implement improvements faster by requiring one-sixth of all sites that do not meet connectivity conservation objectives to be improved every 5 years. These improvements would be specifically intended to improve in-stream conditions for fish, but would also reduce erosion and potential failure risks by addressing the most problematic sites earlier than under Alternative 1. Commitment AQ-FC1 item (9) would also require DNRC to consider stream conditions, cost, sediment risks, and anticipated use when selecting crossing structures, rather than just providing for fish passage as under Alternative 1. The faster timeframe for stream crossing upgrades would help reduce cumulative erosion and delivery of sediment to streams over the entire Permit term compared to Alternative 1, where the upgrades would occur more slowly.

Harvest-related Erosion

Under Alternative 2, commitments AQ-SD4 and AQ-RM1 would reduce the risk of erosion from timber harvest, site preparation, and slash treatments more than existing measures employed as part of DNRC's current program (Alternative 1). Under Alternative 2, DNRC would make a formal commitment to require a water resource specialist to review proposed harvest plans greater than 100 mbf in watersheds with HCP fish species and make recommendations to reduce sediment delivery. While typically done, specialist review would not be required under Alternative 1. This plan oversight, combined with a 50-foot ~~SMZ~~ no-harvest buffer along Class1 stream corridors and greater control on timber harvest in the RMZ, would reduce the potential for delivery of eroded sediment to streams or lakes. In addition, no more than ~~15~~20 percent of the Class1 RMZ of an ~~administrative~~aquatic analysis unit would be allowed in non-stocked or seeding/sapling structural stages, which would also reduce potential effects of harvest on erosion.

However, this alternative would result in an annual sustainable yield of ~~58~~57.6 million board feet per year statewide and about ~~55.7~~55.3 million board feet within the HCP project area, which is about ~~5~~4 million board feet more than Alternative 1. In addition, much of this additional yield would be harvested from the Stillwater Unit, where the abundance of HCP fish species is relatively high. ~~While t~~The no-harvest buffer would protect the areas supporting these species to a greater extent than existing harvest activities under Alternative 1~~, harvest in the upper watersheds would generally continue similarly to existing conditions~~. This includes upper watersheds that contain Class 1 streams where the no-harvest buffer would extend additional habitat protection compared to Alternative 1. The commitments for Class 2 and 3 streams would remain the same as those for Alternative 1. The monitoring and adaptive management measures that are part of Alternative 2 would provide a means to verify the implementation and effectiveness of the commitments and site-specific mitigation measures and ensure that expected reductions in risks from harvest area erosion are attained. If not, these measures would then provide a mechanism for modifying commitments to improve effectiveness. With this process in place, Alternative 2 would result in a greater potential for minimizing the potential effects of harvest area erosion.

Gravel Sources

Gravel pit operations are expected to continue to be relatively small and isolated under Alternative 2, and would be reclaimed soon after specific road projects are completed. The number and size of the gravel pits developed under Alternative 2 would generally correspond to the number of road miles constructed. As a result, these operations are expected to be similar in size and distribution to those expected for Alternative 1. The operations would also continue to be sited away from streams and riparian areas, so the additional riparian buffer and stream protection measures provided by the proposed HCP are not expected to substantially change the limited effects of gravel pit operations. Commitment AQ-SD5 provides additional restrictions beyond Montana Forestry BMPs to reduce the potential for sediment delivery caused by erosion at these sites. In addition, some areas would be subject to restrictions on numbers, locations, sites, and seasons of use of borrow and gravel pits to avoid or minimize effects on grizzly bear habitat or habitat use (commitments GB-NR6, GB-ST5, GB-SW5, GB-SC4).

4.5.2.4 Alternative 3 (Increased Conservation HCP)

Under Alternative 3, annual sustainable yield and miles of new road would be lower than Alternatives 1 and 2. DNRC would also implement resource protection measures that would further reduce the risk of effects of forest management activities on soil productivity and erosion as compared to Alternative 2.

Soil Productivity

Under Alternative 3, approximately ~~1,322~~1,035 miles of new road would be constructed and about 1,322 miles of road (including abandoned and reclaimed roads) would be present at the end of the Permit term (Table 4.4-6). Both of these amounts are~~, which is~~ about 86 miles fewer than under Alternative 1 and about 65 miles fewer than Alternative 2 (Table 4.4-6). As for Alternative 2, this alternative would result in a lower level of permanent soil productivity loss due to fewer roads being constructed, as compared to Alternative 1, but the reduction would not be substantial at the landscape scale. As for Alternatives 1 and 2, DNRC would continue to implement applicable BMPs to minimize risks to soil productivity from compaction and displacement from road-related activities.

The annual sustainable yield under Alternative 3 would be 50.6 million board feet, which is a 5 percent decrease from Alternative 1 (Table 4.2-14). With a lower level of harvest predicted, a comparable decrease in amount of soil disturbance would also likely occur, decreasing the risk of impacts to soil from compaction or displacement. Like Alternative 1, this alternative would include minimal forest management within the Stillwater Core. As for Alternatives 1 and 2, DNRC would continue to implement applicable BMPs to avoid or minimize soil compaction and displacement from harvest-related activities.

As for Alternatives 1 and 2, DNRC would continue to follow the Forest Management ARMs regarding retention of woody debris. Compared to Alternative 2, however, this alternative would result in higher levels of CWD left in units within lynx denning habitat, which could result in higher levels of nutrient retention in these areas.

Harvest activities adjacent to Class 1 streams with HCP fish species would be further restricted compared to Alternative 2. The no-harvest buffer would be extended to the full RMZ (typically 80 to 120 feet), rather than just the first 50 feet. There would be no policy changes for ~~other~~Class 1 non-HCP fish-bearing streams or Class 2 and 3 streams, so risks of effects on soil productivity adjacent to those streams would be the same under this alternative as they would under Alternative~~s~~ 1~~ and 2~~. In contrast, Alternative 2 would extend the 50-foot no-harvest buffer to all Class 1 streams and lakes.

Grazing management under Alternative 3 would be the same as under Alternative 2, except that DNRC would increase the review cycle for grazing licenses to every year and include measurable targets for DFCs. By reviewing grazing licenses more frequently, any problems affecting soil productivity can be identified and corrected sooner to minimize the amount of time such problems can pose risks to other resources.

Erosion

Road-related Erosion

Under Alternative 3, additional commitments beyond those in Alternative 2 for reducing sediment delivery from existing roads would result in faster identification and corrective action for problem road areas where eroded sediments are being delivered to streams. With Alternative 3, the completion timeline for road sediment delivery inventories is faster than Alternative 2, within 5 years for bull trout watersheds, and within 10 years for westslope cutthroat trout and Columbia redband trout watersheds. Corrective actions for DNRC-owned roads with high risk of sediment delivery would also be completed 5 years faster than the other alternatives, particularly Alternative 1, where implementation of corrective actions would occur as part of specific harvest or road projects in the watershed and then only if funding is available. Alternative 3 also addresses moderate sediment delivery roads on a project-specific basis, similar to Alternative 2. As for Alternative 2, a DNRC water resource specialist would also be required to review proposed road activities in watersheds with HCP fish species and make recommendations to reduce sediment delivery, which would also be done under Alternative 1, but not as a requirement.

Alternative 3 is predicted to have fewer miles of new road and total road miles on the landscape, with about 1,035 and 1,322 miles, respectively, within 50 years (Table 4.4-6). These amounts are~~,~~ ~~which is~~ about 65 miles (about 5 percent) less than Alternative 2 and 86 miles (6 percent) less than Alternative 1 (Table 4.4-6). With a slightly lower ~~total~~amounts of total and new roads expected under Alternative 3, increases in the risk of erosion would be slightly less than what would be expected under Alternatives 1 and 2.

Erosion from Stream Crossings

Alternative 3 stream crossing commitments are the same as for Alternative 2, except that upgrades would occur within 10 years for bull trout watersheds and 20 years for westslope cutthroat trout and Columbia redband trout watersheds, instead of 15 and 30 years, respectively, under Alternative 2. This faster timeframe for stream crossing upgrades would help reduce erosion and sediment delivery to the HCP project areas streams compared to Alternatives 1 and 2, where the upgrades would occur more slowly.

Harvest-related Erosion

The provision for a full no-harvest buffer around Class 1 streams supporting HCP fish species, and the requirement for a water resource specialist to review harvest plans, are expected to reduce the risk of effects from harvest area erosion. In addition, this alternative would result in a lower annual sustainable yield (50.6 million board feet per year statewide, 48.2 million board feet within the HCP project area) than the other alternatives. As under Alternative 1, forest management would be minimal in the Stillwater Core under Alternative 3. As described for Alternative 2, this alternative would include monitoring and adaptive management provisions to ensure that commitments and site-specific mitigation requirements are performing as expected and, if not, to modify them to improve performance. With this process in place, Alternative 3 would result in a greater potential for minimizing the potential effects of harvest area erosion than Alternative 2.

~~Compared to Alternative 2, Alternative 3 has additional riparian harvest commitments that expand the no-harvest buffer to the full RMZ (one site potential tree height [SPTH], or typically 80 to 100 feet) and in some cases to the full CMZ for Tier 1 streams. When combined with the commitments for reducing the potential for surface erosion from harvest, site preparation, and slash treatment (which are the same as for Alternative 2), this wide buffer would substantially reduce the risk of sediment delivery to surface waters with HCP fish species. This also would be expected to result in less sediment entering the buffers and the buffers having less surface soil and vegetation disturbance.~~

Gravel Sources

Corresponding to the number of road miles constructed under Alternative 3, the number and size of the gravel pits developed are also expected to be less than the other alternatives. Site-specific gravel pit operations are expected to be similar to existing conditions, which are generally effective at reducing erosion and erosion effects. As a result, the increased mitigation measures provided by Alternative 3 are not expected to substantially change the overall effects of gravel operations in the HCP project area. As under Alternative 2, all gravel pits would be subject to commitments for reducing potential sediment delivery and some areas would be subject to restrictions on numbers, locations, sites, and seasons of use of borrow and gravel pits to avoid or minimize effects on grizzly bear habitat or habitat use.

4.5.2.5 Alternative 4 (Increased Management Flexibility HCP)

Under Alternative 4, annual sustainable yield and miles of new road would be the same as Alternative 2. DNRC would also implement resource protection measures that would reduce the risk of effects of forest management activities on soil productivity and erosion to a level between Alternatives 1 and 2.

Soil Productivity

With the same annual sustainable yield and number of new road miles as Alternative 2, this alternative would result in the same levels of permanent loss of soil productivity and risk of impacts to soil from compaction or displacement. Like Alternative 2, under this alternative forest management would increase in the Stillwater Core. As for the other alternatives, DNRC would continue to implement applicable BMPs to minimize risks to soil productivity from compaction and displacement from road- and forest-related activities.

Regarding nutrient cycling from retained CWD, Alternative 4 would ~~be the same as Alternative 2 regarding~~require retention of at least two potential den sites per square mile in lynx habitat~~;~~, which may result in slightly higher levels of nutrient retention compared to Alternatives 1 and 2. ~~h~~However, this ~~requirement~~alternative would ~~also apply to~~require less retention of blowdown ~~areas, so~~during salvage operations, which may result in retention of less CWD ~~would be retained~~ in these areas as compared to the other action ~~A~~alternatives~~ 1~~.

Harvest activities adjacent to Class 1 streams with HCP fish species would be less restrictive than Alternatives 2 and 3, but more restrictive than Alternative 1. While RMZs would be defined in the same manner as under Alternative ~~1~~2, harvest would not be allowed in the first 25 feet and protections would be limited to HCP fish-bearing streams. There would be no policy changes for other streams, so risks of effects on soil productivity adjacent to those streams would be the same under this alternative as they would under Alternatives 1 and ~~2~~3.

Grazing management under Alternative 4 would be similar to Alternative 1, except that DNRC would decrease the review cycle for grazing licenses to 10 years. By reviewing grazing licenses less frequently, any problems affecting soil productivity may not be identified as readily as under the other alternatives. Therefore, the amount of time such problems could pose risks to other resources would be higher under Alternative 4.

Erosion

Road-related Erosion

Compared to Alternatives 2 and 3, Alternative 4 would retain the process for prioritizing corrective actions based on risk of sediment delivery and a timeline for completing road sediment inventories; however, this alternative would not require completion of corrective actions under specific timelines. The timeline for completing inventories would be 5 years slower than under Alternative 2, and more similar to Alternative 1, Alternative 4 would require implementation on a project-specific basis. As for Alternatives 2 and 3, a DNRC water resource specialist would be required to review proposed road activities in watersheds with HCP fish species and make recommendations to reduce sediment delivery, although this would also typically occur under Alternative 1. Over the Permit term, the potential for cumulative erosion from road problems under Alternative 4 would be lower than Alternative 1, but higher than Alternatives 2 and 3.

New road construction, reconstruction, and maintenance would be the same as for Alternatives 2 and 3. Alternative 4 would result in about the same miles of additional road over time as Alternative 2 (Table 4.4-6), so increases in risk of erosion from roads would be similar to that under Alternative 2.

Erosion from Stream Crossings

Alternative 4 stream crossing commitments are the same as for Alternatives 2 and 3, except that they are implemented on a project-specific basis instead of within a fixed schedule. This would increase the overall time required for improving or replacing problem crossings, which are more likely to fail. As a result, Alternative 4 would lead to an increased probability of more erosion causing sediment delivery to streams compared to Alternatives 2 and 3, but less than Alternative 1.

Harvest-related Erosion

Alternative 4 commitments for harvest-related surface erosion, site preparation, and slash treatments are the same as for Alternative 1, resulting in a similar potential for harvest area erosion effects. However, Alternative 4 also has a higher annual sustainable yield than Alternative 1, with much of this increase resulting from increasing forest management in the Stillwater Core. Therefore, the overall harvest area erosion risks are likely to be greater for Alternative 4 than the other alternatives.

Alternative 4 has similar riparian commitments as Alternative 1, except that this alternative would include a 25-foot no-harvest buffer in Class 1 ~~SMZs~~RMZs for HCP fish-bearing streams.~~, and CMZs would be managed the same as under Alternative 2~~. Alternative 4 would reduce the risk of erosion increasing sediment delivery to buffers and streams compared to Alternative 1. However, the risk of erosion in riparian areas under Alternative 4 would be higher than under Alternatives 2 and 3.

Gravel Sources

Corresponding to the number of road miles constructed under Alternative 4, the number and size of the gravel pits developed are also expected to be similar to Alternative 2, and more than Alternative 3. However, the overall difference in gravel pit operations between alternatives is expected to be relatively small, and similar to existing conditions, which are generally effective at reducing erosion and erosion effects. As a result, the increased flexibility Alternative 4 provides would not be expected to substantially change the overall effects of gravel operations in the HCP project area. As for Alternatives 2 and 3, all gravel pits would be subject to sediment delivery reduction commitments and some would be subject to restrictions intended to avoid or minimize effects on grizzly bear habitat or habitat use.

4.5.2.6 Summary

Maintaining soil productivity by preserving rich, organic topsoil layers is critical for long-term forest growth. Forest management activities can affect soil productivity by causing nutrient loss, compaction, displacement, erosion, and mass movement. As noted previously in this section, mass movement is not considered a major sediment source related to forest practices on HCP project area lands, except for some steep terrace faces, steep or high road cutslopes or fillslopes, and high stream banks. Consequently, alternatives were compared based on differences in changes to soil productivity (nutrient loss, compaction, and displacement) and risks of erosion.

By implementing existing BMPs and complying with the existing regulatory framework, all four alternatives would minimize the risk of effects on soil productivity. However, additional conservation commitments specified by the action alternatives would decrease risks associated with specific activities (e.g., grazing) and locations (e.g., riparian areas). The overall risk of effects on soil productivity was evaluated based on miles of new road and annual sustainable yield, which both provide an indication of the amount of soil disturbance that would occur for each alternative. Based on these evaluations, as well as conservation commitments specified by the alternatives, Alternative 3 would result in the lowest risk of effects on soil productivity, followed by Alternatives 2, 4, then 1. Under all four alternatives, productivity would be permanently lost for soils on which roads are built. Only Alternatives 2 and 4 would result in soil disturbance in the Stillwater Core.

In terms of potential effects from erosion, all four alternatives would be expected to provide adequate protection from erosion effects because they are all primarily based on existing rules, regulations, and BMPs. The existing SMZ Law, Forest Management ARMs, Montana Forestry BMPs, and DNRC forest management policies are generally effective at minimizing soil disturbance activities (DNRC 2006e). In addition, existing harvest methods and procedures minimize soil disturbance, and existing riparian buffers provide adequate filtration of sediments.

Overall, there would be relatively small differences between the alternatives with regard to the risk of erosion based on level of soil disturbance as measured by annual sustainable yield and miles of new road. Alternative~~s 2 and~~ 4 would result in the largest amount~~s~~ of soil disturbance based on an annual sustainable yield of 55.7 million board feet within the HCP project area, followed by Alternative 2 (55.3 million board feet in the HCP project area), Alternative 1 (50.7 million board feet in the project area), and Alternative 3 (48.2 million board feet in the project area). This would suggest that Alternatives 2 and 4 might have a greater risk of erosion problems, based on the increased harvest activities and resulting soil disturbance. Similarly, estimates of new road miles (at 50 years) provide an indication of the risk of erosion from soil disturbance associated with road-related activities. Alternative 1 would result in the most total and new road miles at 50 years (1,408 and 1,121 miles), followed by Alternatives 2 and 4 (1,387 and 1,100 miles) and Alternative 3 (1,322 and 1,035 miles). With the lower annual sustained yield and miles of new road, Alternative 3 would likely result in the lowest risk of erosion-related effects.

Many of the aquatic conservation commitments focus on the reduction of sediment delivery to streams, and the primary mechanism for sediment reaching streams is the erosion and transport of soils from road surfaces and road-stream crossings into streams. Variations between alternatives in terms of how sediment delivery, and also erosion, would be reduced provide a more discriminating way to compare alternatives. While the number of culverts that would be replaced over the Permit term would not change between alternatives, the speed at which high-risk culverts are replaced can have a substantial effect on how much sediment is delivered to streams over time. More aggressive identification and replacement of high-risk structures can reduce the cumulative amount of sediment entering streams at these locations over time. Based on commitments for identifying, prioritizing, and correcting road and stream crossing problems, Alternative 3 would result in the least amount of sediment reaching streams, followed by Alternatives 2, 4, then 1. Both Alternatives 2 and 3 would require inventories and corrective actions to be completed within specified timeframes for affected streams with HCP fish species. Alternative 4 would require inventories to be completed within specific timeframes, but would then schedule corrective actions on a project-by-project basis. Alternative 1 would not require any specific timelines for inventories or corrective actions, but would schedule corrective actions on a project-by-project basis when funds are available.

Evaluating the three factors discussed above: (1) risk of effects on soil productivity, (2) risk of erosion, and (3) rate of identification and repair of high-risk road-related sediment delivery problems, Alternative 3 would result in the least potential for adverse effects from forest management activities and provide the greatest benefit in terms of reducing ongoing sediment delivery to streams. Alternatives 2, 4, and 1 would have increasingly higher potential for adverse effects and decreasing benefits for reducing sediment delivery to streams.

Anticipated climate changes over the Permit term may increase the potential for effects from DNRC's forest management activities on soil productivity, erosion, and mass movements (where soils and landforms are prone to these types of events) for all the alternatives. With more precipitation falling as rain instead of snow, earlier snowmelt, and more extreme weather events such as intense downpours, higher amounts of harvested area and more miles of new roads may result in an increased risk of potential effects on these resources. However, through DNRC's existing BMP monitoring and adaptive management process, such effects from climate change would likely be observed, and DNRC would adapt its designs, BMPs, and other mitigation measures to provide adequate levels of erosion control and water quality protection. While changes in climate may increase the risk of potential effects from DNRC's forest management activities, the risk of potential effects would likely vary based on how quickly road and stream crossing problems would be identified and repaired under each of the alternatives. The shorter timeframes for identifying and addressing such problems under Alternative 3 would result in more timely response for correcting problems and minimizing the potential for increased risk of sediment delivery to streams due to climate change.

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4.6 Water Resources

This section describes water quality and water quantity in the planning area and evaluates how the alternatives may affect the quality and quantity of surface water and groundwater. Rivers, streams, lakes, reservoirs, and other waterbodies in the planning area support numerous beneficial uses. Among these are complex aquatic ecosystems that support stocks of HCP fish species (bull trout, westslope cutthroat trout, and Columbia redband trout) and other aquatic species. Key human uses include drinking water, recreation, and agricultural and industrial water supplies. Activities that reduce the suitability of water for these uses are a major source of concern for resource managers as well as the public.

4.6.1 Affected Environment

This section is divided into four primary parts. Section 4.6.1.1 (Regulatory Framework) introduces the key water-related statutes and regulations that govern DNRC as it manages trust lands. Section 4.6.1.2 (Surface Waters in the Planning Area) describes the streams and lakes that occur in the area and introduces the key water quality and water quantity parameters that may be influenced by timber management activities on trust lands. Section 4.6.1.3 (Surface Water Quality) describes water quality conditions that may be impacted by forest management activities, followed by a summary of current water quality in the HCP project area. ~~Finally,~~ Section 4.6.1.4 (Surface Water Quantity) provides a brief overview of the potential for timber harvest and road building to produce changes in the timing and quantity of water that flows from a watershed, specifically water yield, low flows, and peak flows. Finally, Section 4.6.1.5 (Effects of and Trends in Climate Change) discusses observed and predicted changes in the hydrologic cycle due to a changing climate.

Precipitation is a primary factor influencing vegetation conditions, runoff, sediment yield, and water quality. The highest volume of stream flow in Montana rivers occurs during the spring and early summer months with the melting of the winter snow pack. Heavy rains falling during the spring thaw occasionally constitute a serious flood threat (WRCC 2005). Ice jams, which occur during the spring breakup (usually in March), can cause backwater flooding. Flash floods are probably the most common form of flooding and result from locally heavy rainstorms in the spring and summer. Climate and precipitation are discussed in greater detail in Section 4.1 (Climate).

4.6.1.1 Regulatory Framework

The current regulatory framework for water quality in the state of Montana is based on the federal Clean Water Act (CWA), which was established in 1972 to regulate the discharge of pollutants into waters by establishing national water quality standards and permit guidelines. In 1974, the United States Environmental Protection Agency (EPA), which oversees the implementation of the federal CWA, delegated to Montana the authority to enact many of the provisions of the CWA. The Montana Water Quality Act (MCA 75-5-101 et seq.) is the state's primary legislation for fulfilling its responsibilities under the CWA. While the EPA maintains ultimate authority to administer the CWA in Montana, it has granted MDEQ, Water Protection Bureau, the primary responsibility for implementing the act in Montana. For projects on trust lands, DNRC works in conjunction with local agencies, MDEQ, MFWP, and EPA to ensure compliance with the regulations governing waterbodies within the planning area.

At the state level, MFWP administers the Montana Stream Preservation Act (124 permits) for activities that disturb the bed or bank of a stream. The Forest Management ARMs (ARM 36.11.423) require an assessment of CWE on projects involving substantial vegetation removal or ground disturbance, and using the assessment, ensure the protection of beneficial uses and identify opportunities to mitigate adverse effects. CWE assessments typically address surface water runoff generation and physical effects to stream channels and sediment production, as well as effects to habitat and ecosystem functions (Reid 1993). As stated in Section 4.5.1.1 (Geology and Soils – Regulatory Framework), the Montana Forestry BMPs are recognized as the primary mechanism for achievement of water quality standards.

DNRC also adheres to the SMZ Law, which regulates forest management activities within SMZs on private, state, and federal lands. This law prohibits seven forest management activities in SMZs: (1) broadcast burning; (2) operating wheeled or tracked vehicles, except on established roads; (3) clearcutting; (4) construction of roads, except when necessary to cross a stream or wetland; (5) improper handling, storage, use, or disposal of hazardous or toxic substances; (6) side-casting of road material into waterbodies; and (7) deposit of slash in waterbodies.

The Forest Management ARMs also specify how DNRC manages grazing licenses on classified forested trust lands (ARM 36.11.444). This ARM directs DNRC to 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. DNRC is also required to design grazing plans to minimize loss of riparian stream bank vegetation and to reduce structural damage to stream banks. Inspections occur on a 5-year cycle using a coarse-filter approach specified in the ARM to identify potential problem areas.

DNRC's trust lands are also subject to Montana's open range doctrine, which requires landowners not wishing to allow livestock grazing on their land to fence the livestock out (MCA 81-4-203). This can lead to unauthorized livestock use from open range cattle.

Waterbody Classification

Montana waterbodies are classified according to the present and beneficial uses they normally would be capable of supporting (MCA 75-5-301). The state water use classification system (ARMs 17.30.604 through 629) identifies the following beneficial uses:

- Drinking, culinary use, and food processing
- Growth and propagation of fishes and associated aquatic life, waterfowl, and furbearers
- Bathing, swimming, recreation, and aesthetics
- Agricultural water supply
- Industrial water supply.

Surface waters are classified primarily by

- The level of protection they require,
- The type of fisheries they support (warmwater or coldwater),
- Their natural ability to support use for drinking water, agriculture, etc.

The use classification was designed for streams; consequently, some of the uses designated by the classification system are not always applicable to lakes and wetlands. The designated beneficial uses for each class in the system are summarized in Table 4.6-1.

TABLE 4.6-1. DESIGNATED BENEFICIAL USES BY WATER USE CLASS

	Water Use Class							
Beneficial Use	**A-Closed**	**A-1**	**B-1**	**B-2**	**B-3**	**C-1**	**C-2**	**C-3**
Drinking Water (Human Health)	X[1]	X	X	X	X			X[2]
Fisheries (Salmonid)	X	X	X	X[3]		X	X[3]	
Fisheries (Non-salmonid)					X			X
Aquatic Life	X	X	X	X	X	X	X	X
Recreation	X	X	X	X	X	X	X	X
Agriculture, Industry	X	X	X	X	X	X	X	X[2]

[1] Waters classified A-Closed are to be maintained suitable for drinking, culinary, and food processing purposes after simple disinfection; all other A- and B-class waters require conventional treatment.
[2] The quality of waters classified C-3 is naturally marginal for drinking, culinary, and food processing purposes, as well as agricultural and industrial supply.
[3] Waters classified B-2 and C-2 are marginally suitable for propagation of salmonid fishes and associated aquatic life.
Source: ARM 17.30.620 et seq.

Surface waters support beneficial uses when they meet water quality standards established to protect those uses. Surface waters are considered to be impaired when sufficient credible data shows that the waterbody is failing to achieve compliance with applicable water quality standards and beneficial uses are not fully supported. In some cases, non-compliance with a standard will result in the impairment of only a single use; in other situations, non-compliance with one or more standards may result in the impairment of all uses for the applicable classification.

When natural conditions limit or preclude a designated use, permitted point source discharges or non-point source discharges may not degrade the natural conditions. Montana's antidegradation policy (ARM 17.30.705) requires that waters of higher quality than applicable standards be maintained in their higher quality.

Water Quality Standards

Water quality standards for Montana are based on stream classification and are set by administrative rule (ARM 16.20.601 et seq.). Standards are established at varying levels for individual waterbodies based on water use class (Table 4.6-2). Surface waters are assigned to use classes based on the drainage basin in which they occur. As a result, all state waters are classified and have designated uses and supporting standards.

TABLE 4.6-2. MONTANA WATER QUALITY STANDARDS FOR THE MAJOR NON-CHEMICAL PARAMETERS OF CONCERN

Water Use Class	Dissolved Oxygen: Early Life Stages[1,2]	Dissolved Oxygen: Other Life Stages[3]	Turbidity	Temperature	Sediment
A-Closed	No change from naturally occurring levels.		No increase above naturally occurring turbidity.	No increase above naturally occurring temperature.	Narrative standard[4]
A-1	9.5[5]	6.5	No increase above naturally occurring turbidity.	No increase greater than 1° F above naturally occurring temperatures between 32° F and 66° F, but not to exceed 67° F. When natural conditions exceed 66.5° F, no increase greater than 0.5° F.	Narrative standard[4]
B-1	9.5[5]	6.5	No more than 5 NTU[6] above naturally occurring levels.	Same as Class A-1	Narrative standard[4]
B-2	9.5[5]	6.5	No more than 10 NTU above naturally occurring levels.	Same as Class A-1	Narrative standard[4]
B-3	6.0	5.5	No more than 10 NTU above naturally occurring levels.	No increase greater than 3° F above naturally occurring temperatures between 32° F and 79.5° F, but not to exceed 80° F. When natural conditions exceed 79.5° F, no increase greater than 0.5° F.	Narrative standard[4]
C-1	9.5[5]	6.5	No more than 5 NTU above naturally occurring levels.	No greater than 1° F above naturally occurring temperature between 32° F and 66.5° F, but not to exceed 67° F. When natural conditions exceed 66.5° F, no increase greater than 0.5° F.	Narrative standard[4]
C-2	9.5[5]	6.5	No more than 10 NTU above naturally occurring levels.	Same as Class C-1	Narrative standard[4]
C-3	6.0	5.5	No more than 10 NTU above naturally occurring levels.	No greater than 3° F above naturally occurring temperature between 32° F and 79.5° F, but not to exceed 80° F. When natural conditions exceed 79.5° F, no increase greater than 0.5° F.	Narrative standard[4]

[1] Includes all embryonic and larval stages, and all juvenile forms of fish to 30 days following hatching.
[2] 7-day mean, in milligrams per liter (mg/L); lower values have been established as 7-day mean minima.
[3] 30-day mean, in mg/L; lower values have been established as 7-day mean minima and 1-day minima.
[4] No increases above naturally occurring concentrations, if such increases would create a nuisance or render waters harmful, detrimental, or injurious to public health, recreation, safety, welfare, livestock, wild animals, birds, fish, or other wildlife.
[5] This is the water column concentration recommended to achieve the required inter-gravel dissolved oxygen level concentration of 6.5 mg/L. For species that have early life stages exposed directly to the water column, the minimum standard 7-day mean value is 6.5 mg/L.
[6] NTU: Nephelometric Turbidity Units, the measurement units of turbidity using a nephelometer (light reflected by particles in suspension at a right angle to the original source).
Source: MCA 17.30.620 et seq. and MDEQ (2008).

Activities associated with the management of forested trust lands must comply with the CWA to meet state water quality standards for waters that may be affected by those activities. To work toward meeting water quality standards, DNRC uses BMPs to reduce erosion and soil impacts that can influence water quality (see Section 4.5, Geology and Soils). DNRC also monitors erosion and soil disturbance during watershed surveys and monitors water quality of selected rivers and lakes (DNRC 2005b). Water quality monitoring is conducted on the Stillwater and Swan River State Forests to detect trends in water quantity, nutrients, and sediments in the Whitefish Lake and Stillwater River basins. This monitoring began in 1976 on the Stillwater State Forest and in 2003 in the Swan River drainage and continues today. DNRC is also conducting stream temperature monitoring on an additional approximately 30 sites within the planning area.

The 303(d) List and TMDLs

When water quality monitoring data reveal changes to natural conditions that exceed those allowed by state standards, the water is determined to be impaired (i.e., does not fully meet standards) or threatened (i.e., is likely to violate standards in the near future). More precisely, the specific beneficial uses that are protected by the exceeded standard(s) are determined to be impaired or threatened. Under Section 303(d) of the CWA and Part 7 of the Montana Water Quality Act (MCA 75-5-701 et seq.), the state is required to develop a list of water quality-limited waterbody segments. The laws require the state to establish priority rankings for waterbodies on the list and to develop action plans to improve their water quality. As part of each plan, MDEQ is required to calculate the TMDL of each pollutant of concern that could enter listed waters and still meet its water quality standards and support all designated beneficial uses (see Section 4.6.1.3, Surface Water Quality, for a discussion of impaired streams identified within the EIS planning area and HCP project area).

As part of the 303(d) assessment process, waterbodies are assigned to different categories based on their assessment status:

- **Category 1.** Waters attaining all standards
- **Category 2.** Waters attaining some standards
- **Category 3.** Waters with insufficient information to determine whether any beneficial uses are supported
- **Category 4.** Impaired or threatened waters that do not need or already have completed a TMDL
- **Category 5.** Impaired waters for which a TMDL is required.

Category 4 is further divided into three sub-categories: 4A (all necessary TMDLs have been completed and approved), 4B (other pollution control requirements are expected to result in the attainment of water quality standards), and 4C (identified threats or impairments result from categories for which TMDLs cannot be developed, such as dewatering or habitat modification).

The list of waters in Category 5 is typically called the 303(d) list. The 303(d) list is revised every 2 years, and the most recent list is contained in a draft 2006 report.

Water Quantity Standards

Montana's regulatory framework for water quality does not include streamflow criteria to protect volumes and levels of flow necessary to support existing uses. However, the state does have biological criteria through narrative criteria such as "suitable for salmonids and associated aquatic life." The state is in the process of developing more specific criteria that may include numeric standards.

4.6.1.2 Surface Waters in the Planning Area

Waters in the planning area flow into three river basins. Precipitation west of the Continental Divide (NWLO and SWLO) drains to the Pacific Ocean via the Columbia River. East of the Continental Divide (the CLO), most water flows into the Missouri River, eventually joining the Mississippi and emptying into the Gulf of Mexico. The far northern portion of the CLO is drained by the Saint Mary River, which feeds the north-flowing Saskatchewan River and ultimately flows into Hudson Bay. The following subsections describe the stream and lake resources within the boundaries of the three land offices comprising the planning area. Figures D-6A through D-6C in Appendix D (EIS Figures) show the locations of major lakes and rivers in the planning area. Subsequent discussions address parameters of concern for surface water quality and quantity.

Streams and Lakes

The Clark Fork River is the largest river flowing within the boundaries of the NWLO, although the river's headwaters are in the SWLO. The largest tributary to the Clark Fork River within the NWLO boundary, the Flathead River, originates in Glacier National Park, the Bob Marshall Wilderness, and southern British Columbia and drains the northern portion of the Clark Fork basin. The Kootenai River originates in Canada and flows through the northwestern corner of the NWLO before passing through Idaho and discharging into the Columbia River in Canada. The largest waterbodies in the land office are Flathead Lake, the largest freshwater lake in the United States west of the Mississippi River, and the Lake Koocanusa reservoir, which impounds approximately 48 miles of the Kootenai River upstream of Libby Dam. Other major waterbodies include Hungry Horse Reservoir, Lake MacDonald, Whitefish Lake, Swan Lake, and Noxon Reservoir.

The SWLO is almost entirely within the Clark Fork River basin. Major tributaries to the Clark Fork within the SWLO include the Blackfoot and Bitterroot Rivers, both of which converge with the Clark Fork River in the vicinity of Missoula. The southeastern portion of the SWLO is within the basin of the Big Hole River, which drains into the Missouri River via the Jefferson River. The largest lake within this land office is 3,000-acre Georgetown Lake, which was created by the construction of Flint Creek Dam.

Nearly all of the CLO is drained by the Missouri River. The Missouri River is formed by the convergence of the Jefferson, Gallatin, and Madison Rivers near Three Forks within the CLO. From north to south, other major tributaries within the CLO include the Milk, Marias, Teton, Sun, and Smith Rivers. The southeastern portion of the CLO is within the Upper Yellowstone River basin. The northwestern extreme of the CLO is drained by the Saint Mary River. Major waterbodies within the CLO include (in descending order of area) Canyon Ferry Reservoir, Tiber Reservoir, Hebgen Lake, Clark Canyon Reservoir, Lima Reservoir, and Saint Mary Lake.

Based on information in Montana's hydrography dataset (DNRC 2008a), the planning area has nearly 100,000 miles of intermittent and perennial streams; approximately 4,300 miles of the total stream length (4 percent) occur on trust lands managed by DNRC (Table 4.6-3). This is representative of the general distribution of DNRC-managed lands, which make up approximately 5 percent of the total acreage of the planning area. In the NWLO and SWLO, the majority of streams on trust lands are on parcels included in the HCP project area (75 percent for the two western land offices combined). Less than 10 percent of the stream miles in the CLO are on parcels within the HCP project area. While nearly one-half of the total stream mileage in the planning area occurs in the CLO, only 226 of the stream miles (14 percent) within this land office are located within the HCP project area.

TABLE 4.6-3. MILES OF STREAM IN THE PLANNING AREA AND HCP PROJECT AREA BY LAND OFFICE

	Streams in the Planning Area			Proportion of Streams in the HCP Project Area	
Land Office	**Stream Miles in the Planning Area**	**Stream Miles on Trust Lands[1]**	**Stream Miles in the HCP Project Area**	**Percent of Stream Miles in the Planning Area**	**Percent of Stream Miles on Trust Lands**
NWLO	25,990	996	849	3	85
SWLO	24,631	775	503	2	65
CLO	44,832	2,521	226	1	9
Total	**95,452**	**4,292**	**1,578**	**2**	**37**

[1] Includes all trust lands managed by DNRC, including those comprising the HCP project area.
Source: DNRC (2008a).

Of nearly 500,000 acres of lakes in the planning area, approximately 865 acres (1 percent) occur on trust lands managed by DNRC (Table 4.6-4). Similar to streams, the majority of lake acres on trust lands in the two western land offices are included in the HCP project area; in the CLO, less than one-tenth of 1 percent of lakes on trust lands are in the HCP project area.

TABLE 4.6-4. ACRES OF LAKES IN THE PLANNING AREA AND HCP PROJECT AREA BY LAND OFFICE

	Lakes in the Planning Area (Acres)			Proportion of Lakes in the HCP Project Area	
Land Office	**Total**	**DNRC Lands[1]**	**HCP Project Area**	**Percent of Total Acres**	**Percent of DNRC Acres**
NWLO	255,808	865	598	0.2	69
SWLO	32,556	293	204	0.6	70
CLO	197,893	5,433	3	0.0	0.1
Total	**486,257**	**6,591**	**805**	**0.2**	**12**

[1] Includes all trust lands managed by DNRC, including those in the HCP project area.
Source: DNRC (2008a).

4.6.1.3 Surface Water Quality

Forest practices can affect the water quality of aquatic habitat primarily through changes in water temperature and dissolved oxygen, as well as sediment delivery from roads. Management activities on forested trust lands must provide for adequate water quality protection for fish and wildlife habitat. Water quality conditions impacted by forest management activities are summarized in the following subsections, and these are followed by a summary of current water quality in the HCP project area. Water quality related to aquatic species is also discussed in Section 4.8 (Fish and Fish Habitat).

Temperature

Water temperature is a critical determinant of habitat suitability for aquatic species. Most aquatic organisms are cold-blooded, with internal temperatures that closely follow the temperature of the water in which they live. In general, warmer temperatures result in increased biological activity; a 10 percent increase in metabolic rate per 1° C (1.8° F) increase in water temperature is a typical average (Gorden et al. 1992). As metabolic rates of aquatic species increase with warmer waters, so does their need for oxygen. Warmer water also holds less oxygen, thus compounding the potential effects on aquatic habitat conditions (Brooks et al. 1997).

Many aquatic species can only tolerate a relatively limited range of temperatures. Increased water temperatures associated with timber harvest and road building can have adverse impacts on species adapted to cold-water conditions. Salmonid species are particularly sensitive to increases in water temperatures, and Montana’s native bull trout is widely considered the most temperature-sensitive of all the state’s salmonids. Although a variety of factors influence the status of these fish species, water temperature has been identified as an important limiting factor (MFWP 2005a).

Timber harvest and forest road construction can influence water temperature by removal of riparian forest that shades streams and from changes to the upland hydrology that alters the amount, timing, and temperature of watershed runoff. Water temperatures can increase when stream-shading vegetation is lost, thereby increasing direct solar heating (Beschta et al. 1987). First- to third-order headwaters streams, which typically make up about 85 percent of the total length of the drainage network and where most forest management activities occur, are the most readily influenced by loss of shade from the riparian vegetation. Complete removal of the forest canopy along streams of the Pacific Northwest resulted in an increase in the summer daily maximum temperature of 3 to 8° C (5.4 to 14.4° F) (Hartman et al. 1987).

Water temperature can be impacted by forestry activities that modify the timing and quantity of stream flow (Swanston 1991). Forest management activities have been shown to influence the rates of snow accumulation and melt, evapotranspiration rates, interception of shallow groundwater, concentration of surface runoff from roads, and infiltration and transmission of water into and through forest soils. As a consequence, the amount of groundwater recharge to streams may change in managed watersheds, and stream temperatures, which are moderated by groundwater inputs, can be affected (Chamberlin et al. 1991).

Sediment

Excessive fine sediment delivery to streams can adversely affect water quality and aquatic habitat both directly and indirectly. Increased turbidity in the water can reduce light in the stream environment, impair aesthetic quality, and cause gill abrasion in fish. Increased sediment deposition negatively affects salmonid habitat by filling interstitial spaces in the streambed (see Section 4.8.2.1, Fish and Fish Habitat – Sediment). Increased suspended sediment (i.e., total suspended solids [TSS]) can also increase heat absorption and consequently increase water temperature. Indirectly, sediments may contribute nutrients, oxygen-demanding organic materials, or harmful minerals and chemicals that impair water quality. In lakes and large rivers, high levels of suspended sediment can impact aquatic life by blocking light needed by submerged plants and algae.

Logging and roads have been shown to increase sediment deposition in streams, particularly in steep terrains susceptible to mass movements of soil (Reid and Dunne 1984; Swanston 1991). The amount of fine sediment that reaches a stream depends primarily on the amount of sediment produced through mass wasting and surface erosion, and the ability of sediment to be transported from its source to the stream. A direct source of sediment deposition is erosion of streambank soils.

Forests generally have very low erosion rates unless they are disturbed (Elliot et al. 2000). Common disturbances include timber harvesting, prescribed burning, and wildfires. The impact of these activities on hill-slope soil erosion rates generally only lasts for a few years before the rapid re-growth of vegetation covers the surface with protective plant litter. Forest roads are the most common source of long-term increases in surface soil erosion because road construction, use, and maintenance compact soils, reduce infiltration of rainfall and snowmelt, intercept and concentrate surface runoff and subsurface water, and limit vegetation re-growth. In addition to accelerating the rate of surface erosion and the efficiency of sediment delivery to streams, the soil disturbance and drainage alterations caused by road construction may increase the frequency and magnitude of mass movement. Mass movement (e.g., landslides), a category of natural landscape processes, occurs when large masses of soil are rapidly displaced down slope. Where improperly located, roads may undercut the base of unstable slopes. Where roads intercept and concentrate surface runoff and subsurface flow, water may be diverted to hillsides causing soil saturation and slope failures. Finally, if culverts or other drainage structures become plugged with sediment and debris, road fill can be washed out. Where roads are located on sensitive lands, the probability of mass movement may increase beyond normal frequencies.

The ability of sediment to travel from its source to streams can be affected by timber harvesting in riparian areas. The vegetation in riparian areas generally functions as a filter, removing sediment before it reaches a waterbody. Vegetation immediately adjacent to stream channels is also important in maintaining streambank stability and limiting streambank erosion.

Livestock grazing also has the potential to increase sediment delivery to streams, particularly where rangeland is a large component of a watershed or where livestock are concentrated near streams. Research on a rangeland watershed in North Dakota found that grazing and its attendant effects on depletion of plant cover and litter and trampling of the soil was the most important factor contributing to erosion and sedimentation (Sedivec 1992). Observations while monitoring the application of grazing BMPs at a ranch in western Montana showed evidence that short-term in-stream suspended sediments were associated with the presence of cattle near sampling sites, but the overall effects on stream sedimentation were inconclusive (Sherwood et al. 2000).

Dissolved Oxygen

Dissolved oxygen in water is critical for nearly all forms of aquatic life. Oxygen enters the water by diffusion at the air-water interface, from air bubbles introduced by turbulent flow in rapids, or from rainfall. Oxygen is also a byproduct of photosynthesis by aquatic plants (Gordon et al. 1992). The solubility of oxygen in water is inversely related to water temperature, so the summer is typically a critical time for low dissolved oxygen concentrations.

Dissolved oxygen concentrations are also related to nutrient concentrations through a process known as eutrophication, which is the nutrient enrichment of aquatic systems. In lakes, dissolved oxygen concentrations are often depleted in this process as added nutrients stimulate the growth of aquatic plants and algae, which eventually die and decompose. The decomposition reduces oxygen levels, which in some lakes can reach levels low enough to impact many aquatic species (EPA 1999). High-gradient streams in forested environments often have enough turbulence that results in rapid replenishment of dissolved oxygen content (Gualtieri and Gualtieri 1999). Low dissolved oxygen concentrations are more likely to be associated with lakes and point sources, such as municipal wastewater treatment facilities or industrial facilities, than with forest streams (MacDonald et al. 1991).

Dissolved oxygen concentrations are strongly associated with thermal changes and organic inputs. By reducing thermal cover and increasing sediment or nutrient input, timber harvest and road building can negatively affect dissolved oxygen concentrations.

Nutrients

Nutrients include a wide range of chemical constituents that plants and animals need to grow and survive. For water quality investigations, the various forms of nitrogen and phosphorus are the primary nutrients of interest. Excessive amounts of these nutrients can stimulate the growth of algae, which in turn can interfere with the beneficial uses of lakes and streams. In excessive amounts, algae can alter the composition of macroinvertebrate and fish communities, change dissolved oxygen levels, and interfere with aesthetic and recreational uses of rivers and streams (Nordin 1985).

Harvest and road building have the potential to increase nutrients in streams by introducing more organic material and sediment (MacDonald et al. 1991). Nutrient loading can increase indirectly as a result of forestry activities, as nutrient uptake is reduced by the reduction of vegetation (Brown 1989).

Existing Surface Water Quality

Available GIS data do not allow an analysis of the use classification for waterbodies in the planning area, on trust lands in the planning area, or in the HCP project area. However, water quality assessments have been completed for approximately 10 percent of the total stream miles and 61 percent of the total lake acres in the planning area (Tables 4.6-5, 4.6-6, and 4.6-7) (DNRC 2008a). Of the streams for which assessments have been completed, approximately 50 percent have been determined to be threatened or impaired and in need of TMDLs, TMDLs have already been completed for an additional 3 percent, and TMDLs are not required for 10 percent. Of the assessed lakes, approximately 64 percent have been determined to be threatened or impaired and in need of TMDLs, and TMDLs are not required for 8 percent. More than 324 streams in the planning area have been identified as threatened or impaired. Of these, approximately 103 occur on trust lands in the NWLO, SWLO, or CLO, and 39 are on located within the HCP project area (Tables 4.6-6 and 4.6-7).

TABLE 4.6-5. MILES OF STREAMS AND ACRES OF LAKES WITH COMPLETED TMDL WATER QUALITY ASSESSMENTS IN THE PLANNING AREA, BY ASSESSMENT CATEGORY

	Streams (Miles)			Lakes (Acres)		
Category[1]	**Total**	**Trust Lands[2]**	**HCP Project Area**	**Total**	**Trust Lands[2]**	**HCP Project Area**
1	688.95	19.21	6.38	10,647.73	7.93	3.48
2	924.31	17.31	3.88	43,182.05	0.0365	0
3	2,085.32	134.60	29.87	28,969.81	182.02	0
4A	274.75	20.35	0	0	0	0
4B	0	0	0	0	0	0
4C	999.81	31.82	15.34	25,009	0	0
5	4,983.36	157.00	55.30	190,635.54	40.65	0.10
Total	**9956.50**	**380.29**	**110.77**	**298,444.13**	**230.64**	**3.58**

[1] Categories are defined in subsection The 303(d) List and TMDLs in Section 4.6.1.1 (Regulatory Framework), above. TMDLs are required for waters in Category 5.
[2] Includes all trust lands managed by DNRC, including those in the HCP project area.
Source: DNRC (2008a).

TABLE 4.6-6. POTENTIAL FORESTRY-RELATED CONTRIBUTIONS TO IMPAIRMENT OF STREAMS IN THE PLANNING AREA

	Number of Stream Segments			Stream Miles		
Cause	**Total**	**Trust Lands[1]**	**HCP Project Area**	**Total**	**Trust Lands[1]**	**HCP Project Area**
Thermal modifications	49	16	4	1,102.60	74	3.30
Habitat alterations	284	91	33	4,234.89	145.43	47.45
Suspended solids	18	4	2	292.36	19.18	11.12
Turbidity	10	2	1	106.12	4.01	0.83
Organic enrichment/ Low dissolved oxygen	6	1	1	114.45	2.60	1.24
Pesticides	0	0	0	0	0	0
Nutrients	84	31	14	1,507.60	51.59	22.41
Total Impairment[2]	**324**	**103**	**39**	**4,989.62**	**166.70**	**53.90**

[1] Includes all trust lands managed by DNRC, including those in the HCP project area.
[2] These totals are not a sum of the columns above. Instead, they represent the total number and mileage of segments impaired by one or more cause, and include the sum of all Category 4A, 4B, 4C, and 5 waters.
Source: DNRC (2008a).

TABLE 4.6-7. POTENTIAL FORESTRY-RELATED CONTRIBUTIONS TO IMPAIRMENT OF LAKES IN THE PLANNING AREA

Cause	Number of Waterbodies			Acres		
	Total	Trust Lands[1]	HCP Project Area	Total	Trust Lands[1]	HCP Project Area
Thermal modifications	0	0	0	0	0	0
Habitat alterations	1	1	0	3,735.76	15.91	0
Suspended solids	0	0	0	0	0	0
Turbidity	0	0	0	0	0	0
Organic enrichment/ Low dissolved oxygen	2	1	0	12,5247.59	24.76	0
Pesticides	1	0	0	3,200.03	0	0
Nutrients	5	1	0	167,177.50	24.76	0
Total Impairment[2]	**5**	**2**	**0**	**170,421.53**	**40.67**	**0**

[1] Includes all trust lands managed by DNRC, including those in the HCP project area.
[2] These totals are not a sum of the columns above. Instead, they represent the total number and mileage of segments impaired by one or more cause, and include the sum of all Category 4A, 4B, 4C, and 5 waters.
Source: DNRC (2008a).

In the HCP project area, the most common cause of impairment is habitat alterations. With the data available for this analysis, it is not possible to determine how many 303(d) listings are related to forest management and how many are a result of other land uses, such as urban development or agriculture, or due to natural conditions.

The ~~most current~~2004 303(d) list ~~(2004)~~ documents 49 freshwater segments that have been identified as impaired due to high temperature. Some of these streams may have naturally elevated temperatures, but that determination will not be made until a TMDL is developed for each stream. There are also more than six stream segments listed for dissolved oxygen, along with several listings each for turbidity and fine sediment.

4.6.1.4 Surface Water Quantity

Timber harvest and road building can produce changes in the timing and quantity of water that flows from a watershed. Three key measures of water quantity – water yield, low flows, and peak flows – are discussed in the sections that follow.

Water Yield

Water yield refers to the amount of water that flows from a watershed in a given period of time. Studies have shown that water yields increase for several years after logging (Troendle 1983; King 1989; Burton 1997; WADNR 1994). With water supply shortages in many areas of the western United States, increases in water yield attributable to forest harvest are not always perceived to be detrimental and in some cases may be viewed as beneficial (Haupt 1979; Hibbert 1979; Troendle 1983).

Low Flows

Low flow refers to the period with minimum rates of discharge, which typically occurs during the late summer or early fall in the western United States. Low-flow discharge results from the combined effects of reduced precipitation, declining drainage from groundwater sources, and sustained high summer rates of evapotranspiration (MacDonald et al. 1991). Similar to the effects on water yield, vegetation changes that reduce evapotranspiration rates have the potential to increase low flows. Because increased low flows (i.e., more water in the stream) for summer months generally do not adversely affect aquatic life, such changes will not be discussed further. Small volumetric increases may provide improved habitat conditions (lower stream temperature, increased in-stream wetted area and volume) and survivability of aquatic species.

Peak Flows

Peak flow refers to the period of maximum discharge associated with individual storms or rapid snowmelt periods.

In forested areas, roads can have significant effects on peak flows if they are improperly constructed and if their drainage networks are allowed to become connected to the stream network through improper construction or inadequate maintenance or abandonment procedures (USFS 2001; CMER 2004).

The interception of surface runoff during storms and interception of shallow groundwater flow by a road prism can affect the routing of surface water, extend the channel network (Wemple et al. 1996), increase the potential for higher peak flows, and increase the potential for mass wasting (Montgomery 1994). Roads can act as extensions of the drainage network if they drain to streams. Road-influenced peak flows have been demonstrated in small watersheds (Ziemer and Lisle 1998); however, the effects of roads on a river basin scale are less understood (Jones and Grant 1996; Beschta and Boyle 1995).

The relationship between timber harvest and increased peak flows is not straightforward. In a study of six basins in northwestern Montana, MacDonald and Hoffman (1995) found no apparent correlation between the magnitude of peak flows and the amount of forest harvest. Most recent research suggests that peak flow changes due to forest practices are difficult to detect on large river systems. Additionally, effects of peak flow changes due to forest practices in small basins are highly variable, but small peaks are apparently affected more than large peaks (e.g., Thomas and Megahan 1998; Beschta et al. 2000).

The quantification of peak flow increases resulting from forest management activities is complicated by naturally high variability in inter-annual peak flows, and by the possibility that management activities may desynchronize runoff peaks, thus increasing water yield but decreasing peak flows.

Peak flow increases resulting from land management activities have been most commonly and confidently identified in first- and second-order headwater streams in which large portions of the watershed have been harvested. The confounding effects of runoff timing and volume can dilute the evidence of peak flow increases downstream of the impacted sites and in higher-order streams and larger watersheds. The scientific literature on peak flow increase is thus variable, and consensus among researchers has not been established (MacDonald et al. 1991; Brooks et al. 1997; WFPB 1997).

The best-understood effect of timber harvest on peak flows is its influence on stream flow relating to altering snow accumulation and melt rate. Increased peak flows can occur in the winter when a warm, wet storm brings rain after a cold storm deposits substantial amounts of snow. Such rain-on-snow events have been most well-documented in the coastal mountain ranges of western North America. The greatest susceptibility to rain-on-snow events occurs in areas where topography allows the incursion of relatively warm, moist marine air flowing from the Pacific Ocean into the Columbia Plateau and up the Snake River Valley. In the planning area, such areas occur in the NWLO and include northwestern Montana, where valleys open into the Columbia Plateau (Ferguson 1999). While rain-on-snow events are a natural occurrence, their effects can be exacerbated when a watershed has been logged in a short amount of time (25 to 30 years) (Harr and Coffin 1992; Troendle and Leaf 1981).

The two most important watershed variables that affect rain-on-snow events are elevation and extent of timber harvest. Timber harvest has the potential to alter snow accumulation and melt rates in any portion of a watershed, but predominantly in the rain-on-snow zone. The rain-on-snow zone in western Montana typically occurs in mid- to low-elevation areas; for example, the rain-on-snow zone in the Grave Creek watershed near Eureka occurs between 4,500 and 5,500 feet (MDEQ 2005b). Forest openings are conducive to increased snow pack accumulations because more snow reaches the ground as a result of less snow interception by the tree canopy.

Because timber harvest can cause increased snow accumulation in openings, areas where runoff is dominated by snowmelt can theoretically experience increased peak flows (Benda et al. 1998). However, research in the Pacific Northwest has not consistently demonstrated this effect. While Cheng (1989) found as much as a 35 percent increase in peak flows with 30 percent clearcuts in British Columbia, Fowler et al. (1987) found no effect in small watersheds in Oregon. In perhaps the most comprehensive study, Anderson and Hobba (1959) found an 11 percent increase in spring peak flows across 21 watersheds in eastern Oregon.

MacDonald et al. (1991) identified six mechanisms by which forest management activities can increase peak flows:

1. Road building (due to both the impervious surface and the interception or interruption of shallow subsurface flow)
2. Reduction of infiltration rates and soil moisture storage capacity by compaction
3. Reduced rain and snow interception due to removal of the forest canopy
4. Higher soil moisture levels due to the reduction of evapotranspiration
5. Increased rate of snowmelt
6. Change in the timing of flows that result in a synchronization of previously unsynchronized flows.

4.6.1.5 Effects of and Trends in Climate Change

As discussed in Section 4.1 (Climate), the western United States, including Montana, has experienced and is likely to experience further changes in the hydrologic cycle due to increases in temperature and changes in precipitation patterns. Increasing temperatures in the western United States have resulted in decreases in snowpack and snowfall, more winter rain events, increased peak winter flows, and reduced summer flows (Cayan et al. 2005; Field et al. 2007; Karl et al. 2009; Lundquist et al. 2009; Mote 2006; Saunders et al. 2008). Earlier melt-out of mountain snowpacks has also been observed (Cayan et al. 2001; CIRMOUNT Committee 2006; Mote 2006; Pederson et al. 2009; Saunders et al. 2008). In western Montana, the recession of glaciers in Glacier National Park has lead to fewer first-order watersheds that historically contained glaciers at the source of their headwaters containing glaciers or perennial snow and ice (Pederson et al. 2009). Pederson et al. (2009) notes that these glaciers provide base flows during the hot, dry summers and moderate stream temperatures.

As a key component of the hydrologic cycle in the western United States, mountain snowpack stores water from winter snowfall and releases it in the spring and early summer, when economic, environmental, and recreational demands for water are typically highest (Mote et al. 2005). However, the changing hydrologic cycle has begun to shift available water supplies to earlier in the year (Saunders et al. 2008). Lundquist et al. (2009) cited several studies indicating that the fraction of annual stream flow that runs off during the late spring and summer in the western United States has declined since the 1950s by 10 to 25 percent and that snowmelt runoff now occurs 1 to 3 weeks earlier in most mountainous catchments across western North America. Brick et al. (2008) predicted that a warming climate will cause spring runoff to begin a month earlier, resulting in low water flows during the summer and fall months.

As discussed in Section 4.5 (Geology and Soils), increased peak flows and more frequent intense downpours may increase the risk of erosion and mass movements (where soils and landforms are prone to these types of events). Such events may increase the amount of sediment entering streams, thereby decreasing water quality. Water quality effects may also occur during the summer months when streamflows are lowest. Increased air temperatures during summer low-flow periods can increase stream temperatures and evaporation, which further reduce streamflows (Karl et al. 2009; Saunders et al. 2008). At higher summer temperatures, dissolved oxygen is reduced in lakes, reservoirs, and rivers, causing stress on aquatic species, such as cold-water fish and the organisms on which they feed (Karl et al. 2009). Additionally, lower oxygen levels decrease the capabilities of rivers to self-purify (reducing their pollutant loads through natural hydrologic and biological processes) (Karl et al. 2009). While water quality changes during the last century were likely due to causes other than climate change, increased occurrences of intense rainfall events, as well as longer periods of low summer streamflows are expected to increase water quality effects already occurring due to sediments, nitrogen from agriculture, disease pathogens, pesticides, herbicides, and elevated stream temperatures (Karl et al. 2009). With the potential for more sediments to enter streams and more concentrated levels of pollutants during lower summer flows, the EPA expects the number of waterways considered “impaired” by water pollution to increase (Karl et al. 2009).

4.6.2 Environmental Consequences

This section describes how the no-action and the three action alternatives may directly or indirectly affect surface water quality and quantity in the planning area over the short and long terms. Cumulative effects are discussed in Chapter 5.

4.6.2.1 Introduction and Evaluation Criteria

Possible impacts to surface waters from its forest management activities are addressed by DNRC primarily through use of no-harvest and partial-harvest buffers along streams, lakes, and wetlands, as well as adherence to the SMZ Law. As part of analyzing potential effects on fish and fish habitat, streamside forest conditions were modeled to guide management levels that meet temperature and aquatic rules, and these results are discussed in Section 4.8 (Fish and Fish Habitat).

The analyses of each alternative's potential effects on water quality consider (1) widths of and allowable activities within streamside buffers, (2) management commitments concerning water quality (such as minimizing sediment delivery from roads and harvest units), and (3) miles of new road construction. Because all these factors are related to the same management practices, streamside buffers and BMP applications, the effects of each alternative related to dissolved oxygen, turbidity, TSS, and nutrients are discussed together (also see Section 4.8, Fish and Fish Habitat, and Section 4.5, Geology and Soils). Specific criteria for analyzing differences in the effects of each alternative on water quality are

- Changes in widths of and allowable activities within streamside buffers
- Changes in management commitments concerning water quality
- Location and magnitude of expected changes in road miles.

Forest management activities, including timber harvest and road building, can increase both water yield and peak flows by forming a more efficient drainage network that intercepts shallow groundwater and overland flow with roads and ditches, and by reducing evapotranspiration from harvested areas. Machinery used for timber harvest, and the weight of felled trees and logs that are yarded or skidded, can also increase soil compaction and surface runoff. Specific criteria for analyzing the effects of each alternative on water quantity (water yield, peak flow, and low flow) are

- Amount and location of timber harvest
- Location and magnitude of expected changes in road miles.

The greatest potential water quantity effects are from roads and the commitments for minimizing forest management roads, and the alternatives do not differ materially in total road miles predicted. Therefore, impacts from forest management activities on water yield would be similar under all the alternatives and are not assessed further.

Forest management activities can modify groundwater quantity by changing the amount of water that infiltrates, causing the interception of shallow groundwater by roads, and decreasing evapotranspiration. Similar to surface water yield, groundwater quantity effects are not expected to be materially different between the alternatives and are not assessed further. Groundwater quality is not typically changed by forest management activities, with the possible exception of herbicide and fertilizer use. Because herbicide and fertilizer use by DNRC is relatively limited; the materials are applied in accordance with the manufacturer's specifications; and herbicides are restricted in the SMZ; their use relative to groundwater issues is not discussed further.

All of the alternatives include minimizing miles of new and existing road, implementing BMPs, prohibiting roads within SMZs except where needed to cross streams, and assessing and prioritizing maintenance needs for open and closed roads. All of the action alternatives include monitoring and adaptive management procedures to evaluate the effectiveness of the conservation commitments and thereby provide for improvements to water quality conditions in the planning area. The following sections discuss the effects of implementing the no-action alternative and the three action alternatives over the Permit term.

4.6.2.2 Alternative 1 (No Action)

Water Quality

DNRC has achieved a high level of success limiting sediment delivery to streams through its protection and mitigation efforts under the current forest management program, as evidenced by 97 to 98 percent application and effectiveness of BMPs (DNRC 2006e). Under Alternative 1, DNRC would continue to address water quality issues as it does now under the existing program. Under Alternative 1, management activities would continue to be directed by the current SFLMP, SMZ Law, and Forest Management ARMs. Management of SMZs and RMZs would retain trees to ensure adequate levels of shade, but the potential for water temperature changes would occur under Alternative 1 because partial harvest would be allowed in SMZs.

Under Alterative 1, partial-harvest would be allowed in the entire SMZ and RMZ, resulting in a slightly increased potential for erosion, soil compaction, or displacement to deliver sediment during storm runoff periods. There would also be a potential for the extended partial harvest in the SMZ to reduce the effectiveness of vegetation to filter and retain sediment from adjacent hill slopes. The existing Forest Management ARMs require retention of bank edge trees and trees lying within the stream channel and restrict the use of ground-based equipment. Therefore, under Alternative 1, there is only a low potential for harvest activities to result in channel instability or damage to stream banks that might make them more vulnerable to streambank erosion. There is insufficient research on sediment delivery effects from partial harvest activities to quantify the differences between alternatives. Therefore, it is uncertain whether sediment delivery to streams, lakes, and wetlands from partial harvest under Alternative 1 could increase the potential for measurable impacts to turbidity, TSS, dissolved oxygen, and nutrient loading.

For road and timber harvest activities, Alternative 1 would continue under existing program policies to minimize sediment delivery from roads. While this alternative does not require a DNRC water resource specialist to review proposed road and harvest area activities in watersheds with sensitive fish or make recommendations for reducing sediment delivery, DNRC typically does do this and would continue to do so. Alternative 1 specifies that road inventories and implementation of corrective actions with BMPs occur on a project basis, and then only when funds are available. Within the Stillwater Block and Swan River State Forest, DNRC currently identifies and prioritizes road maintenance needs and ineffective road closures on a 5-year cycle, as required by ARM 36.11.421. Roads on scattered parcels are assessed at a less-regular frequency during timber sale planning and watershed inventories. DNRC is currently in the process of examining its program to determine whether the ARM requirement to assess all roads every 5 years can be met, especially for roads on scattered parcels. Because there is no timeline for inventory or correction of sediment problem sites under the current program, continuation of these practices would result in problem sites potentially impacting water quality until they are identified and corrected.

With Alternative 1, an estimated 1,408 additional miles of ~~new~~ road (including abandoned and reclaimed roads) would be ~~built~~present on the HCP project area landscape, including about 1,121 miles of new road construction, within the 50-year Permit term (see Table 4.4-6). Despite the application of ARMs and BMPs in the design and building of roads, any increase in road miles would likely increase runoff and erosion, especially during the first few years following construction, resulting in increased sediment delivery harmful to water quality.

Installation and maintenance of stream crossings would continue under the existing program for Alternative 1. This alternative requires that new structures on fish-bearing streams provide for fish passage as specified under current regulations. Culverts would continue to be replaced on a project-by-project basis, with sites identified through DNRC's fish passage inventory and connectivity assessment and prioritized based on existing levels of connectivity, species status, and biological goals. Additional mitigation associated with stream crossings would be implemented on a case-by-case basis. Where stream crossing failures or potential failures are not identified or not corrected due to project or funding limitations, there would be an increased risk of adverse water quality effects from these sites until they are repaired or replaced.

For Alternative 1, licensed grazing on classified forest trust lands would continue to be managed by DNRC based on existing program policies. Midterm and renewal license inspections would be used to evaluate current conditions, identify problems areas, and assess improvements implemented since the last inspection to mitigate or rehabilitate riparian or stream channel damage greater than levels specified in ARM 36.11.444.

Water Quantity

Alternative 1 plans for about 53.2 million board feet of timber harvest annually in the state, with 50.7 million board feet of that to be harvested within the planning area each year (Table 4.2-14). Measurable changes in water quantity would be expected only where timber harvest occurs in small watersheds, particularly within the rain-on-snow elevation zone. This alternative includes existing program requirements to analyze CWE, including watershed-level thresholds to protect beneficial water uses with a low to moderate degree of risk.

4.6.2.3 Alternative 2 (Proposed HCP)

Water Quality

Alternative 2 would provide the potential for more water quality protection than Alternative 1. This alternative would include the additional commitments for a more formal documentation of CWE analysis and process for setting project-level thresholds.

Unlike Alternative 1, Alternative 2 would include additional riparian harvest commitments for Class 1 streams ~~with HCP fish species~~ (commitment AQ-RM1). In most cases, there would be a 50-foot no-harvest buffer in RMZs. Partial-harvest would be allowed in the rest of the RMZ, which is designed to ensure adequate levels of shade. Alternative 2 also would extend the RMZ for CMZs when they are likely to influence riparian functions along HCP fish-bearing streams. This would provide greater assurance that temperature criteria would be met in Class 1 streams ~~supporting HCP fish species (Tier 1)~~with HCP fish species. For Alternative 2, riparian management for ~~Class 1 streams with non-HCP fish species and for~~ Class 2 and 3 streams ~~without fish~~ would be the same as Alternative 1, and would provide relatively less assurance that temperature criteria would be met in those stream reaches.

Alternative 2 commitments for reducing sediment delivery would be greater than for Alternative 1, with commitments AQ-SD4 and AQ-RM1 designed to reduce potential sediment delivery from timber harvest, site preparation, and slash treatments. These commitments, combined with 50-foot no-harvest buffers within RMZs and greater DNRC oversight on harvests greater than 100 mbf in watersheds with HCP fish species would reduce the potential for delivery of eroded sediment to streams or lakes.

Under this alternative, a DNRC water resource specialist would be required to review proposed harvests greater than 100 mbf in watersheds with HCP fish species and make recommendations to reduce sediment delivery (commitment AQ-SD4). This would ensure that adequate technical input would be included in project design and would likely reduce the potential for harvest-related eroded sediment reaching streamside buffers, thereby reducing the risk of increased sediment reaching the streams or lakes~~ as compared to Alternative 1~~. While these actions typically occur under the current program (Alternative 1), and would likely continue to occur, they are not required or assured.

Alternative 2 also includes additional commitments for reducing sediment delivery from new and existing roads (AQ-SD2 and AS-SD3) compared to Alternative 1. This alternative specifies completion of a road sediment delivery inventory within 10 years for bull trout watersheds and within 20 years for watersheds with westslope cutthroat trout or Columbia redband trout. Corrective actions for roads with a high risk of sediment delivery would be required within 15 years in bull trout watersheds and within 25 years for westslope cutthroat trout and Columbia redband trout watersheds. Alternative 2 would also address roads with moderate risk of sediment delivery on a project-by-project basis, and it would incorporate goals, targets, and prescriptions in approved TMDLs applicable to covered forest management activities in some cases. Compared to Alternative 1, the faster timeframe for correction of erosion problem sites with Alternative 2 would reduce road-related erosion impacts because problem areas would be addressed sooner. This, combined with more streamside buffer protection, would reduce the amount of sediment delivered to streams and lakes in a shorter time-period than Alternative 1.

With Alternative 2, and similar to Alternative 1, an estimated ~~1,387~~1,100 miles of new road would be built and a total of about 1,387 miles of road (including abandoned and reclaimed roads) would be present on the landscape within the 50-year Permit term (Table 4.4-6). The~~se~~ new roads would increase surface storm runoff and erosion, especially during the first few years following construction.

Alternative 2 also commits DNRC to more stream crossing improvements than Alternative 1. It calls for prioritizing streams with HCP fish species and improving crossings within a known timeframe of 15 years for bull trout watersheds and 30 years for westslope cutthroat trout and Columbia redband trout watersheds through commitment AQ-FC1 items (5), (6), and (7). Commitment AQ-FC1 item (8) under this alternative also requires improvements, or at least improvement designs, to be completed faster by calling for one-sixth of all sites that do not meet connectivity conservation objectives to be improved every 5 years. These improvements would be specifically for fish criteria, but because the crossings would be modified, erosion and reduced failure risk could also be a part of the designs. The faster timeframe for stream crossing upgrades would help reduce local and cumulative erosion and delivery of sediment to the streams compared to Alternative 1, under which the upgrades would occur more slowly.

Compared to Alternative 1, Alternative 2 includes additional management commitments that would identify grazing impacts to stream banks and riparian vegetation through enhanced coarse-filter reviews during the midterm and renewal periods for grazing licenses (commitment AQ-GR1). To the extent that the reviews result in actions taken to protect stream banks and riparian plants from grazing impacts, erosion and sediment delivery to streams could be reduced under Alternative 2. Beyond reducing the turbidity, TSS, and nutrient impacts from sediment delivery, additional water quality benefits could result from healthier riparian vegetation that provides more shade to help reduce high water temperatures and increase low dissolved oxygen concentrations.

Water Quantity

Generally, water quantity effects under Alternative 2 are expected to be similar to Alternative 1. There would be a small difference in the overall amount of planned timber harvest, with an increase in harvest of approximately ~~10~~8 percent under Alternative 2 compared to Alternative 1 (Table 4.2-14). The biggest difference between Alternatives 1 and 2 is in the Stillwater Unit, where Alternative 2 would have nearly ~~50~~44 percent more harvest than Alternative 1. These differences would have the potential to result in measurable changes in water quantity where more timber harvest would be concentrated in small watersheds, particularly within the rain-on-snow elevation zone. These effects would likely be largely offset by the 50-foot no-harvest buffer required under Alternative 2. While Alternative 1 would continue existing program commitments to analyze CWE, including watershed-level thresholds to protect beneficial water uses with a low to moderate degree of risk, Alternative 2 includes additional CWE commitments for a more formalized documentation of CWE analysis and process for setting project-level thresholds for watersheds with HCP fish species (commitment AQ-CW1), which would also help offset potential risks to water quantity.

4.6.2.4 Alternative 3 (Increased Conservation HCP)

Water Quality

~~Alternative 3 provides the most protective commitments for streamside buffers and would apply the most commitments for road and harvest area practices. Commitments beyond those specified under other alternatives include~~ Under Alternative 3, a mandatory Level 3 watershed analysis would be required if the equivalent clearcut area (ECA) on an HCP project area watershed exceeds 25 percent. If this analysis indicates a high or moderate watershed risk, then DNRC would be required to prepare a mitigation plan for review and approval by the USFWS. Consequently, this alternative would provide the greatest potential for protection of water quality.

~~With Alternative 3, forest management activities would be subject to additional riparian harvest commitments for Class 1 streams with HCP fish species. In addition to the streamside buffer commitments specified in Alternative 2,~~ Alternative 3 would prohibit harvest in the full width of the RMZ for Class 1 streams with HCP fish species. Of all the alternatives, this one would provide the greatest protection for shade and temperature along HCP fish-bearing streams. ~~Unlike Alternatives 1 and 2,~~ Alternative 3 would ~~also~~ account for the changing nature of streams by including the CMZ in the no-harvest buffer, providing greater assurance that riparian forest shade and temperature protection would be maintained in the long term, and thereby increasing the potential for meeting temperature water quality criteria. In comparison, Alternative 1 provides no provisions for CMZs, and Alternative 2 expands the no-harvest buffer on HCP fish-bearing streams to include the CMZ only under certain conditions. However, for non-HCP fish-bearing Class 1 streams and lakes, Alternative 3 does not include any additional protection beyond Alternative 1, while Alternative 2 includes a 50-foot no-harvest buffer on these waterbodies.

Alternative 3 includes additional commitments beyond those in Alternative 2 for reducing sediment delivery from roads. The completion timeline for road sediment delivery inventories would be shorter, within 5 years for bull trout watersheds, and within 10 years for westslope cutthroat trout and Columbia redband trout watersheds. Corrective actions for roads with high risk of sediment delivery would also be required to be completed 5 years faster than Alternative 2, within 10 years in bull trout watersheds and 20 years for westslope cutthroat trout and Columbia redband trout watersheds, while Alternative 1 would incorporate corrective actions into specific harvest or road projects only when funding is available. Similar to Alternative 2, Alternative 3 would also address moderate sediment delivery roads on a project basis and require a DNRC water resource specialist to review proposed road activities in watersheds with HCP fish species and make recommendations to reduce sediment delivery.

Alternative 3 stream crossing design commitments are the same as for Alternative 2, but they would be required to be completed more quickly, within 10 years for bull trout streams and 20 years for streams with westslope cutthroat trout and Columbia redband trout. This faster timeframe for stream crossing upgrades would help reduce cumulative erosion and delivery of sediment to the streams compared to Alternatives 1 and 2 where the upgrades occur more slowly.

Under Alternative 3, an estimated ~~1,322~~1,035 miles of new road would be constructed within the 50-year Permit term, and about 1,322 total road miles (including abandoned and reclaimed roads) would be present on the landscape at the end of the Permit term (Table 4.4-6). These amounts are~~which is~~ about 6 fewer miles than Alternative 2 and 86 fewer miles than Alternative 1 (Table 4.4-6). These new roads would increase surface storm runoff and erosion, especially during the first few years following construction, but the increase would be slightly less than for Alternatives 1 and 2.

Compared to Alternative 1, Alternative 3 includes additional management commitments for identifying grazing impacts to stream banks and riparian vegetation through enhanced coarse-filter reviews during the midterm and renewal periods for grazing licenses. These commitments go beyond those of Alternative 2 by requiring the enhanced coarse-filter reviews of grazing effects every year rather than every 5 years. To the extent that the reviews result in actions taken to protect stream banks and riparian plants from grazing impacts, erosion and sediment delivery to streams could be further reduced under Alternative 3. These reductions in grazing impacts could improve water quality conditions for turbidity, TSS, water temperature, and dissolved oxygen.

Water Quantity

Generally, water quantity effects under Alternative 3 are expected to be similar to Alternative 1. There would be a small difference in the overall amount of planned timber harvest between alternatives, with Alternative 3 having about ~~13~~12 percent less harvest than Alternative 2 and 5 percent less than Alternative 1 within the planning area (Table 4.2-14). The biggest difference between alternatives would be in the Stillwater Unit, where Alternative 3 would have nearly ~~50~~41 percent less harvest planned than under Alternative 2. The differences would have the potential to result in measurable changes in water quantity only where more timber harvest is concentrated in small watersheds, particularly within the rain-on-snow elevation zone. Alternatives 1, 2, and 3 include conservation commitments to analyze CWE, including watershed-level thresholds to protect beneficial water uses with a low to moderate degree of risk. For watersheds with HCP fish species, Alternative 3 includes additional CWE commitments for a Level 3 watershed analysis wherever ECAs on HCP project area watersheds exceed 25 percent. If Level 3 analysis indicates a moderate or high level of watershed risk, then a mitigation plan would be completed by DNRC and reviewed and approved by the USFWS.

4.6.2.5 Alternative 4 (Increased Management Flexibility HCP)

Water Quality

Alternative 4 provides the potential for more water quality protection compared to Alternative 1, but less than Alternatives 2 and 3. This alternative would include the additional commitments for a more formal documentation of CWE analysis and process for setting project-level thresholds,

With Alternative 4, riparian management activities would be the same as Alternative 1, except with a 25-foot no-harvest buffer added to RMZs for Class 1 streams with HCP fish species. Partial-harvest would be allowed in the rest of the RMZ, and RMZs would also be extended for CMZs, similar to Alternative 2. This would provide greater assurance that temperature criteria would be met in Class 1 streams supporting HCP fish species ~~(Tier 1)~~ compared to Alternative 1. For Alternative 4, and like Alternative~~s 2 and~~ 3, riparian management for Class 1~~, 2, and 3~~ streams with non-HCP fish species and Class 2 and 3 streams without fish would be the same as Alternative 1 and would provide relatively less assurance that temperature criteria could be met on those stream reaches.

~~Similar to Alternatives 2 and 3~~Compared to Alternative 1, Alternative 4 maintains a 25-foot no-harvest buffer along streams. This provision, along with a CMZ defined the same as for Alternative 2, would reduce the potential for sediment delivery to streams compared to Alternative 1. Alternative 4 commitments for harvest-related surface erosion, site preparation, and slash treatments are the same as for Alternative 1, so more sediment could potentially reach the buffer area compared to Alternatives 2 and 3.

The completion timeline for road sediment delivery inventories is 5 years longer than Alternative 2 and 10 years longer than Alternative 3 for bull trout, westslope cutthroat trout, and Columbia redband trout watersheds. This would increase the potential for water quality degradation from sediment delivery compared to Alternatives 2 and 3. However, because timelines are still a part of this alternative, the potential for water quality degradation would likely be lower compared to Alternative 1.

New road construction, reconstruction, and maintenance commitments are the same as for Alternatives 2 and 3. Alternative 4 would result in the same amount of new roads as Alternative 2, which would be slightly lower than Alternative 1 and slightly higher than Alternative 3 (Table 4.4-6). As for the other alternatives, these new roads would increase surface storm runoff and erosion, especially during the first few years following construction.

Corrective actions for roads with high risk of sediment delivery are less restrictive under Alternative 4 and would only be completed on a project basis, rather than within a specified timeframe as under Alternatives 2 and 3. This would increase the risk of water quality effects relative to Alternatives 2 and 3. As for Alternatives 2 and 3, this alternative requires a DNRC water resource specialist to review proposed road activities in watersheds with HCP fish species and make recommendations to reduce sediment delivery. Alternative 4 would likely have a lower risk of water quality effects than Alternative 1, which would have no timeframe specified or specific method identified for prioritizing corrective actions based on risk of sediment delivery.

Alternative 4 stream crossing commitments are the same as for Alternative 2, but they would be completed on a project basis instead of within a fixed timeframe. This would slow down the implementation of repairs on the crossings more likely to fail, thereby increasing the probability of increased sediment delivery and water quality impacts to streams as compared to Alternatives 2 and 3 while decreasing the probability as compared to Alternative 1.

Compared to Alternative 1, Alternative 4 includes additional management commitments addressing grazing impacts to stream banks and riparian vegetation through enhanced coarse-filter reviews. These commitments are less restrictive than those of Alternatives 2 and 3 by requiring enhanced coarse-filter reviews of grazing effects only once every 10 years, rather than every 5 years (Alternative 2) or every year (Alternative 3). To the extent that the reviews would result in actions taken to protect stream banks and riparian plants from grazing impacts, erosion and sediment delivery to streams could be reduced under Alternative 4 as compared to Alternative 1.

Water Quantity

Generally, water quantity effects under Alternative 4 are expected to be similar to Alternative 1. The amount of planned timber harvest, including management activities within the Stillwater Core, and CWE commitments under Alternative 4 would be the same as those under Alternative 2, so potential changes to water quantity would likely be the same as well.

4.6.2.6 Summary

DNRC has achieved a high level of success with protection and mitigation efforts under its current forest management program, resulting in 97 to 98 percent application and effectiveness of BMPs to limit sediment delivery to streams (DNRC 2006e). DNRC's existing program would continue under Alternative 1, so this level of success would be expected to continue during the Permit term.

However, compared to the action alternatives, Alternative 1 would not provide any additional protection of streamside buffers, additional commitments for road and harvest area practices that protect water quality, more formal documentation of CWE thresholds and mitigation requirements, or enhanced coarse-filter reviews of grazing effects. All three action alternatives would provide ~~some~~varying levels of protection through these additional commitments, with Alternative 3 providing the most protective measures and least risk of adverse effects on water quality, followed by Alternative 2, then Alternative 4. Compared to Alternative 1, the action alternatives' additional protective measures and adaptive management program would likely reduce the risk of adverse effects on water quality from changes in precipitation and streamflow patterns anticipated from a changing climate. For example, through monitoring and adaptive management, if audits determine that BMP effectiveness has fallen below 90 percent, DNRC would adapt its BMPs to meets its BMP effectiveness compliance thresholds.

Changes in water quantity effects would generally be similar among all alternatives. Potential to measurably change water quantity would be highest under Alternatives 2 and 4, because these alternatives have the highest levels of planned timber harvest and include increasing management in the Stillwater Core. However, differences among alternatives would have the potential to result in measurable changes in water quantity only where more timber harvest is concentrated in small watersheds, particularly within the rain-on-snow elevation zone. These effects may be greater in the future as the climate changes and more winter precipitation is expected to fall as rain; however, such changes would likely be taken into account under each of the action alternatives through the CWE process, which requires DNRC to set water quality thresholds at levels that ensure compliance with water quality standards and protection of beneficial water uses. As conditions change in response to climate change, meeting these thresholds may require DNRC to adapt several of its timber harvest practices including BMPs, harvest design, roads, and access, to protect both water quality and quantity.

4.7 Plant Species of Concern, Noxious Weeds, and Wetlands

4.7.1 Plant Species of Concern

4.7.1.1 Affected Environment

This section describes the regulatory framework under which DNRC manages for plant species of concern (SOC); describes known presence of plant SOC in the planning area and HCP project area; and identifies management activities that may adversely affect those species.

Regulatory Framework

The USFWS is the federal agency responsible for listing plant species requiring protection under the ESA. While Montana's Nongame and Endangered Species Conservation Act (MCA 87-5-101 through 103) offers protection to endangered indigenous wildlife species, it currently does not offer any protection to threatened or endangered plant species.

The Montana Natural Heritage Program (MNHP) maintains a database and serves as the clearinghouse for Montana SOC, which includes taxa that are at-risk or potentially at-risk due to rarity, restricted distribution, habitat loss, and/or other factors (MNHP 2008a). SOC encompass federally listed threatened, endangered, or candidate species and species identified as sensitive by organizations or agencies in Montana.

DNRC manages for threatened and endangered plant species under ARM 36.11.428 and for sensitive plant species under ARM 36.11.436. Both of these rules direct DNRC to give consideration to these species during project design, conduct surveys if needed to determine specific locations of plant SOC populations, and develop mitigation measures designed to avoid or minimize risk to populations present in areas where management is planned. ARM 36.11.428 also gives DNRC the discretion to participate in interagency working groups established to manage the recovery effort of listed species and requires DNRC to report sightings of listed species to respective working groups or to the MNHP.

During the timber sale planning process and prior to MEPA analysis, DNRC submits a request to the MNHP for a list of plant SOC and associated habitat that may occur within the proposed ~~harvest~~project area. If plant SOC are identified within or adjacent to the area, and DNRC determines that harvest activities may adversely affect those species, field surveys are conducted to identify potential locations or delineate known locations of the plant species. Depending on location of the species, timing of harvest, and harvest method, mitigations may be developed to avoid or minimize potential impacts resulting from harvest activities.

Plant Species of Concern in the Planning Area and HCP Project Area

MNHP produces periodic publications identifying plant SOC and potential plant SOC. MNHP employs the standardized ranking system developed by the international network of Natural Heritage Programs to denote global and state status of individual plant and animal species. MNHP's 2006 *Plant Species of Concern* report identifies 358 vascular plant SOC and 133 vascular plants of potential concern. Taxa included in the SOC category are ranked as S1, S1S2, S2, S2S3, SH, or G3 (MNHP 2006) and include federally listed threatened and sensitive species. The following definitions describe the different categories of state ranking system used for SOC:

- **S1.** At high risk because of extremely limited and/or rapidly declining population numbers, range, and/or habitat, making it highly vulnerable to global extinction or extirpation in the state.
- **S2.** At risk because of very limited and/or potentially declining population numbers, range, and/or habitat, making it vulnerable to global extinction or extirpation in the state.
- **G3 S3.** Potentially at risk because of limited and/or declining numbers, range, and/or habitat, even though it may be abundant in some areas.
- **SH.** Historical, known only from records usually 40 or more years old; may be rediscovered.

Plants listed as federally threatened or endangered by the USFWS receive a ranking of S1 or S2.

Of the 358 vascular plant SOC, 279 are known to occur throughout the planning area. No endangered plant species and three federally threatened species have been identified in Montana. Plant SOC known to persist in the planning area include all three federally threatened species. The remaining SOC are ranked as S1, S2, S1S2, S2S3, and SH. Of the 279 plant SOC known to historically or currently exist in the planning area, 55 (including federally threatened species) are known to currently exist in the HCP project area (Table E4-2 in Appendix E, EIS Tables). These species occupy a range of various habitats, including

- **Wetland/riparian.** Areas along springs, fens, rivers, streams, lakes, and ponds.
- **Grassland.** Meadows, gravelly grasslands, or mesic grasslands in valley bottoms and foothills.
- **Dry woodland.** Grasslands or meadows in dry open woodlands typically occupied by ponderosa pine.
- **Shrub steppe.** Areas with sparse vegetation typically dominated by sagebrush.
- **Moist forest.** Typically densely stocked or mature coniferous forests that have dense litter and vegetation on the forest floor. Also includes open forests that have moist soils.
- **Rock outcroppings.** Talus slopes or rock crevices.

Of these habitats, most SOC on HCP project area lands exist in wetland/riparian areas and moist forests (Table E4-2 in Appendix E, EIS Tables).

Threatened Plants

Spalding's Campion

~~Populations of~~ Spalding's campion (*Silene spaldingii*) ~~have~~has been documented in the HCP project area ~~in the NWLO~~ (MNHP 2008b). The population occurs on a scattered parcel surrounded on three sides by the Lost Trail National Wildlife Refuge, and it is monitored by refuge staff. DNRC granted the grazing license for this parcel to the USFWS, which holds the license as an easement to prevent grazing there. ~~Known occurrences of~~In Montana, this species occurs in open, dry grasslands in valleys and foothills in the northwestern part of the state. Invasive weeds, housing development, grazing, road construction, fire exclusion, and population isolation threaten the persistence of this species throughout its extent.

Spalding's campion was listed by the USFWS as threatened on October 10, 2001 (as Spalding's catchfly, 66 FR 51597-51606). When listed, the USFWS found that designation of critical habitat for this species was prudent; however, no such designation has yet been made. A draft recovery plan for Spalding's campion was issued on March 16, 2006 (71 FR 13625-13626) (USFWS 2006a). This plan identifies five distinct physiographic regions in which populations of Spalding's catchfly reside, one of which is located within the NWLO (in intermontane valleys). The recovery strategy presented in this plan includes the identification of key conservation areas within each distinct physiographic region for additional actions to protect, enhance, and maintain existing large populations of Spalding's campion. Recovery actions identified in the plan include enhancing the existing populations, surveying for additional populations, addressing species recovery in management plans, controlling and managing invasive non-native plant species, protecting the species from development, and effectively managing livestock grazing in the species' habitat (USFWS 2005a).

Water Howellia

Populations of water howellia (*Howellia aquatilis*) have been documented in the HCP project area in the Swan River State Forest (MNHP 2008b; Pierce and Barton 2000, 2003). Water howellia is restricted to small pothole ponds and abandoned river oxbows associated with broadleaf riparian trees and a well-developed riparian shrub component. Timber harvesting, road construction, land development, certain recreational activities, and invasive plants are factors that threaten this species (Mincemoyer 2005).

Water howellia was listed by the USFWS as threatened on July 14, 1994 (59 FR 35860-35864) (USFWS 2006a). When listed, the USFWS found that designation of critical habitat for this species was not prudent due to the potential for increased take or vandalism of the species. A draft recovery plan for water howellia was completed in 1996; however, it was not finalized or adopted by the USFWS (Mincemoyer 2005). Mincemoyer completed a range-wide status assessment for this species in 2005. The checkerboard ownership within the Swan River Valley was listed as a complicating factor for management of this species, as several occurrences occupy more than one ownership (Mincemoyer 2005).

Ute Ladies' Tresses

Although Ute ladies' tresses (*Sprianthes diluvialis*) has been documented in the planning area, no known populations exist in the HCP project area (MNHP 2008b). This species appears to prefer meandering wetlands and swales in broad, open valleys at margins with calcareous carbonate accumulations. Habitat loss associated with urban development, road construction, and agriculture threatens to reduce current populations of this species (Fertig et al. 2005).

The USFWS listed the Ute ladies' tresses as threatened on January 17, 1992 (57 FR 2048-2054) (USFWS 2006a). When listed, the USFWS found that designation of critical habitat for this species was not prudent due to the potential for increased vulnerability of this orchid to collection. A draft recovery plan for Ute ladies' tresses was completed in 1995; however, it was not finalized by the USFWS (Fertig et al. 2005). On October 12, 2004, the USFWS initiated a 12-month status review of the Ute ladies' tresses in response to a petition for de-listing of the species. A range-wide status review was completed in September 2005 (Fertig et al. 2005), indicating that this species is more widely distributed and abundant than what was known for the original listing. However, a decision to de-list this species has not been made by the USFWS, and it remains listed as threatened (USFWS 2006a).

Because Ute ladies' tresses have not been documented in the HCP project area, they are not further addressed in this analysis.

Management Activities Affecting Plant Species of Concern

DNRC forest management practices that may affect plant SOC and/or their current or potential habitats include timber harvesting, road construction and/or maintenance, and grazing. These activities may either directly remove existing populations or indirectly affect these species by altering the habitat in which they persist. Indirect effects resulting from the above mentioned management activities may include alteration of hydrologic functions; increased sedimentation/siltation into riparian zones; soil disturbance or removal, which may exacerbate noxious weed spread; and alteration of vegetative cover that may decrease the suitability of current habitat.

Effects of and Trends in Climate Change

As discussed in Section 4.2 (Forest Vegetation), several types of climate change-related effects on plant populations have been observed or are expected to occur, and these may also affect plant SOC within the planning area.

- Distribution shifts northward and upward in elevation
- Heterogeneous displacement of individual species
- Changes in phenology (e.g., earlier bloom)
- Asynchrony (e.g., loss of plant-pollinator relationships)
- Increased stress due to increased temperatures and reduced water availability
- Invasion by weeds, diseases, and pests
- Increased wildfires

Those plant species with limited distributions may be more at risk due to such changes. Plant SOC occupying habitats that may be more sensitive to a drier climate, such as wetland/riparian areas and moist forests, may also be at higher risk, while drought-tolerant species may be less affected. Conversely, some plant SOC may be at an increased risk of disturbance from erosion or changing hydrologic patterns associated with flooding caused by more frequent and intense weather events. Anthropogenic factors, such as land use changes and habitat fragmentation, may also increase risks to plant SOC by creating barriers to plant dispersal or increasing stress on plant populations as they respond to changing climatic conditions (Karl et al. 2009).

4.7.1.2 Environmental Consequences

This section discusses the potential direct and indirect effects of the three proposed action alternatives on threatened plant species and other plant SOC and their current or potential habitat in the HCP project area relative to those anticipated under the no-action alternative. Cumulative effects of the alternatives are addressed in Chapter 5.

Introduction and Evaluation Criteria

DNRC recognizes that certain levels of management activities may increase potential risk to existing populations, to populations that have not yet been identified, or to potential habitat for plant SOC. Factors associated with the alternatives that could influence potential risk include amount of new road construction and changes in management strategies addressing specific habitats in which plant SOC may occur. These factors were used to describe and compare the effects among the proposed alternatives on known populations of plant SOC and preferred habitat where unidentified populations may potentially exist.

Under all alternatives, there would be no policy changes specific to the management of plant SOC, including Spalding's campion and water howellia. DNRC would continue to manage for threatened plant species and other plant SOC under ARMs 36.11.428 and 36.11.436, both of which require DNRC to minimize potential impacts to known populations of plant SOC (as described in subsection Regulatory Framework in Section 4.7.1.1, Affected Environment, above). DNRC would continue to inquire about location, status, and recovery efforts associated with plant SOC, and would apply, to the maximum extent practicable, measures that would avoid or minimize impacts to known plant SOC populations. Therefore, impacts associated with all of the alternatives are not expected to adversely effect known populations of the threatened species Spalding's campion and water howellia that occur in the HCP project area.

DNRC recognizes that undiscovered populations of threatened plant species and other plant SOC likely exist throughout portions of the HCP project area. To account for potential impacts to these unknown populations, the following analyses disclose the effects associated with alternatives that may affect habitat commonly associated with Spalding's campion and water howellia and other plant SOC.

Alternative 1 (No Action)

DNRC would construct approximately ~~1,400~~1,121 miles of new road on HCP project area lands within 50 years, resulting in about 1,408 total road miles (including abandoned and reclaimed roads) present on the landscape at the end of the Permit term (derived from Table 4.4-6 including blocked and scattered lands). New road miles may introduce noxious weeds into areas, thereby potentially increasing risk of adverse effects to plant SOC populations or habitat.

Riparian harvest conservation commitments currently in place, which would continue under Alternative 1, contain measures that may provide some degree of protection to wetland/riparian plant SOC including water howellia. For example, SMZs would continue to be extended to create RMZs equal to one site potential tree height (SPTH) along streams supporting fish populations. This would continue to offer protection to wetland/riparian plant SOC that may occur along such waterways. Other measures include the prohibition of clearcutting; retaining shrubs, sub-merchantable trees, and half of the merchantable trees within SMZs; and retaining trees to provide adequate levels of shade in RMZs. WMZs would continue to be established when forest management activities are proposed within or adjacent to an isolated wetland or adjacent to a wetland found within an SMZ. All of these conservation commitments currently existing in the ARMs would continue to help reduce the disturbance in wetland/riparian areas, and help to maintain desirable shading conditions for potential occurrences of water howellia and other plant SOC associated with that habitat.

Sediment delivery reduction conservation commitments under the existing ARMs, such as minimizing roads, implementing BMPs during new road construction and road maintenance, and prohibiting road construction in SMZs except when necessary to cross a stream, would continue to provide some protection to wetland/riparian plant SOC that are vulnerable to excess sedimentation/siltation. Minimizing roads would also continue to minimize the spread of noxious weeds throughout the HCP project area and potential plant SOC habitat. Gravel pit operations would also continue to require the implementation of BMPs and abide by the opencut mining permit stipulations, all of which would continue to minimize the amount of sedimentation/siltation occurring in wetland/riparian habitat.

Stream banks, riparian vegetation, and noxious weed evaluations would continue during grazing license renewal (10-year cycle) and midterm evaluation (5-year cycle). The licensee would continue to be required to mitigate or rehabilitate riparian areas and stream channels when damage is greater than allowed in the ARMs. This would continue to afford minimal protection to plant SOC associated with wetland/riparian habitats.

Alternative 2 (Proposed HCP)

The differences in road miles and other commitments under Alternative 2 that would affect plant SOC are described below and generally would result in greater indirect protection of threatened plant species and other plant SOC than Alternative 1.

Alternative 2 would retain the commitment of minimizing total roads as in Alternative 1, in addition to minimizing new open road construction in riparian areas and avalanche chutes (commitment GB-PR4). Some terrestrial plant SOC associated with moist forest habitats would be afforded some degree of protection from minimizing roads in avalanche chutes.

The risk of noxious weed spread due to amount of road miles would be almost indistinguishable between Alternatives 1 and 2. In all, there would be approximately 21 fewer miles of road by year 50 when compared to Alternative 1 (Table 4.4-6). Relative to Alternative 1, under Alternative 2, DNRC would improve maintenance of road closures on scattered parcels in grizzly bear recovery zone (commitment GB-RZ3), which may slow the spread of noxious weeds that is often associated with off-road vehicle traffic. This would likely decrease the chance of noxious weeds spreading, thereby offering greater protection to plant SOC.

Grizzly bear NROH spring management restrictions (commitment GB-NR3) under Alternative 2 propose to prohibit commercial forest management activities, pre-commercial thinning, and heavy equipment slash treatment more than 100 feet from open roads during the spring in spring habitat. This could provide plant SOC that inhabit low-elevation, moderately moist environments, such as river valley bottoms and mesic meadows (water howellia), some degree of protection as they sprout or come out of dormancy at this time, when they are young and more vulnerable to impacts from forest management activities. Some wetland/riparian or grassland plant SOC would benefit from commercial activity restrictions in spring, especially Spalding's campion, which inhabit open, mesic grasslands in the valleys and foothills, consistent with the spring habitat of grizzly bear.

The post-denning mitigation restrictions (commitment GB-RZ5) in grizzly bear recovery zones under Alternative 2 that prohibit motorized activities on slopes greater than 45 percent above 6,300 feet between April 1 and May 31, could provide slight benefits to plant SOC that occur on steep slopes above 6,300 feet elevation.

Under Alternative 2 in the Stillwater Block, new permanent road construction would be prohibited on Class A lands, and an 8-year rest period of no forest management activities would ensue after 4 years of active management (commitment GB-ST2). The 8-year rest period may be beneficial for any plant SOC occurring in these designated Class A lands by allowing the population a period of time to rebound and recover from the disturbance, depending on the extent of the impact and specific biology of the species.

~~Riparian harvest conservation commitments (AQ-RM1) under Alternative 2 along non-HCP fish-bearing streams would be the same as those under Alternative 1, and there would be no difference in the impact to plant SOC. However, along HCP fish-bearing streams~~Compared to Alternative 1, Alternative 2 would ~~potentially~~ expand the RMZ on all Class 1 streams and lakes by 30 feet or more (depending on slope and 100-year site index tree height), establish a 50-foot no-harvest buffer, and in floodprone areas on HCP fish-bearing streams, potentially expand the RMZ to include the entire CMZ, with no harvest in active floodplains or unstable stream channels. The addition of the no-harvest buffer would increase the protection of wetland/riparian plant SOC, by giving a buffer where these species would not be disturbed and reducing the amount of tree harvest in a larger area beyond the no-harvest buffer. This commitment would offer greater protection to plant SOC occurring in wetland/riparian habitats than Alternative 1.

The sediment delivery reduction conservation commitments (AQ-SD2) under Alternative 2 put deadlines on the inventory and completion of corrective action on roads that have a high risk of sediment delivery. This could help protect the habitat of water howellia and other wetland/riparian plant SOC that are vulnerable to sedimentation.

Under the program-wide grizzly bear conservation commitment for gravel operations (GB-PR7), DNRC would comply with biennial agreements with county weed boards, using an integrated management approach to control noxious weeds as is done currently under Alternative 1. Additionally, Alternative 2 would limit the number of active pits in each administrative unit in addition to a cap on the size of non-vegetated areas associated with large pits. Gravel operations under the aquatic conservation commitments (AQ-SD5) would be prohibited in SMZs and RMZs, except for one medium non-reclaimed pit within the portion of RMZ extending beyond the SMZ in both the Stillwater Block and Swan Unit. These commitments may benefit SOC plants by decreasing the chances for the spread of noxious weeds, reducing overall disturbance across the landscape, and controlling sedimentation from gravel pit sites.

Similar to Alternative 1, stream banks, riparian vegetation, and noxious weed evaluations would continue during grazing license renewal (10-year cycle) and midterm evaluation (5-year cycle). Compared to Alternative 1, Alternative 2 would have more stringent timelines for verifying potential problem sites and implementing corrective actions to address such problems. This would likely offer more protection to plant SOC associated with wetland/riparian habitats than Alternative 1.

Alternative 3 (Increased Conservation HCP)

Overall, Alternative 3 would provide the greatest indirect protection of plant SOC. This is attributed to the following more restrictive commitments that would be implemented under this alternative versus Alternative 2.

Alternative 3 would result in approximately 86 fewer miles of road by year 50 when compared to Alternative 1 (Table 4.4-6). This is the lowest level of road construction of any alternative.

Spring management restrictions (GB-NR3) under Alternative 3 further restrict motorized activities during the spring period. This would be slightly better for plant SOC that inhabit low-elevation, moderately moist environments, such as mesic meadows (Spalding's campion), giving these species 10 more days of protection during their emergence.

The expansion of the no-harvest buffer to include the entire RMZ or CMZ on HCP fish-bearing streams and lakes under Alternative 3 (commitment AQ-RM1) would increase protections to potential locations of water howellia and other wetland/riparian plant SOC occurring in riparian habitat associated with lakes or streams supporting HCP fish species as compared to Alternative 2. For Class 1 streams and lakes without HCP fish species, Alternative 3 would provide the same level of protection as Alternative 1, which is less than what would be provided under Alternative 2.

The time period for evaluation and corrective action for the inventory of roads for sediment delivery would be 5 years faster under Alternative 3 (commitment AQ-SD2), further reducing the risk wetland/riparian plant SOC face from sedimentation, providing slightly better protection than Alternative 2.

The intervals for monitoring grazing effects under Alternative 3 (commitment AQ-GR1) would be more frequent, allowing for faster corrective actions to take place, helping to further protect wetland/riparian plant SOC that could be affected by damages done by grazing.

Under Alternative 3, minimal forest management would occur in the Stillwater Core, thereby increasing the relative protection level of plant SOC that occur in that portion of the HCP project area.

Alternative 4 (Increased Management Flexibility HCP)

Indirect effects on plant SOC under Alternative 4 would be most similar to those described under Alternative 2, with the following exceptions.

Under the spring NROH commitment (GB-NR3), there would be no limit on site preparation, road maintenance, or bridge replacement. This would slightly reduce protection for plant SOC that inhabit low-elevation, moderately moist environments.

The ~~zone along~~ no-harvest buffer would apply only to HCP fish-bearing streams and would extend 25 feet instead of 50 feet. Additionally, the area in which DNRC would retain shrubs, sub-merchantable trees, and at least 50 percent of trees greater than 8 inches dbh under commitment AQ-RM1 would be between 25 and 50 feet instead of between 50 feet and the 100-year site index tree height that would be in place under Alternative 2. There would also be increased management flexibility under Alternative 4 in terms of having 5 more years to complete the inventory of sediment delivery reduction sites (commitment AQ-SD2). The grazing commitment (AQ-GR1) would require monitoring grazing effects every 10 years instead of every 5 years, thus possibly increasing chances of plant SOC being affected.

Summary

All alternatives would implement current practices (ARMs and MCA) that address identified plant SOC as described in subsection Regulatory Framework in Section 4.7.1.1 (Affected Environment). However, under the action alternatives, some conservation commitments would potentially result in greater protection of potential plant SOC habitat (where unknown populations may exist) over Alternative 1. This would mostly be due to spring management restrictions, restrictions on harvest in riparian areas, and improved monitoring and corrective actions for grazing licenses. All action alternatives offer some form of these commitments, with Alternative 3 providing ~~slightly greater restrictions in riparian areas through an increased no-harvest buffer~~faster timelines for completing corrective actions at problem sediment sites and more frequent inspection of grazing licenses.

While any climate change-related effects on plant SOC would be the same under all alternatives, the additional protections of potential plant SOC habitat offered by the action alternatives would likely reduce the risk of additional effects from forest management activities on those populations.

4.7.2 Noxious Weeds

4.7.2.1 Affected Environment

This section describes the regulatory framework under which DNRC manages for noxious weeds; describes noxious weed occurrences and management; and identifies management activities that may contribute to noxious weed spread.

Regulatory Framework

MCA 7-22-21 establishes county weed control throughout the state. Each county is required to establish a weed management district and appoint a district weed board to administer the noxious weed management program for the district. Under MCA 80-7-705, the Montana Department of Agriculture is required to distribute funding to enhance weed management programs in the weed management districts.

MCA 7-22-2151 requires DNRC to enter into a written cooperative agreement with district weed boards throughout the state. The agreement must specify mutual responsibilities for noxious weed management on state-owned lands.

DNRC complies with the existing management policy for controlling noxious weeds through ARMs 36.11.445 and 36.25.159. ARM 36.11.445 requires DNRC to develop management plans that include prevention, education, cultural, biological, and chemical methods as appropriate. Under this rule, DNRC is required to limit herbicide application, prioritize new outbreaks of weeds, promptly re-vegetate disturbed sites, require right-of-way permittees to control weeds, cooperate with weed districts, and review implementation of mitigation and control measures on cooperative projects. Under ARM 36.25.132, DNRC requires lessees or licensees of state trust land to keep the land free of noxious weeds in compliance with MCA 7-22-21.

For timber sale projects, noxious weed management (of both introduction and spread) is primarily addressed through timber sale contract administration. Timber sale contracts require all equipment to be power washed by the contractor and inspected by the forest officer prior to transport to the project area. 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. All of these measures help to reduce the amount of ground disturbance within a project area and thus the potential areas for noxious weeds to establish and spread. After a contract is completed, disturbed areas are typically reseeded to provide vegetative cover and weed competition. The project area is then typically monitored for various resource concerns, including noxious weed establishment and spread. Timber sale areas are monitored for noxious weeds by the forest officer who administers the project. If noxious weeds are identified, the proper treatment (integrated weed management) is developed and implemented, with technical assistance, if needed, from an FMB resource specialist. 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.

Noxious Weed Occurrences and Management

The Montana Department of Agriculture places noxious weeds into three categories based on the extent of their distribution in the state:

- Category 1 noxious weeds are currently widespread in many counties of the state.
- Category 2 species have recently been introduced to the state or are rapidly spreading from their current infestation sites.
- Category 3 noxious weeds have not been detected in the state or may be found only in small, scattered, localized infestations.

Published information regarding the biology and ecology of Category 1 through 3 noxious weed species is located on the Center for Invasive Plant Management website (http://www.weedcenter.org/management/weed_mgmt_profiles.html). A list of these species, along with information obtained from this website about their general habitat associations, is provided in Table 4.7-1.

DNRC documents noxious weed occurrences on trust lands through SLI data collection and during grazing inspections. DNRC inventories and maps weed infestations during grazing license renewals and midterm inspections. The information is recorded in a central database maintained by the FMB Technical Services Section.

DNRC regularly conducts weed spraying and herbicide applications. Weed spraying is typically associated with weed infestations on road rights-of-way, skid trails, and log landings. Herbicide applications are typically used for tree planting and spot applications for seedlings to reduce

TABLE 4.7-1. STATE OF MONTANA NOXIOUS WEED SPECIES LIKELY TO OCCUR ON TRUST LANDS BY CATEGORY AND GENERAL HABITAT ASSOCIATION

			General Habitat Association		
Common Name	**Species**	**Category**	**Forest**	**Riparian**	**Grassland/ Shrubland**
Hoary cress	*Cardaria draba*	1	No	Occasionally in aspen/willow communities	Yes
Diffuse knapweed	*Centaurea diffusa*	1	Dry forests below 7,000 feet	No	Yes
Spotted knapweed	*Centaurea maculosa*	1	Ponderosa pine and Douglas-fir	No	Yes
Russian knapweed	*Centaurea repens*	1	No	Yes	Yes
Oxeye daisy	*Chrysanthemum leucanthemum*	1	No	No	Yes
Canada thistle	*Cirsium arvense*	1	No	Yes	Yes
Field bindweed	*Convolvulus arvensis*	1	No	Yes	Yes
Houndstongue	*Cynoglossum officinale*	1	Spruce/fir, aspen birch, Douglas-fir, ponderosa pine, western white pine, larch, lodgepole pine	No	Yes
Leafy spurge	*Euphorbia esula*	1	Low-elevation woodlands	Yes (also in undisturbed areas)	Yes (also in undisturbed areas)
St. Johnswort	*Hypericum perforatum*	1	Low-elevation woodlands	No	Yes
Dalmatian toadflax	*Linaria dalmatica*	1	Spotty	No	Yes
Yellow toadflax	*Linaria vulgaris*	1	Spotty	No	Yes
Sulfur cinquefoil	*Potentilla recta*	1	Ponderosa pine	No	Yes
Common tansy	*Tanacetum vulgare*	1	No	Yes	Yes
Orange hawkweed	*Hieracium aurantiacum*	2	No	No	Yes
Meadow hawkweed complex	*Hieracium pretense, H. floribundum, H. piloselloides*	2	No	No	Yes
Dyer's woad	*Isatis tinctoria*	2	No	No	Yes
Perennial pepperweed	*Lepidium latifolium*	2	No	Yes	No
Purple loosestrife	*Lythrum salicaria,*	2	No	Yes	No
European wand loosestrife	*Lythrum virgatum*	2	No	Yes	No
Tall buttercup	*Ranunculus acris*	2	No data	No data	No data
Tansy ragwort	*Senecio jacobaea*	2	Clearcuts	Yes	Yes
Saltcedar	*Tamarix* spp.	2	No	Yes	No
Yellow starthistle	*Centaurea solstitialis*	3	No	No	Yes
Rush skeletonweed	*Chondrilla juncea*	3	No	No	Yes
Common crupina	*Crupina vulgaris*	3	No	No	Yes
Yellow flag iris	*Iris pseudacorus*	3	No	Wetlands, marshes	No
Eurasian watermilfoil	*Myriophyllum spicatum*	3	No	Wetlands, marshes	No

Source: Data obtained from the Center for Invasive Plant Management website: http://www.weedcenter.org/management/weed_mgmt_profiles.html competition. For the most recent year statewide data are available, 2004, DNRC sprayed 5,449 acres for noxious weed control, and applied herbicides on 350 acres (Table 4.7-2). DNRC also released bio-controls on 32 acres in 2005 (DNRC 2008a). Between 1998 and 2004, DNRC sprayed an annual average of 2,392 acres statewide and treated 236 acres statewide by herbicide application (Table 4.7-2).

TABLE 4.7-2. ACRES OF WEEDS TREATED BY DNRC IN FISCAL YEAR 2004

Method	Annual Average, 1998–2004	Fiscal Year 2004
Spray	2,392	5,449
Herbicide Application	236	350

Source: DNRC (2008a).

Management Activities Affecting Noxious Weeds

Noxious weeds are invasive, non-native plant species that often dominate regions and ecosystems because of their ability to reproduce prolifically and out-compete native species for available resources. Their ability to colonize and dominate newly invaded ecosystems is often attributed to the absence of native, herbivorous control agents, or as new research indicates, the absence of soil biota native to the invasive species' place of origin, which inhibit plant growth more than soil biota native to the weed invasion site (Callaway et al. 2004). Without such natural control mechanisms in place, invasive plants can spread quickly, particularly following human-induced soil disturbances such as road building, agriculture, livestock grazing, and logging.

DNRC management activities on forested trust lands that may affect noxious weed spread include timber harvesting, road construction and/or maintenance, and grazing.

Effects of and Trends in Climate Change

While human-induced climate change is not generally the initiating factor, nor the most important one, for noxious weed invasion, it is becoming a more important part of the mix (Karl et al. 2009). With climate change likely to continue, invasive plant species are expected to become a growing problem for several reasons (Karl et al. 2009).

- Some invasive plants respond with greater growth rates than native plants with increasing CO_2
- Invasive plants tend to tolerate a broader range of environmental conditions
- Invasive plants can migrate and establish themselves more rapidly than native plants.
- Invasive plants do not typically depend on external pollinators or seed dispersers to reproduce.

As with other plant species, increasing temperatures are causing noxious weed species to move northward and upward in elevation (Karl et al. 2009). For the reasons listed above, however, the movement of noxious weed species may be faster than other plant species, resulting in effects on plant communities previously unaffected by such species.

4.7.2.2 Environmental Consequences

Introduction and Evaluation Criteria

The effects of the no-action and action alternatives on the risk of noxious weed spread was assessed by evaluating, at a programmatic level, the amount of ground disturbance, length of road network, and conservation commitments that have the potential to affect weed infestation risk.

Alternative 1 (No Action)

Under Alternative 1, DNRC would continue to implement current practices (ARMs and MCA) that address noxious weeds. Other current practices by DNRC also indirectly help control and minimize the spread of noxious weeds. These include ARMs that limit ground disturbance, limit road vehicle traffic, and monitor grazing.

Under Alternative 1, approximately 1,400 miles of new road would be constructed in the project area by year 50 (derived from Table 4.4-6). Of the total HCP project area (548,500 acres), this alternative would have approximately 106,875 acres of grass-forb (non-stocked forest) and seedling/sapling successional forests at year 50 (Table 4.2-15). It is along these roads and in the young forests (as well as in riparian zones) where weed infestations would be most likely to occur. Although the ARMs require DNRC to identify noxious weeds and prescribe control measures, noxious weeds would continue to persist and spread by wind, water, and vehicles. Roadsides and disturbed areas would continue to be most susceptible (Potash 1991; Smith-Kuebel and Lillybridge 1993). New weed infestations, if left untreated, can displace native vegetation and persist for many years (Floyd et al. 2006).

DNRC would continue to control timber harvest activities within RMZs and SMZs, which would help protect riparian habitats from weed infestations. DNRC would continue to address roads with sediment delivery issues, which would stabilize some sites vulnerable to weed infestation. BMPs implemented for road construction and maintenance and gravel pit operations would help to prevent spread of noxious weeds along the road network.

Under current road management ARMs (36.11.421), DNRC closes and abandons all roads that are non-essential for near-term management activities.

In the Stillwater Block, under Alternative 1, road miles would increase by 17.6 miles over the next 50 years and they would be closed to all motorized public access. DNRC motorized use would likely be seasonally restricted on at least some of the new roads. In the Swan River State Forest, roads would increase by 70.3 miles, but all new roads would be restricted from motorized public access so that there would be no increased risk of weed spread through vehicle travel, particularly because road closures are inspected on a routine schedule.

Grazing licenses would continue to be reviewed at time of license renewal and midterm for noxious weeds (every 5 years). While DNRC and the licensees would be required to rehabilitate riparian areas damaged by grazing (and thus susceptible to weed infestation), there would be no timeframe established and no effectiveness monitoring. Because the number of AUMs issued under a grazing license is generally relatively low, it can be difficult to make improvements cost-effective.

Alternative 2 (Proposed HCP)

Alternative 2 would implement current practices (ARMs and MCA) that address noxious weeds as described under Regulatory Framework. None of the new HCP commitments would specifically address noxious weeds; however, they may indirectly help control and prevent noxious weed invasion better than Alternative 1 through greater restrictions on ground disturbance and road vehicle traffic, and enhanced monitoring and correction of grazing issues.

Alternative 2 would result in fewer miles of total roads and open roads on DNRC land (Table 4.4-6), but would result in approximately 11.7 percent more grass/forb and seedling/sapling forests (Table 4.2-15) relative to Alternative 1.

Minimizing new open road construction in riparian areas and avalanche chutes (commitment GB-PR 4) would help to reduce the chances for noxious weeds to spread in these habitats. Additionally, the aquatic conservation strategy under Alternative 2 would increase RMZ widths along streams and lakes supporting HCP fish species, which would help prevent invasion of weeds along these systems.

Program-wide gravel operation conservation commitments (GB-PR7) under Alternative 2 would comply with biennial agreements with county weed boards. Noxious weeds would be managed using an integrated weed management approach, and medium and large gravel pits would have a cap on their size and number in each administrative unit in addition to a cap on the size of non-vegetated areas associated with large pits. This would likely decrease chances for the spread of noxious weeds.

Relative to Alternative 1, under Alternative 2, DNRC would also improve maintenance of road closures, which may slow the spread of noxious weeds that is often associated with off-road vehicle traffic. Alternative 2 would also require more frequent monitoring and correction of erosion risk areas on roads that, if left untreated, could be invaded by noxious weeds (AQ-SD2). By requiring additional review by water resource specialists and adoption of TMDLs (AQ-SD3), road management activities would be less likely to result in additional erosion sites susceptible to weeds.

In the Stillwater Block, under Alternative 2, road miles would increase by 19.3 miles but they would be closed to all motorized public access, and DNRC motorized use would be seasonally restricted on 10.5 miles of the new road. Under Alternative 2, some existing roads would also be reclassified, resulting in a net increase of 47.6 miles of road that would become seasonally available to public motorized use. Therefore, there could be a slight increase in the spread of noxious weeds in these areas.

In the Swan River State Forest, under all action alternatives, if the Swan Agreement is terminated, overall road miles would increase by 70.3 miles (same as under Alternative 1). In addition, open road miles could increase by 28 miles because DNRC may be required to provide access to adjacent intermingled private lands. However, an additional 41 miles would be reclassified and restricted year-round from motorized public access. For the 28 miles of potential road, there may be an increased risk of noxious weed invasion attributed to new road construction and vehicle traffic. This would be partially offset by restricted vehicle access on 41 miles of road.

Additional commitments under Alternative 2 that would have some beneficial effect on controlling weed infestations include grizzly bear commitments in recovery zones for designing timber sales to protect grizzly bear habitat, leaving up to 100 feet of vegetation between open roads and clearcut and seed tree harvest units, and avoiding granting existing or new access across HCP project area lands where possible (GB-RZ1, GB-NR4, GB-RZ6, respectively).

The riparian timber harvest conservation strategy would establish a 50-foot no-harvest buffer on all Class 1 streams and lakes and would extend that no-harvest buffer to CMZs under some conditions for HCP fish-bearing streams. Compared to Alternative 1, these buffers would create less opportunity for weed infestations on fish-bearing streams and lakes.

Under Alternative 2 the aquatic grazing conservation strategy (AQ-GR1) requires DNRC to monitor and address damage to stream banks, riparian vegetation, and noxious weed infestation every 5 years instead of 10 years under Alternative 1. This commitment would also require site-specific corrective actions for addressing verified grazing problems and effectiveness monitoring, which should help address noxious weed problems.

Alternative 3 (Increased Conservation HCP)

Alternative 3 would implement current practices (ARMs and MCA) that address noxious weeds as described under Regulatory Framework. None of the new HCP commitments would specifically address noxious weeds; however, those that further restrict disturbance activities could influence the spread of noxious weeds throughout the HCP project area, resulting in this alternative providing greater indirect benefits for noxious weed control and prevention than the other alternatives. The effects would be similar to Alternative 2, with the following exceptions.

Total road length at year 50 would be the lowest of any of the alternatives (Table 4.4-6), and the acreage of grass/forb and seedling/sapling successional forests would be lower than the other alternatives in year 50 (Table 4.2-15). ~~The aquatic conservation strategy~~Compared to Alternative 2, this alternative would ~~increase~~require wider no-harvest buffers in RMZs and CMZs~~ beyond what is specified in Alternative 2~~, creating less opportunity for weed infestations on HCP fish-bearing streams, while providing no increased protection along non-HCP fish-bearing streams. The schedule for inventorying and addressing erosion risk areas would be accelerated by 5 years.

Under Alternative 3, because the Stillwater Core would receive minimal forest management, the risk of weed infestation would be lower than under Alternative 2. However, within the Stillwater Block, DNRC would only build 1.6 fewer miles of road than under Alternative 2.

Instead of monitoring grazing impacts every 5 years as under Alternative 2, DNRC would monitor impacts annually, which should help address noxious weed problems.

Alternative 4 (Increased Management Flexibility HCP)

Alternative 4 would implement current practices (ARMs and MCA) that address noxious weeds as described under Regulatory Framework. In terms of the indirect benefits of the commitments on noxious weeds, Alternative 4 would rank between Alternative 1 and Alternative 2.

This alternative would have similar mileage of new roads and acreages of grass/forb and seedling/sapling forests in year 50, and generally the same effects on weed infestations as Alternative 2, with the following exceptions.

Alternative 4 would have slightly greater restrictions in SMZs and RMZs than Alternative 1, but less than Alternatives 2 and 3, retaining ~~the~~a 25-foot no-harvest buffer~~, but~~ and reducing the buffer for restricted harvest from 26 to 50 feet for streams and lakes supporting HCP fish species instead of out to one 100-year site index tree height under Alternative 2. The schedule for inventorying and addressing erosion risk areas would be delayed by 5 years compared to Alternative 2.

Grazing commitments would be the same as Alternative 2, except monitoring grazing effects would occur every 10 years instead of every 5 years. This alternative would be similar to the no-action alternative in that DNRC would not require a timeframe completion date for problem licenses that have impacts to stream banks and vegetation and/or weed infestation, or monitoring of effectiveness of corrective actions.

Summary

All alternatives would implement current practices (ARMs and MCA) that address noxious weeds as described under Regulatory Framework. However, under the action alternatives, some conservation commitments would potentially help reduce the spread of noxious weeds as compared to Alternative 1. This would mostly be due to reduced ground disturbance or stabilization of disturbed areas, less road vehicle traffic, and greater grazing monitoring. Alternative 3 would provide the greatest level of protection because it would construct the fewest miles of road, place more roads under restrictions from public access, require the shortest timeframe for correction of eroding roads, and require the most frequent grazing inspections.

Climate change-related effects on noxious weeds would be the same under all alternatives; however, the additional protections offered by the action alternatives may reduce the risk of additional infestations and subsequent effects on native plant communities.

4.7.3 Wetlands

4.7.3.1 Affected Environment

This section describes the regulatory framework under which DNRC manages wetlands, describes wetlands and their functions, and characterizes existing wetland conditions in the planning area.

Regulatory Framework

When forest management activities are proposed within or adjacent to an isolated wetland, or an adjacent wetland found within an SMZ, DNRC establishes WMZ boundaries. Within WMZs, DNRC abides by requirements set forth by the SMZ Law (MCA 77-5-3-1 through 77-5-307, ARMs 36.11.301 through 36.11.313) and Forest Management ARMs (36.11.426), and avoids use and construction of roads within WMZs, with some exceptions. DNRC also limits harvest and equipment operations within WMZs to low-impact harvest systems that avoid excessive compactions, displacement, or erosion of soil. Operations of ground-based equipment are also limited within WMZs to periods of low soil moisture, frozen soil, or snow-covered ground conditions.

The primary regulation that governs wetland management in the planning area is the federal CWA. This act, which is administered by the ACOE and EPA, is intended to protect the biological, physical, and chemical integrity of the nation's waters, including wetlands. Two sections of the CWA could pertain to the proposed project: Sections 404 and 401. Section 404 regulates placement of dredge or fill material into waters of the United States, including wetlands. Activities that constitute placement of fill include trenching, ditching, draining, and installing piers or pilings. Project proponents intending to undertake such activities must obtain a permit from the ACOE prior to initiating site work. The purpose of Section 401 water quality certification is to ensure that federally permitted projects are consistent with state water quality standards. Projects that require a Section 404 permit generally must have a Section 401 water quality certification. According to Section 404, certain activities including normal silviculture activities, such as harvesting, are exempt from Section 404 permit requirements.

In addition to the CWA, Executive Order 11990 further protects wetlands when there is federal involvement by mandating that agencies minimize destruction, loss, or degradation to wetlands and preserve and enhance the natural and beneficial value of wetlands by restricting new construction in wetlands. The ARMs provide specific guidelines on wetland management for forestry-related activities within the planning area (Table 4.7-3).

TABLE 4.7-3. APPLICABLE EXISTING WETLAND-RELATED REGULATIONS

Regulation	Requirement
Federal	
Clean Water Act, Section 404	Regulates the discharge of dredged and fill materials into waters, including wetlands.
Clean Water Act, Section 401	Requires water quality certification from the state.
Executive Order 11990	Mandates agencies to minimize the destruction, loss, or degradation of wetlands; preserve and enhance the natural and beneficial values of wetlands; and restrict new construction in wetlands.
State	
ARMs:	
Streamside Management Zones 36.11.301 through 313	Defines wetlands regulated under the SMZ Law. Provides restrictions on timber harvest, equipment operation, and road construction where wetlands exist adjacent to stream channels.
Wetland Management Zones 36.11.426	Defines wetland management zones on forested trust lands and provides restrictions on timber harvest, equipment operation, and road construction and use in these areas.
Montana Water Quality Act	Governs process for obtaining a state water quality certificate, pursuant to Section 401 of the federal CWA.

Wetlands and their Functions

As formally defined by the ACOE, wetlands are those areas that are inundated or saturated by surface water or groundwater at a frequency and duration sufficient to support, and that under normal circumstances do support, a prevalence of vegetation typically adapted for life in saturated soils (Environmental Laboratory 1987). Typical wetlands include forested swamps, marshes, and bogs.

Under ARM 36.11.403, DNRC defines wetlands in a very similar way to the ACOE definition. Wetlands are those areas that are inundated or saturated by surface water or groundwater at a frequency and duration sufficient to support a prevalence of vegetation typically adapted for life in saturated soil conditions. Wetlands include marshes, swamps, bogs, and similar areas. According to ARM 36.11.426, DNRC identifies wetlands by using the following criteria: plant species composition, soil characteristics, or depth of water table.

Wetlands provide important environmental functions. These functions can be divided into two general categories: hydrological and habitat support (Table 4.7-4). Hydrological functions include shoreline and bank stabilization; flood flow alteration; groundwater recharge; sediment removal and retention; and nutrient and pollutant removal, retention, and transformation. Habitat functions include general habitat suitability, as well as specific habitat functions providing fish, birds, amphibians, and other wildlife access to food, cover, and breeding and rearing opportunities. In addition, wetlands may also support cultural and socioeconomic values.

TABLE 4.7-4. WETLAND FUNCTIONS

Function	Description
Hydrological	
Shoreline and bank stabilization	Reduce shoreline and bank erosion by binding soil substrates in wetland plant roots.
Flood flow alteration	Attenuate peak water flow during major storm events.
Groundwater recharge	Help maintain minimum stream base flows by naturally regulating the release of groundwater discharge into streams and by recharging aquifers that discharge groundwater into streams.
Sediment removal and retention	Remove and retain sediments from the water.
Nutrient and pollutant removal, retention, and transformation	Remove, retain, and transform nutrients and pollutants from the water.
Habitat	Provide food, cover, and nesting, rearing, and other habitat functions for a variety of fish and wildlife.

Wetlands in the Planning Area

The National Wetlands Inventory (NWI) wetland data provides GIS data for wetland locations and types (riverine, lacustrine, and palustrine) in the planning area (DNRC 2008a). Riverine wetlands are those wetlands that are contained within a river or stream channel; lacustrine wetlands are associated with lakes and reservoirs that are generally at least 20 acres in size; and palustrine wetlands include isolated ponds, marshes, swamps, bogs, and wet prairies. The NWI data are based on photo-interpretation and do not capture small wetlands. An NPS study in the Sierra Nevadas of California found that 45 percent of wetlands were missed by NWI data, particularly those obscured by canopy cover. Additionally, classifications of these wetlands were of varying accuracy. Of the sites identified by NWI within the study, lacustrine sites were identified with 97 percent accuracy, palustrine sites were identified with 94 percent accuracy, and riverine sites were identified correctly with only 51 percent accuracy (Werner 2005). There are approximately 440,000 acres of wetlands in the planning area, most of which are lacustrine and palustrine types (Table 4.7-5). Within the HCP project area, approximately 1,800 acres of wetlands occur, most of which are palustrine.

TABLE 4.7-5. ACRES OF RIVERINE, PALUSTRINE, AND LACUSTRINE WETLANDS IN THE PLANNING AREA

Wetland Type	All Ownership in the Planning Area (Acres)	Trust Lands in the Planning Area (Acres)	Non-Trust Lands in Planning Area (Acres)	HCP Project Area (Acres)
Riverine	36,600	900	35,700	200
Lacustrine	208,700	2,000	206,700	60
Palustrine	194,200	8,100	186,100	1,500
Total	**439,600**	**11,100**	**428,500**	**1,800**

Note: Totals may not add up due to rounding.
Source: DNRC (2008a).

Although assessments of the conditions of the individual wetlands in the planning area are not available, information on wetland condition in Montana as a region is available. The SFLMP (p. III-8 to III-9) summarizes wetland conditions in Montana as follows:

> *"… the integrity of riparian [and wetland] areas has been compromised by the often combined effects of beaver removal, large organic debris removal, logging, livestock grazing, and road construction . . . Mountain riparian ecosystems probably have not changed as much as more accessible lowland floodplain areas . . . Southwest Montana shows some fairly significant riparian [and wetland] degradation from livestock grazing. The impact of silviculture is not nearly as severe as that of grazing, but is nonetheless important . . . In the Northwest portion of Montana, livestock grazing is not as prevalent as in the Southwest, but silvicultural impacts are most widespread there."*

Effects of and Trends in Climate Change

Increased temperatures and decreased precipitation may affect patterns of water inputs, storage capacity, wetland recharge, and drought, resulting in the following potential effects on wetlands (North American Bird Conservation Initiative, U.S. Committee 2010).

- Increased evaporation and reduced summer soil moisture may reduce the extent of semi-permanent and seasonal wetlands.
- Wetlands dependent on snowmelt may diminish or disappear.
- Increased frequency and intensity of severe storm events may increase the risk of erosion or alter the time a wetland holds water.
- Plant communities and the habitat functions they provide may change.
- Montane wetlands may experience greater effects if associated temperature-sensitive plant and animal species are unable to move upslope.

Wetland functions, such as flood control, sediment capture, and groundwater replenishing may also be affected (North American Bird Conservation Initiative, U.S. Committee 2010).

4.7.3.2 Environmental Consequences

Introduction and Evaluation Criteria

None of the alternatives would change how DNRC protects wetlands or mitigates for impacts. Rather the effects on wetlands were analyzed based on each alternative's riparian timber harvest commitments, road sediment commitments, and grazing evaluations and monitoring requirements.

Alternative 1 (No Action)

Under Alternative 1, wetland protection would continue as under current conditions (ARMs 36.11.301 through 36.11.313 and 36.11.426). Riparian harvest would be restricted along Class 1 and 2 streams and lakes based on the SMZ Law, which extends SMZs to include wetlands and requires retention of shrubs and trees, which would help protect wetlands and wetland functions. DNRC would continue to establish WMZs and limit equipment operations to low-impact harvest systems and operations that do not cause excessive compaction, displacement, or erosion of the soil. DNRC would also continue to select logging systems to minimize erosion within WMZs.

Impacts on wetlands from erosion from roads is currently addressed in the ARMs by requiring an assessment and prioritization of road maintenance needs every 5 years, although DNRC currently does not meet this timeframe on scattered parcels.

Although not explicitly stated, the 10-year grazing license renewal assessment (10-year cycle) and midterm evaluations (5-year cycle) for damage to stream banks, riparian vegetation, and noxious weed infestation also includes wetlands. If wetland damage is documented, DNRC and the licensee are required to mitigate.

Alternative 2 (Proposed HCP)

Under Alternative 2, wetland protection would continue as under current conditions (ARMs 36.11.301 through 36.11.313 and 36.11.426). However, some commitments would be enhanced resulting in an overall improvement in the protection of wetlands under this alternative.

Riparian harvest activities ~~in SMZs and RMZs on~~ along Class 1 lakes and streams ~~supporting HCP fish species~~ (AQ-RM1) would be restricted through a 50-foot no-harvest buffer, a wider buffer with reduced harvest, and a provision to expand the buffer for some CMZs on HCP fish-bearing streams, providing greater protection of wetlands.

Sediment and erosion impacts on wetlands would be reduced compared to Alternative 1 by requiring DNRC to complete inventory, assessment, and corrective actions on sediment delivery roads within a specified timeframe based on bull trout, westslope cutthroat trout, and Columbia redband trout presence in the watershed (AQ-SD2).

Alternative 2 would require assessment for damage to stream banks, riparian vegetation, and noxious weed infestation, which also includes wetlands, every 5 years versus 10 years for Alternative 1 (AQ-GR1). Additionally, under Alternative 2, if damage is documented, DNRC and the licensee are required to mitigate within a specified timeframe and monitor corrective actions.

Alternative 3 (Increased Conservation HCP)

Under Alternative 3, wetland protection would continue as under current conditions (ARMs 36.11.301 through 36.11.313 and 36.11.426). However, Alternative 3 requires additional conservation commitments that would have the most beneficial effects on wetlands of any alternative. The effects would be most similar to Alternative 2, with the following exceptions that would increase protection of wetlands in certain circumstances.

Riparian harvest activities along HCP fish-bearing streams would be further restricted through a no-harvest buffer that would include the entire RMZ and would include CMZs (AQ-RM1), while wetlands near non-HCP fish-bearing streams would receive the same level of protection as provided under Alternative 1. The schedule for identifying and correcting sedimentation issues on roads would be accelerated by 5 years (AQ-SD2), which would further minimize the effects of erosion on wetlands. Instead of monitoring grazing impacts every 5 years as under Alternative 2, DNRC would monitor impacts annually (AQ-GR1).

Alternative 4 (Increased Management Flexibility HCP)

Under Alternative 4, wetland protection would continue as under current conditions (ARMs 36.11.301 through 36.11.313 and 36.11.426). Other commitments that benefit wetlands under Alternative 4 would be very similar to Alternative 2, although the increased management flexibility would slightly reduce protection of wetlands from indirect effects of timber harvest and grazing. The primary differences between this alternative and Alternative 2 are described below.

Alternative 4 would ~~retain the~~implement a 25-foot no-harvest buffer, ~~but~~and the buffer for restricted harvest would ~~be reduced to the zone~~extend from 26 to 50 feet for streams and lakes supporting HCP fish species instead of out to one 100-year site index tree height~~ for~~, as required by Alternatives 2 and 3~~ (AQ-RM1)~~. The schedule for identifying and correcting sedimentation issues on roads would be extended by 5 years (AQ-SD2). Grazing impacts would be monitored every 10 years instead of every 5 years (AQ-GR1).

Summary

Under all alternatives, wetland protection would continue as under current conditions (ARMs 36.11.301 through 36.11.313 and 36.11.426). However, under the action alternatives, some conservation commitments would result in enhanced wetland protection over Alternative 1. This would mostly be due to stream buffers that limit riparian harvest; requirements for inventory, assessment, and corrective actions on sediment delivery roads; and increased frequency of inspection requirements for correction of issues associated with grazing licenses. Of the action alternatives, Alternative 3 may provide~~s the greatest potential~~more protection of wetlands in the RMZ on HCP fish-bearing streams compared to the other alternatives due to wider streamside buffers where harvest would be prohibited, ~~which would protect wetlands located in the riparian zones of streams~~while Alternative 2 may provide more protection due to the implementation of a 50-foot no-harvest buffer on non-HCP fish-bearing Class 1 stream and lakes. Alternative 3 also has the shortest timeline for identifying and correcting sedimentation issues on roads, which would reduce sediment and erosion impacts on wetlands.

While any climate change-related effects on wetlands would be the same under all alternatives, the additional protections of wetlands offered by the action alternatives would likely reduce the risk of additional effects from forest management activities on those systems.

4.8 Fish and Fish Habitat

The planning area provides habitat for a diverse array of fish species, with over 86 fish species known or expected to occur in Montana, more than 50 of which are native to the state. This section addresses the existing conditions and management of fish and fish habitat in the HCP project area. The first subsection provides an overview of existing fisheries-related regulations, the second subsection provides an overview of the important components of the aquatic environment that fish require and that forest practices may affect, and subsequent subsections address various fish species groups (HCP fish species, special status species, and other fish). Emphasis is placed on HCP fish species because these native, cold-water fish would be most influenced by changes in forest management practices resulting from the proposed HCP and other alternatives. Sources of information include communications with local and regional biologists, GIS data from DNRC and other sources, fisheries data from MFWP, and literature review.

4.8.1 Regulatory Framework

Management of the DNRC lands in the planning area is governed by various fisheries-related federal and state regulations (Table 4.8-1). While some of these regulations are specific to individual species (i.e., ESA), other regulations provide more general guidance on the protection of fish habitat, while still others address the various environmental factors and conditions that might affect fish.

The most applicable regulations governing fish management on trust lands include the SMZ Law, and the Forest Management ARMs. These laws and rules were implemented to protect streams, wetlands, and watersheds from the adverse effects of timber harvest and associated activities, such as road building and subsequent erosion into adjacent streams. The primary features of these rules are to restrict the scope and range of activities that may pose a threat to aquatic habitat and species.

This section addresses only those regulations that are specific to fish and in-stream/riparian aquatic habitat. The regulations affecting other types of environmental factors that can directly and indirectly affect fish, such as road building and water quality, are also described, but covered in more detail in Sections 4.4 (Transportation) and 4.6 (Water Resources), respectively.

The SMZ Law (MCA 77-5-301 through 307) and rules (ARMs 36.11.301 through 313) regulate commercial timber harvest conducted immediately adjacent to all streams, specific lakes, and other waterbodies in Montana. The SMZ is defined as the stream, lake, or other waterbody and an adjacent area of varying width where management practices that might affect wildlife habitat or water quality, fish, or other aquatic resources need to be modified (MCA 77-5-302(8)). The primary features of these regulations are to restrict the scope and range of activities associated with commercial timber harvest that may pose a threat to aquatic habitat and species.

TABLE 4.8-1. APPLICABLE EXISTING AQUATIC RESOURCE-RELATED REGULATIONS

Regulation	Overseeing Agency	Purpose
Federal		
Endangered Species Act, 16 USC 1531 et seq.	USFWS	Protect and recover threatened and endangered fish species and their critical habitat (including bull trout).
Fish and Wildlife Coordination Act, 16 USC 661 through 667	USFWS, MFWP	All fish, especially riparian and aquatic wildlife (including bull trout, westslope cutthroat, and Columbia redband trout).
Clean Water Act, Section 303	EPA	Waters of the United States.
Clean Water Act, 33 USC 1251, Section 401	EPA (Administered by MDEQ)	Waters of the United States, including wetlands.
Clean Water Act, 33 USC 1344, Section 404	EPA (Administered by ACOE)	Waters of the United States, including wetlands.
Rivers and Harbors Act, Section 10, 33 USC 403 and 407	U.S. Coast Guard	Navigable waters.
State		
SMZ Law and rules, MCA 77-5-301 through 307 ARMs 36.11.301 through 313	Montana DNRC	Management of timber harvest activities near streams and other waterbodies.
Forest Management ARMs (36.11.422 through 443)	Montana DNRC	Threatened and endangered species, DNRC sensitive species, game species, fish habitat.
Montana Stream Protection Act, MCA 87-5-501 through 507, 87-5-509	MFWP	Any project that may affect the natural and existing shape and form of any stream or its banks or tributaries.

The six established functions of an SMZ are:

1. Acts as a sediment filter to maintain water quality
2. Provides shade to regulate water temperature
3. Supports diverse and productive aquatic and terrestrial habitats
4. Protects the stream channel and banks
5. Provides for the recruitment of LWD to maintain stream channel features
6. Promotes floodplain stability.

The SMZ Law designates three classes of stream based on fish presence and stream flow characteristics, with varying degrees of riparian zone protection measure requirements (Table 4.8-2). These protection measures include minimum buffer widths, exceptions to accommodate wetland protection, tree retention regulations, as well as prohibited or regulated activities within SMZs.

In addition to the SMZ Law, the Forest Management ARMs (36.11.422 through 443) apply to more specific state land management practices. These include rules governing road management, watershed management, cumulative effects, monitoring, RMZs, WMZs, and fisheries (Table 4.8-3).

TABLE 4.8-2. STREAM CLASSIFICATIONS AND ASSOCIATED MANAGEMENT REQUIREMENTS OF THE SMZ LAW TO PROTECT MONTANA WATERBODIES

	Stream Classification		
	Class 1	**Class 2**	**Class 3**
Classification Parameters	Supports fish, or contributes flow to another waterbody for 6 months per year	Contributes flow to another waterbody < 6 months per year, or does not contribute surface flow to another waterbody but has surface flow for 6 or more months	Rarely contributes flow to other waterbodies, and has surface flow < 6 months per year
Minimum SMZ Width	50 feet, or 100 feet for slopes > 35%	50 feet, or 100 feet for slopes > 35%	50 feet
Increase SMZ Size to Accommodate Wetlands	Yes	Yes	Yes
Clearcutting Allowed	No	No	No
Tree Retention Regulations	At least 50%, or 10 per 100 feet, of trees ≥ 8 inches dbh	At least 50%, or 5 per 100 feet, of trees ≥ 8 inches dbh	Sub-merchantable trees and shrubs
Retained Tree Characteristics	Favor leaning trees and trees within 50 feet of stream that represent pre-harvest size and species	Favor leaning trees and trees within 50 feet of stream that represent pre-harvest size and species	None

TABLE 4.8-3. REQUIREMENTS OF FISH-RELATED FOREST MANAGEMENT ARMS

Administrative Rule	Topic	Application on State Lands
36.11.421	Road Management	Minimize the miles and size of roads.
		Build, maintain, and abandon roads to maximize efficiency.
36.11.422	Watershed Management	Maintain high-quality water.
		Incorporate appropriate BMPs.
36.11.423	Cumulative Effects	Assess and minimize CWE.
36.11.424	Monitoring	Develop monitoring strategies to assess watershed impacts of land use activities.
36.11.425	RMZs	Contain size and land use restriction related to RMZs.
36.11.426	WMZs	Protect forested wetlands.
36.11.427	Fisheries	Minimize impacts to fish populations and habitat.
36.11.436	Sensitive Species	Adequately consider sensitive species in assessments and management decisions.

The intent of the ARM related to road management (ARM 36.11.421) is to minimize the number of roads to reduce impacts to fish and fish habitat by reducing sediment delivery to streams and limiting disturbance to streamside vegetation. Some road management practices are prioritized based on actual or potential fish use of area streams or other habitat or water quality concerns.

ARM 36.11.425 requires the establishment of an RMZ, when forest management activities (including timber harvest) are proposed on sites that are adjacent to fish-bearing streams. The total

RMZ width, including the SMZ, is equal to the 100-year site index tree height. Harvest conducted within the combined SMZ and RMZ must retain all bank edge trees and retain enough other trees to ensure adequate levels of shade and potential LWD recruitment to the stream. Adequate levels of shade are defined under the ARM as those that maintain natural stream temperature ranges. Adequate levels of LWD recruitment are defined under the ARM as those that maintain channel form and function. Target levels of LWD and shade, and the adequacy of proposed prescriptions in meeting target levels, are currently determined on a site-specific, project-level basis.

In addition to the SMZ and RMZ rules, ARM 36.11.426 provides regulations relative to WMZs. This rule states that for wetlands found within an SMZ, the WMZ boundary shall be 50 feet from the wetland. All requirements under the SMZ Law (ARMs 36.11.301 through 313) must be met for wetlands located within or intercepting the SMZ boundary.

ARMs 36.11.427(2)(i) and 36.11.427(3) also require forest management activities to protect and maintain bull trout, Yellowstone and westslope cutthroat trout, arctic grayling, and all other sensitive fish and aquatic species. The FMB maintains its own list of species that are considered sensitive under the rules. This list is modified using information and classification systems developed by the USFS, USFWS, MNHP, and MFWP. Also under the ARMs, DNRC is required to minimize impacts to fish populations and habitat by making reasonable efforts, in its sole discretion, to cooperate in the implementation of conservation strategies developed for the State of Montana. These include

- *Restoration Plan for Bull Trout in the Clark Fork River Basin and Kootenai River Basin* (MBTRT 2000)
- *Memorandum of Understanding and Conservation Agreement for Westslope Cutthroat and Yellowstone Cutthroat Trout in Montana* (MFWP 2007a)
- *Bull Trout Draft Recovery Plan* (USFWS 2002a)
- Existing institutional practices.

In addition to the protective measures that are directly applicable to DNRC activities (including regulatory measures and those developed by DNRC), other agencies and entities have also developed measures to protect fish and their habitat. These measures include INFISH guidelines developed by the USFS (1995b) and those measures covered under the Plum Creek HCP for forest activities in Montana (Plum Creek 2000). These measures may be implemented on lands adjacent to DNRC lands that are owned by a federal agencies and Plum Creek, respectively.

INFISH, if implemented under the new USFS national forest land management planning strategy, applies federal management guidelines to protect native fish to reduce the risk of population loss and negative impacts to aquatic habitat through the establishment of riparian management objectives and riparian habitat conservation areas. The Plum Creek HCP habitat goals and objectives are based on the principle of providing cold, clean, complex, and connected waters (primarily to benefit salmonids) on 1.4 million acres of Plum Creek Timber Company lands in western Montana.

4.8.2 Affected Environment - Key Aquatic Habitat Factors

The distribution and abundance of fish populations within the planning area and HCP project area is largely a function of aquatic habitat quantity and quality. These aquatic habitat parameters are influenced by a number of land use activities and factors that directly or indirectly affect fish or their habitat. These factors include sediment loading from road construction and maintenance, population connectivity relative to stream crossings (blockages), CWE, livestock grazing, and riparian habitat conditions.

Montana contains diverse aquatic resources due to geographic variability across the state, from the Rocky Mountain region in the west, to the broad plains region in the east. This variability is also reflected in the diversity of aquatic habitat available throughout the state (Figures D-6A through D-6C in Appendix D, EIS Figures). The state contains about 2,000 natural lakes; 50 reservoirs of 500 acres or larger; 15,000 miles of cold-water streams; 1,300 miles of warm-water streams; thousands of small reservoirs and ponds; and thousands of miles of intermittent streams (DNRC 2008a). Many of these waterbodies support either cold- or warm-water fish species, while some support both.

The description of the affected environment requires subdividing the HCP project area into discrete, spatially relevant geographic units, which allow appropriate description of existing conditions within a landscape context. Within this EIS, other resources (e.g., wildlife and vegetation) are evaluated at a spatial scale defined by DNRC administrative boundaries, such as land offices and administrative unit offices. However, fish and other aquatic life are influenced by habitat interactions that occur within a river basin and watershed scale, which are not necessarily confined by biologically arbitrary administrative units. Therefore, analysis of habitat and fish population conditions within the HCP project area uses a watershed approach, with 14 EIS aquatic analysis units (Table E4-3 in Appendix E, EIS Tables, and Figure D-7, Appendix D, EIS Figures). For comparative purposes, the relationship of the EIS aquatic analysis units to DNRC administrative units is presented in Table 4.8-4.

The bull trout was initially listed as three separate distinct population segments (DPSs) (63 FR 31647-31674, June 10, 1998, 64 FR 17110-17125, April 8, 1999). The final listing rule for the contiguous United States population of the bull trout consolidated all the population segments into a single listed taxon, bull trout in the contiguous United States (64 FR 58910-58933, November 1, 1999). Five segments of the contiguous United States population of bull trout were identified as interim recovery units: (1) Jarbidge River, (2) Klamath River, (3) Columbia River, (4) Coastal-Puget Sound, and (5) St. Mary-Belly River. A comprehensive discussion of these topics is found in the USFWS's draft recovery plan for bull trout (USFWS 2002a), the USFWS's Science Team Document (Whitesel et al. 2004), the 5-year status review (USFWS 2005b), and the final rule listing designated critical habitat (70 FR 56211-56311, September 26, 2005). A revised rule for bull trout critical habitat was issued for public comment in January 2010 (75 FR 2270-2431, January 14, 2010). The final rule is anticipated in September 2010 and will likely take effect 30 days after notification in the Federal Register. The draft bull trout recovery plan (USFWS 2002a) describes an organizational hierarchy for bull trout at nested spatial levels that include recovery units, core areas, and local populations (the lowest level in the organizational hierarchy). Twenty-seven major watersheds were referred to as recovery units; however, terminology has since been revised, and the former recovery units are now referred to as management units. Management units are the major units for managing recovery efforts, with each management unit consisting of one or more core areas, and each core area representing the closest approximation of a biologically functioning unit for bull trout. A local population is a group of bull trout that spawn within a particular stream

TABLE 4.8-4. ACREAGE OF EIS AQUATIC ANALYSIS UNITS WITHIN THE HCP PROJECT AREA BY DNRC LAND OFFICE

	Acres of EIS Aquatic Analysis Unit															
DNRC Land Office and Administrative Units	Lower Kootenai	Middle Kootenai	Upper Kootenai	North Fork Flathead	Flathead Lake/ Main Fork	Swan	Stillwater	Lower Clark Fork	Middle Clark Fork	Upper Clark Fork	Bitterroot	Blackfoot	Rock Creek	Upper Missouri	Total	Percent of Total Project Area
NWLO																
Kalispell	0	7,324	0	0	10,470	4,914	3,454	0	15,493	0	0	0	0	0	**41,654**	7.6
Libby	3,527	21,442	3,480	0	0	0	0	0	2	0	0	0	0	0	**28,452**	5.2
Plains	0	1	0	0	0	0	0	4,185	49,371	0	0	0	0	0	**53,556**	9.8
Stillwater	0	0	7,673	18,499	0	0	83,867	0	0	0	0	0	0	0	**110,039**	20.1
Swan	0	0	0	0	0	39,699	0	0	0	0	0	0	0	0	**39,699**	7.2
SWLO																
Anaconda	0	0	0	0	0	0	0	0	0	33,757	0	3,342	4,592	2,244	**43,935**	8.0
Clearwater	0	0	0	0	0	0	0	0	1	409	0	43,740	0	1	**44,150**	8.0
Hamilton	0	0	0	0	0	0	0	0	0	0	20,913	0	0	0	**20,913**	3.8
Missoula	0	0	0	0	0	0	0	0	23,646	13,007	6,830	9,446	0	0	**52,928**	9.6
CLO																
Bozeman	0	0	0	0	0	0	0	0	0	0	0	0	0	16,483	**16,483**	3.0
Conrad	0	0	0	0	0	0	0	0	0	0	0	0	0	0	**0**	0.0
Dillon	0	0	0	0	0	0	0	0	0	0	0	0	0	70,608	**70,608**	12.9
Helena	0	0	0	0	0	0	0	0	0	0	0	0	0	26,106	**26,106**	4.8
TOTAL	**3,527**	**28,767**	**11,153**	**18,499**	**10,470**	**44,613**	**87,321**	**4,185**	**88,512**	**47,173**	**27,743**	**56,528**	**4,592**	**115,441**	**548,525**	
% of Project Area	0.6	5.2	2.0	3.4	1.9	8.1	15.9	0.8	16.1	8.6	5.1	10.3	0.8	21.0		**100**

Source: DNRC (2008a).

or portion of a stream system and is considered to be the smallest group of fish that is known to represent an interacting reproductive unit. Multiple local populations may exist within a core area. Thirteen of the 14 EIS aquatic analysis units correspond to the bull trout core areas described in the *Draft Bull Trout Recovery Plan* (USFWS 2002a).

In summary, until the draft recovery plan for bull trout is finalized, the USFWS has adopted the use of local population, core area, management unit, and interim recovery unit for purposes of consultation and recovery.

The EIS aquatic analysis units range greatly in size from less than 500,000 acres (Swan and Lower Kootenai) to more than 12.9 million acres (Upper Missouri). To simplify some discussions, the 14 EIS aquatic analysis units are combined into four EIS aquatic planning basins (Kootenai, Flathead, Clark Fork, and Missouri River basins) (see Table E4-3 in Appendix E, EIS Tables).

The distribution of HCP project area lands is not uniform across the 14 EIS aquatic analysis units. For example, two EIS aquatic analysis units (Stillwater and Swan) each contain a total of over 9 percent of HCP project area lands by area, while four other analysis units (Lower Clark Fork, Rock Creek, Lower Kootenai, Upper Missouri) contain less than 1 percent of the HCP project area within their boundaries (Table 4.8-4).

Most of the planning area is mountainous, resulting in highly variable streamflow, particularly in the small rivers and streams that serve as headwaters for all the major river systems in Montana. Peak flows generally occur May through June from melting snow and rainfall. Increased flows also occasionally occur for short durations in the summer due to thunderstorms. The planning area contains over 75,600 miles of stream habitat, of which about 43,959 miles (58 percent) have intermittent stream flow (Table E4-4 in Appendix E, EIS Tables). In addition, the vast majority of stream miles (intermittent or perennial) are located on non-trust land. Less than 5 percent of the planning area stream miles (3,469 miles) are located on trust land, and about 2 percent (1,578 miles) on HCP project area lands (see Table E4-4 in Appendix E, EIS Tables). Within the planning area, only about 3 percent (1,006 of 31,646 miles) of the perennial stream miles, and almost 3 percent of the intermittent stream miles, occur on trust lands.

A total of 3,469 miles of stream occur on trust lands within the planning area, although only ~~130~~580 miles (~~7~~17 percent) support HCP fish species (see Table E4-4 in Appendix E, EIS Tables). Nearly all (~~99~~98 percent) of this HCP fish species supporting habitat supports westslope cutthroat trout, while ~~67~~73 percent supports bull trout. Within the HCP project area, there are approximately 1,578 stream miles, of which approximately 451 stream miles (29 percent) support HCP fish species. Within the HCP project area, 21 percent of all stream miles support bull trout, 30 percent support westslope cutthroat trout, and 1 percent support Columbia redband trout.~~Thus, about 10 percent of all bull trout habitat, 8 percent of all Columbia redband trout habitat, and 6 percent of all westslope cutthroat trout habitat in the planning area occurs on trust lands.~~

4.8.2.1 Sediment

Erosion and sedimentation occur naturally in a watershed and provide the sources and surfaces necessary for habitat formation for aquatic and terrestrial wildlife species (Naiman et al. 1992). A disturbance, be it natural or human induced, is any substantial change in the supply or routing of water, sediment, or woody debris that causes a measurable difference in channel structure and biological community. Natural disturbances such as floods, fire, and landslides are an integral part of watershed dynamics. These events can substantially affect sediment loading to area streams. While these are natural events, land management activities can influence their degree and frequency.

Land management activities can also have a direct influence on the amount of sediment entering these waterbodies, by affecting stormwater runoff rates, and erosion from road surfaces and other disturbed soil areas. Increased sediment loading to rivers and streams results in filled pools, substrate embeddedness, increased turbidity, and deterioration of in-stream habitat (particularly salmonid spawning habitat).

Importance of Sediment to Fish

Sedimentation rates are important because chronic inflow of fine sediment can seriously diminish salmonid spawning success, alter fish behavior, and cause many other deleterious sub-lethal effects (Cederholm et al. 1981; Servizi and Martens 1992; Kondolf 2000). Fine sediment can cause direct mortality to salmonid eggs (Chapman 1988), sac fry (Reynolds et al. 1989), and juvenile fish (Lloyd 1985). Although all salmonid eggs are susceptible to suffocation from the accumulation of fine sediments in spawning gravel, Bjornn and Reiser (1991) report that cutthroat 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, with 100 percent mortality with 50 percent fines.

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 1992), reduced feeding and repressed growth rates (Newcombe and MacDonald 1991), respiratory impairment (Servizi and Martens 1992), reduced tolerance to disease and toxicants (Goldes et al. 1988), and physiological stress (Servizi and Martens 1992).

DNRC Activities Potentially Affecting Sediment

Forest Management

Although forest management activities have historically resulted in substantial erosion and sediment delivery to Montana streams, current regulations and established BMPs substantially reduce these risks. DNRC recently assessed soil impacts on 74 timber harvest areas, which were harvested between 1988 and 2003 (DNRC 2004e). The results indicate that areas harvested in 1988 and 1989, prior to formal adoption of BMPs, had the highest percentages of impacted area compared to later harvest sites. Overall, about 47 percent of the sites had total detrimental soil impacts less than 20 percent, with an overall range of 3 to 44 percent (DNRC 2004e).

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 road construction, road use, and maintenance activities are a primary source of fine sediment delivery to Montana streams. Stormwater runoff from such roads is a direct source of fine sediments, and the increased runoff rates can contribute to increased erosion of upland soils. Increased runoff results in increased stream flows and an increased potential for streambank erosion and further sedimentation levels.

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. 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 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.

Grazing

The impacts of livestock grazing on sediment delivery to streams are also typically 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.

There are currently 391 individual parcels with grazing licenses on classified forest trust lands in the HCP project area, encompassing about 164,931 acres (Table 4.8-5, Figures D-8A through D-8C in Appendix D, EIS Figures). Approximately 163 (42 percent) of these 391 parcels contain a segment of stream known to support at least one of the three HCP fish species, including approximately 111 parcels with bull trout habitat, 161 parcels with westslope cutthroat trout habitat, and 8 parcels with Columbia redband trout habitat. Similarly, about 46 percent (75,566 of 164,931 acres) of the licensed grazing acres in the HCP project area support at least one HCP fish species.

Sixty-seven (60 percent) of the 111 licensed grazing parcels containing bull trout habitat are located in two of the EIS aquatic analysis units, including 27 parcels (24 percent) in the Blackfoot analysis unit and 40 parcels (36 percent) in the Middle Clark Fork analysis unit. Only eight grazing parcels contain Columbia redband trout habitat, with seven occurring in the Middle Kootenai analysis unit. Westslope cutthroat trout habitat is more widely distributed in the project area, occurring in 12 of the 14 analysis units.

However, 60 percent of the parcels occur in the Blackfoot and Middle Clark Fork analysis units. Only about 122 (24 percent) of the HCP project area stream miles that support at least one HCP fish species actually occur within the boundaries of the grazing license parcels (Table 4.8-6). This includes 120.8 miles, 81.6 miles, and 3.9 miles of stream that support westslope cutthroat trout, bull trout, and Columbia redband trout, respectively.

TABLE 4.8-5. DNRC PARCELS AND ACRES WITH GRAZING LICENSES BY AQUATIC ANALYSIS UNIT WITHIN THE HCP PROJECT AREA

EIS Aquatic Analysis Unit	Number of parcels with Grazing Licenses in the HCP Project Area	Number of Grazing License Parcels Containing HCP Fish Species				Acres Under Grazing Licenses in the HCP Project Area	Acres Under Grazing License Containing HCP Fish Species			
		Bull Trout	Westslope Cutthroat Trout	Columbia Redband Trout	Any HCP Fish Species		Bull Trout	Westslope Cutthroat Trout	Columbia Redband Trout	Any HCP Fish Species
Bitterroot	49	16	21	0	21	21,363	8,270	10,636	0	10,636
Blackfoot	87	27	41	0	41	36,306	11,383	18,613	0	18,613
Flathead Lake	8	0	2	0	2	3,483	0	1,234	0	1,234
Lower Clark Fork	5	0	0	0	0	1,597	0	0	0	0
Lower Kootenai	1	1	1	1	1	319	319	319	319	319
Middle Clark Fork	112	40	56	0	56	45,404	16,878	25,294	0	25,294
Middle Kootenai	22	5	11	7	11	9,091	2,269	4,681	2,596	4,681
North Fork Flathead	3	3	3	0	3	912	906	906	0	906
Rock Creek	6	2	1	0	2	2,192	1,110	646	0	1,110
Stillwater	10	3	2	0	3	3,585	1,055	798	0	1,055
Swan	4	2	2	0	2	1,446	994	994	0	994
Upper Clark Fork	37	7	14	0	14	16,612	3,652	7,500	0	7,500
Upper Kootenai	8	5	7	0	7	3,841	1,924	3,223	0	3,223
Upper Missouri	39	0	0	0	0	18,778	0	0	0	0
TOTAL[1]	**391**	**111**	**161**	**8**	**163**	**164,931**	**48,761**	**74,845**	**2,916**	**75,566**

[1] Some individual parcels were double counted if the parcel straddled two or more analysis units.
Source: DNRC (2008a).

TABLE 4.8-6. STREAM MILES AND FISH DISTRIBUTION WITHIN HCP PROJECT AREA GRAZING LICENSE PARCELS

	Stream Miles on Grazing License Parcels Within the HCP Project Area				
EIS Aquatic Analysis Unit	**Total Stream Miles**	**Bull Trout Habitat**	**Westslope Cutthroat Trout Habitat**	**Columbia Redband Trout 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	45.9	0.0	0.0	0.0	**0.0**
TOTAL	**502.1**	**81.6**	**120.8**	**3.9**	**122.1**

Source: DNRC (2008a).

Existing Sediment Conditions in HCP Project Area

Road-generated Sediment

Despite recent improvements in the implementation of protective BMPs, the construction, maintenance, and use of forest roads can be a substantial source of sediment loading to streams. The overall length and density of roads within the HCP project area indicate the sediment loading potential from DNRC land management activities. GIS analyses indicate approximately 4,570 miles of existing roads are located on trust lands in the planning area, with about 2,646 miles (58 percent) occurring on HCP project area lands (Table 4.8-7). The average road density in the HCP project area is about 3.1 mi/mi^2, ranging between 1.7 and 5.5 mi/mi^2. While the lowest road density estimate is associated with the largest aquatic analysis unit (Upper Missouri), and one of the smallest units (Lower Clark Fork), there is no apparent consistent pattern between area and road density.

As discussed above, roads have the potential to affect HCP fish species, particularly those road segments located within 300 feet of a stream. An estimated 700 miles (27 percent) of the existing roads on HCP project area lands are located within 300 feet of any stream, although only about 8.9 percent of the road miles in the HCP project area are within 300 feet of streams known to support one of the HCP fish species (Table 4.8-7). Because GIS road layers for non-DNRC (federal and private) lands are generally lacking or incomplete, no assessment of road miles, density, or condition could be conducted over the entire planning area. Information on existing road

TABLE 4.8-7. ROAD MILES, FISH USE OF ROADED AREAS, AND ROAD DENSITY WITHIN THE HCP PROJECT AREA

	EIS Aquatic Analysis Unit															
	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	Outside Planning Units	Total
Planning Area Road Miles on DNRC Ownership	257.9	470.5	158.6	14.7	12.1	546.8	195.4	71.1	20.8	482.0	267.1	266.6	98.7	1,204.5	503.0	4,569.8
Planning Area Road Miles on all DNRC Ownership within 300 Feet of any Stream	93.4	109.9	36.3	2.3	2.0	168.4	50.2	13.3	5.5	109.7	55.3	74.0	25.5	383.3	21.6	1,150.9
HCP Project Area Road Miles	210.1	386.1	81.4	11.4	12.0	447.5	183.9	69.1	13.2	382.6	258.9	195.4	95.1	298.8	N/A	2,645.5
HCP Project Area Road Miles within 300 Feet of any Stream	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	N/A	700.1
HCP Project Area Road Miles within 300 Feet of Bull Trout Streams	18.1	13.4	0.1	0.3	0.6	45.0	10.8	6.7	0.1	43.9	24.4	9.9	3.3	0.0	N/A	176.7
HCP Project Area Road Miles within 300 Feet of Westslope Cutthroat Trout Streams	21.9	28.5	3.9	0.3	0.6	59.5	14.2	8.4	0.3	40.8	27.7	17.6	4.7	6.7	N/A	235.2
HCP Project Area Road Miles within 300 Feet of Columbia Redband Trout Streams	0	0.0	0.0	0.0	0.6	0.0	11.2	0.0	0.0	0.0	0.0	0.0	0.0	0.0	N/A	11.8
HCP Project Area Road Miles within 300 Feet of HCP Fish Species Streams	21.9	28.5	3.9	0.3	0.6	59.5	14.2	8.4	0.3	45.2	27.7	17.6	4.7	6.7	N/A	239.6
Area (square miles)	43.3	88.3	16.4	6.5	5.5	138.3	44.9	28.9	7.2	136.4	69.7	73.7	17.4	180.4	N/A	857.1
Road Density (mi/mi^2)	4.8	4.4	5.0	1.7	2.2	3.2	4.1	2.4	1.8	2.8	3.7	2.7	5.5	1.7	N/A	3.1
Road Density within 300 Feet of any HCP Project Area Stream	1.8	1.1	1.2	0.3	0.4	1.0	1.1	0.5	0.5	0.7	0.8	0.7	1.4	0.4	N/A	0.8
Road Density within 300 Feet of HCP Fish Species Streams (mi/mi^2)	0.5	0.3	0.2	0.1	0.1	0.4	0.3	0.3	0.0	0.3	0.4	0.2	0.3	0.0	N/A	0.3

Source: DNRC (2008a).

conditions on trust lands comes from a variety of programs, including the watershed monitoring program; NWLO and SWLO road monitoring programs; and timber sale planning, design, and EAs. In addition, road improvement needs are identified through casual observations or reports made to DNRC field staff during the normal course of carrying out their administrative duties.

Between 1998 and 2001, DNRC inventoried 405 miles of roadway on forested trust lands in the HCP project area, to assess sediment delivery potential related to forest roads. This represents 15 percent of the 2,646 miles of forested trust land roads in watersheds supporting HCP fish species (DNRC 2006c). These data indicate that about 46 percent of the identified road problem sites causing sediment delivery to streams on forested trust lands are related to inadequate road surface drainage (DNRC 2006c).

To model the amount of sediment generated from inadequate road surface drainage, information from the DNRC road inventories was used to estimate the existing road conditions on HCP project area lands and to estimate the amount of sediment generated by these roads (DNRC 2006f, 2006g, 2008f; Earth Systems 2007, 2008; USDA 2008). Based on several variable parameters (road slope, geometry, road bed material, rainfall patterns, etc.), this modeling exercise generated a range of potential sediment generated per road mile. Although this information is useful in estimating the scale of sediment generated from problem roads, it should be noted that the modeling exercise does not give information on sediment delivery into streams, which is the process that most directly affects aquatic species. The model does not take into account downslope filtration and interception of sediment by vegetation and soils, factor in the exact distance of roads from stream courses, or account for the full range of slope and road surface conditions.

Stream Crossing Generated Sediment

In addition to the miles of road located within 300 feet of streams, there are about 2,258 stream crossings within the HCP project area, although only 24 percent (550 crossings) occur on perennial streams (Table 4.8-8). While the HCP fish species (particularly westslope cutthroat trout) may occupy intermittent streams at certain times of the year, such use is limited. There are 330 stream crossings of streams supporting bull trout, and 446 and 17 crossings of streams supporting westslope cutthroat trout and Columbia redband trout, respectively. The proportion of total stream crossings in the individual aquatic analysis units, that support any HCP fish species, ranges from 0 percent (Rock Creek and Lower Kootenai aquatic analysis units) to 63.3 percent (North Fork Flathead Unit). The next highest proportions of crossings in HCP fish species streams are in the Swan (34.3 percent), Stillwater (30.4 percent), and the Upper Clark Fork (27.7 percent) analysis units. Less than 22 percent of the total stream crossings in the other analysis units occur in HCP fish species streams.

Forty-one percent of the inventoried problems are associated with stream crossing deficiencies. Approximately 132 of the stream crossing CMPs analyzed (34 percent) were identified as problematic as to risk for sediment delivery. The most common stream crossing problems were related to culvert alignment or grade (24 percent), inadequate capacity (26 percent), and inadequate armoring of inlet or outlet (20 percent). In addition, the amount of sediment at risk of delivery was estimated for each problem stream crossing. On average at each problem site, 69 cubic yards of sediment was at risk for potential delivery to the streams. Of the 132 identified road crossing problem sites, 74 percent would deliver less than 100 cubic yards of material to the associated stream assuming a catastrophic failure, and 90 percent would deliver less than about 150 cubic

TABLE 4.8-8. NUMBER OF ROAD-STREAM CROSSINGS IN THE HCP PROJECT AREA BY EIS AQUATIC ANALYSIS UNIT

EIS Aquatic Analysis Unit	Road-stream Crossings[1]	Road-stream Crossings on Perennial Streams	Road-stream Crossings on Intermittent Streams	Road-stream Crossings on Known Bull Trout Streams	Road-stream Crossings on Known Westslope Cutthroat Trout Streams	Road-stream Crossings on Known Columbia Redband Trout Streams	Road-stream Crossings on any HCP Fish Species Streams
Bitterroot	204	46	158	38	44	0	44
Blackfoot	323	41	282	21	46	0	46
Flathead Lake	78	10	68	0	6	0	6
Lower Clark Fork	7	1	6	1	1	0	1
Lower Kootenai	5	0	5	0	0	0	0
Middle Clark Fork	423	77	346	47	75	0	75
Middle Kootenai	180	21	159	17	28	17	28
North Fork Flathead	60	38	22	28	38	0	38
Rock Creek	11	0	11	0	0	0	0
Stillwater	303	106	197	89	80	0	92
Swan	169	58	111	45	58	0	58
Upper Clark Fork	177	54	123	35	49	0	49
Upper Kootenai	99	12	87	9	12	0	12
Upper Missouri	219	86	133	0	9	0	9
TOTAL	**2,258**	**550**	**1,708**	**330**	**446**	**17**	**458**

[1] Road-stream crossings include any type of structure (e.g., bridges, culverts, fords).
Source: DNRC (2008a).

yards. However, it should be noted that these sites are only at risk for failure of sediment delivery. The actual occurrence of sediment delivery is primarily driven by the magnitude and duration of storm events. For example, an undersized culvert is at greater risk of failure due to high flows produced by larger storm events, such as a 100-year storm, which on average has only a 1 percent chance of occurring in any given year.

Using extrapolation based on the frequency of problem culverts, and the average amount of sediment at risk of delivery, the number of problem culverts and total amount of sediment at risk was estimated for each EIS aquatic analysis unit (Table 4.8-9). It should be noted that the volume of sediment at risk would be a "worst-case scenario," and represents the volume of sediment delivered to a stream if all of the problem culverts were to totally fail. Based on probability and the distribution of large storm events, it is extremely unlikely that this entire at-risk volume of sediment would be delivered into HCP project area streams, even over a long time period (i.e., 50 years). In addition, existing DNRC policies and procedures would not preclude all of the at-risk crossings from eventually being improved or upgraded.

Timber Harvest and Landslide Generated Sediment

Timber harvest and landslides can also contribute sediment into streams. However, as discussed in the Section 4.5 (Geology and Soils), these factors are relatively minor contributors of in-stream sediment as compared to road-related sources. Existing timber harvest BMPs have been shown to be effective in reducing or eliminating sediment delivery to streams (Sheridan et al. 1999; Appelbloom et al. 2001; DNRC 2004c).

4.8.2.2 Habitat Complexity

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). Stream habitat complexity is also often associated with LWD abundance, as wood contributes to the formation of high-quality aquatic rearing habitat (Stouder et al. 1997). 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).

With the loss of LWD in the channel, stream morphology shifts away from the characteristic step-pool and pool-riffle habitats to a more simplified, glide-dominant channel form, with a subsequent decrease in available rearing (pool) habitat. LWD also provides direct nutrients to streams, as well as substrate for aquatic invertebrate production.

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

TABLE 4.8-9. ESTIMATED NUMBER OF PROBLEM ROAD-STREAM CROSSINGS ON KNOWN HCP FISH SPECIES STREAMS IN THE HCP PROJECT AREA BY EIS AQUATIC ANALYSIS UNIT, AND THE ESTIMATED SEDIMENT VOLUME AT RISK DUE TO CMP FAILURE

EIS Aquatic Analysis Unit	Problem CMPs	Problem Crossings on Known Bull Trout Streams	Problem Crossings on Known westslope cutthroat trout Streams	Problem Crossings on Known Redband Trout Streams	Problem Crossings on any HCP Fish Species Stream	Sediment Volume at Risk Due to CMP Failure on any HCP Fish Species Stream (Cubic Yards)
Bitterroot	70	13	15	0	15	1,024
Blackfoot	111	7	16	0	16	1,070
Flathead Lake	27	0	2	0	2	140
Lower Clark Fork	2	0	0	0	0	23
Lower Kootenai	2	0	0	0	0	0
Middle Clark Fork	145	16	26	0	26	1,745
Middle Kootenai	62	6	10	6	10	651
North Fork Flathead	21	10	13	0	13	884
Rock Creek	4	0	0	0	0	0
Stillwater	104	31	28	0	32	2,140
Swan	58	15	20	0	20	1,349
Upper Clark Fork	61	12	17	0	17	1,140
Upper Kootenai	34	3	4	0	4	279
Upper Missouri	75	0	3	0	3	209
TOTAL	**776**	**113**	**153**	**6**	**157**	**10,655**

Source: DNRC (2008a).

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.

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 of protecting over 80 percent of the LWD functions. Other ecological functions (stream shading, root strength, and litter fall) are effective with smaller riparian buffers (FEMAT 1993). Adequate LWD recruitment is generally provided with a high degree of certainty by riparian buffer widths of 100 to 200 feet (about the 100-year site index tree height), depending on the site and stream size (Murphy and Koski 1989; Robison and Beschta 1990; McDade et al. 1990, Thomas et al. 1993). The site index tree height at age 100 years, within the DNRC HCP project area, ranges from approximately 80 to 120 feet.

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 (see Section 4.6, Water Resources, for more details).

Importance of Habitat Complexity to Fish

Many ecological processes are associated with LWD in streams. This includes the formation of habitat features critical to fish and a host of other organisms. Wood is important in creating refugia for fish and other aquatic species. In small streams, wood plays a major role in creating invertebrate habitat. In small streams, wood debris dams are instrumental in 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).

Perhaps the most important role that LWD provides in relation to fish species is the creation and maintenance of deepwater pool habitat (Dolloff and Warren 2003). Pools and other habitats associated with LWD are important to fish because they provide lower water velocities and greater depths associated with pools during low-flow periods. Salmonids, including trout, 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.

DNRC Activities Potentially Affecting Habitat Complexity

Forest Management

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.

Grazing

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).

Under the SFLMP and ARM 36.11.444, DNRC performs midterm inspections of all grazing licenses issued on classified forest trust lands, as well as before the renewal date, to determine range, riparian, and streambank conditions. Recent assessments indicate approximately 251 DNRC-issued grazing licenses on 445 parcels of classified forest trust land. DNRC conducted 228 midterm or license renewal supplemental grazing evaluations between 1998 and 2004 (DNRC 2005b). Of the 183 licenses with stream or other riparian areas on the licensed parcel, about 72 percent (132) were within the criteria established by the SFLMP. These assessments found streambank damage as the most common reason for exceeding the criteria, with 39 individual inspections exceeding the allowable 10 percent damage. In comparison, there were only six licenses with criteria exceeded for riparian forage utilization and 32 inspections exceeding either the moderate or heavy browse utilization criteria. Overall, the majority (79 percent) of the inspections indicated no change in condition compared to previous inspections. While there were also 14 inspections where the conditions improved, 8 inspections indicated a decline in conditions (DNRC 2005b).

Existing Habitat Complexity in the HCP Project Area

Although in-stream habitat complexity in forested sites can be influenced by many factors, the structural component of riparian timber stands is often a primary driver of processes that influence habitat complexity, such as LWD recruitment. These structural components include the number and type of tree species and the number, size (age), and spatial distribution of all trees within a riparian stand. These stand descriptions (also known as tree lists) can be used to both describe existing riparian stands as well as a basis for modeling stand growth and development into the future. To assess landscape conditions for the SYCs, DNRC assumed the existing conditions on forested trust lands were represented by 77 stand descriptions. However, these stand types were based on upland conditions, and do not accurately represent the growth conditions present within the riparian zone. Therefore, to assess existing stand structural characteristics, DNRC evaluated data from riparian timber cruise plots. The cruise plot data were evaluated to ensure that it was representative of riparian stands representing the variety of physiographic and biological conditions within the HCP project area. A total of five stand types were chosen to represent general baseline riparian conditions and to serve as a basis for growth models specific to the riparian zone. Although these stand types do not account for the full range of conditions within riparian forests, they do nonetheless represent the diversity of riparian stand types and the range of forest conditions within the HCP project area. The stand types, named for the geographic area where the cruise plots were taken, are described below, with summaries and visual representations of each stand type presented in Figures 4.8-1 through 4.8-5.

The Beaver Creek Riparian Stand (Figure 4.8-1) is located in the Upper Willow Creek drainage on the Anaconda Unit. This stand is an *Abies lasiocarpa*/*Clamagrostis canadensis* (subalpine fir/bluejoint reedgrass) habitat type (Hansen et al. 1995). The current stand is dominated by lodgepole pine established following a large stand-replacement fire and several subsequent lower-intensity burns. This stand is representative of a major type of riparian stand that is found within the HCP project area at mid to high elevations throughout west-central Montana and east of the Continental Divide. It commonly occurs along sub-irrigated (areas with a high water table condition) stream terraces, wet meadows, and pond margins.

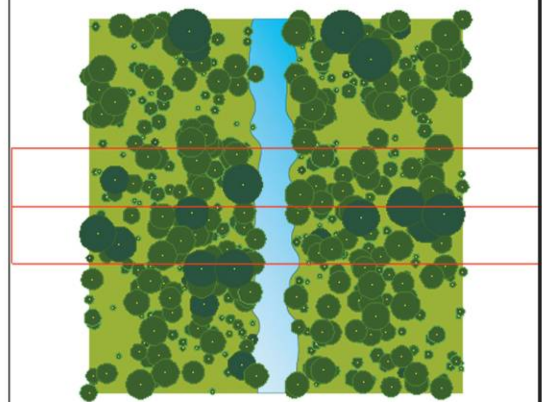
The Gird Creek Riparian Stand (Figure 4.8-2) is located in the Bitterroot River drainage on the Hamilton Unit. This stand is a *Picea/Cornus stolonifera* (spruce/red-osier dogwood) habitat type (Hansen et al. 1995). The current stand is dominated by Engelmann spruce with lesser amounts of Douglas-fir. This stands is representative of a major type of riparian stands found on flat alluvial benches and terraces bordering streams at low to mid elevations in the west central portion of the HCP project area.

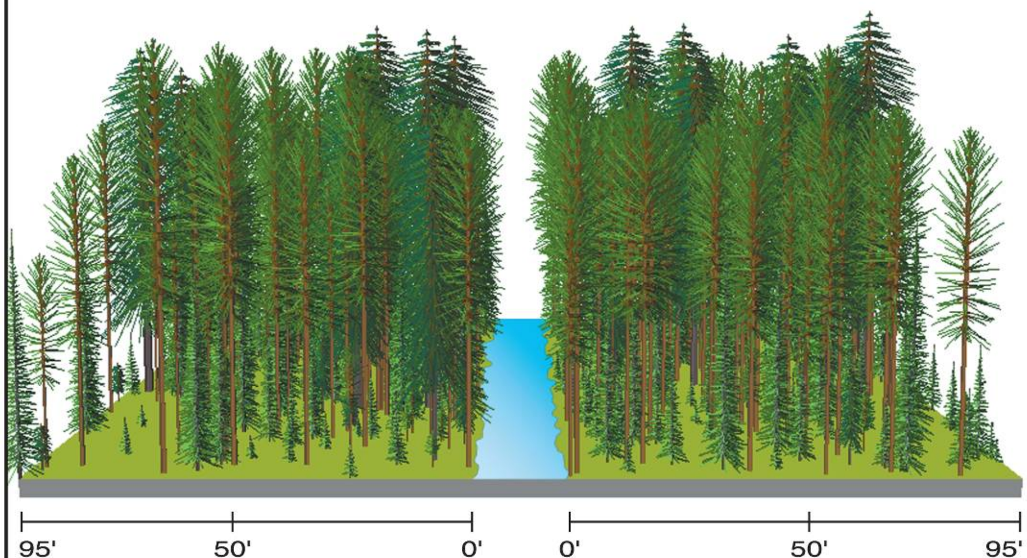
The Dingley Creek Riparian Stand (Figure 4.8-3) is located in the Grasshopper Creek drainage on the Dillon Unit. This stand is a *Picea/Calamagrostis canadensis* (spruce/bluejoint reedgrass) community type and is considered a late seral stage of the *Abies lasiocarpa/ Calamagrotis canadensis* (subalpine fir/bluejoint reedgrass) habitat type (Hansen et al.1995). This stand is representative of similar riparian stands commonly found on cool, moist sites such as flat alluvial benches bordering streams and ponds at low to high elevations throughout the mountains of the HCP project area.

The South Lost Creek Riparian Stand (Figure 4.8-4) is located in the Swan River State Forest. This stand is a *Thuja plicata/Athyrium filix-femina* (western redcedar/lady fern) habitat type (Hansen et al.1995). The current stand is dominated by western redcedar and grand fir with lesser amounts of Douglas-fir, western larch, and western white pine. These types of stands are found on stream terraces at low to mid elevations in the northwest portion of the HCP project area.

Beaver Creek Riparian Stand

The Beaver Creek Riparian Stand is located in the Upper Willow Creek drainage on the Anaconda Unit. This stand is a *Abies lasiocarpa/Calamagrostis canadensis* (subalpine fir/bluejoint reedgrass) habitat type. The current stand is dominated by lodgepole pine established following a large stand replacement fire and several subsequent lower intensity burns. This stand is representative of a major type of riparian community found within the HCP Project Area at middle to high elevations throughout west-central Montana and east of the Continental Divide. It commonly occurs along subirrigated stream terraces, wet meadows and pond margins.





Site potential tree height of dominant and co-dominant species at 100 years = 74 ft.

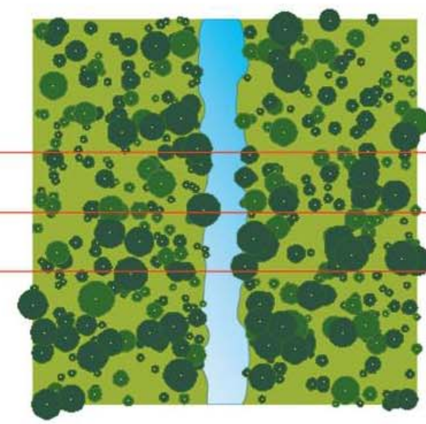
SUMMARY STAND DATA

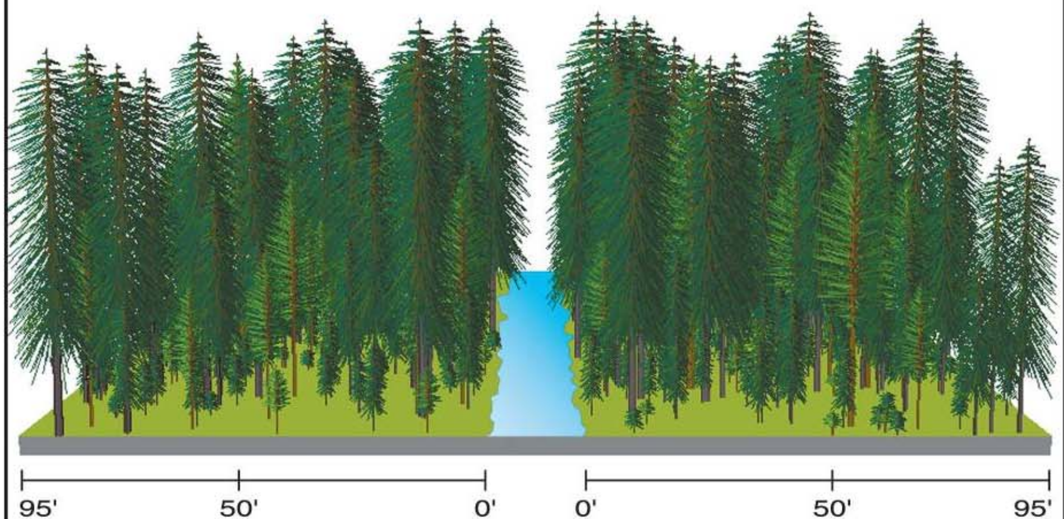
SPECIES	Trees per acre	Quadratic mean diameter (in.)	Basal area (sq. ft. / acre)
Douglas Fir	30	1.4	0.3
Lodgepole Pine	226	9.3	107.0
Spruce	44	15.4	56.7
Subalpine Fir	320	3.3	19.5
All Species	**620**	**7.4**	**183.5**

FIGURE 4.8-1. BEAVER CREEK RIPARIAN STAND DESCRIPTION

Gird Creek Riparian Stand

The Gird Creek Riparian Stand is located in the Bitterroot River drainage on the Hamilton Unit. This stand is a *Picea/Cornus stolonifera* (spruce/red-osier dogwood) habitat type. The current stand is dominated by Engelmann spruce with lesser amounts of Douglas-fir. This stand is representative of a major type of riparian community found on flat alluvial benches and terraces bordering streams at low to middle elevations in the west-central portion of the HCP Project Area.





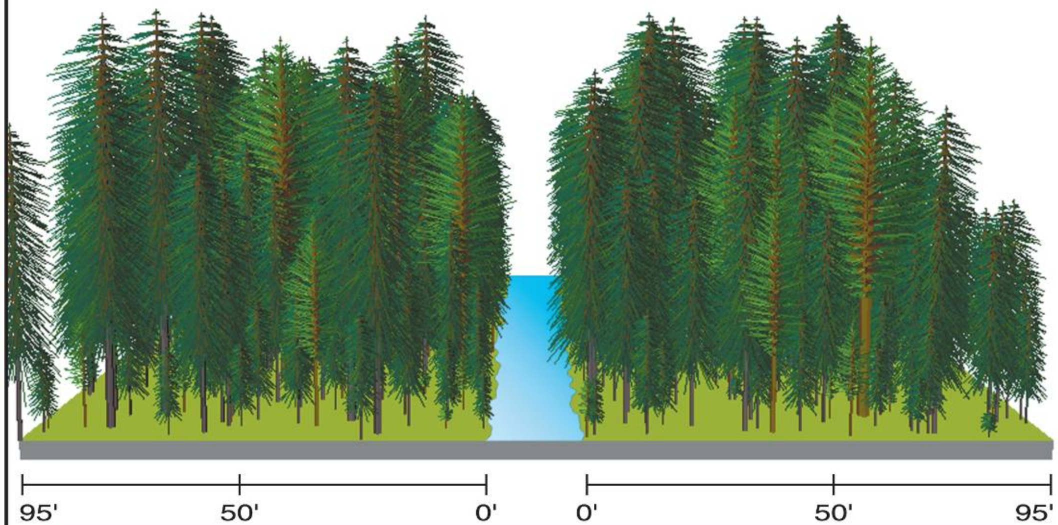
SUMMARY STAND DATA			
SPECIES	Trees per acre	Quadratic mean diameter (in.)	Basal area (sq. ft. / acre)
Douglas Fir	178	6.1	36.4
Spruce	377	7.3	109.0
All Species	**555**	**6.9**	**145.4**

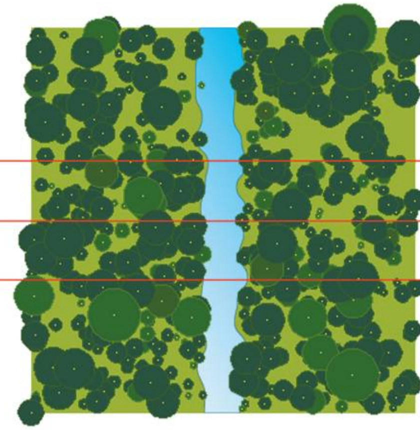
Site potential tree height of dominant and co-dominant species at 100 years = 119 ft.

FIGURE 4.8-2. GIRD CREEK RIPARIAN STAND DESCRIPTION

Dingley Creek Riparian Stand

The Dingley Creek Riparian Stand is located in the Grasshopper Creek drainage on the Dillon Unit. This stand is a *Picea/Calamagrostis canadensis* (spruce/bluejoint reedgrass) habitat type and is considered a late seral stage of the *Abies lasiocarpa/Calamagrostis canadensis* (subalpine fir/bluejoint reedgrass) habitat type. The stand is representative of similar riparian stands commonly found on cool, moist sites, such as flat alluvial benches bordering streams and ponds at low to high elevations throughout the mountains of the HCP Project Area.





Site potential tree height of dominant and co-dominant species at 100 years = 88 ft.

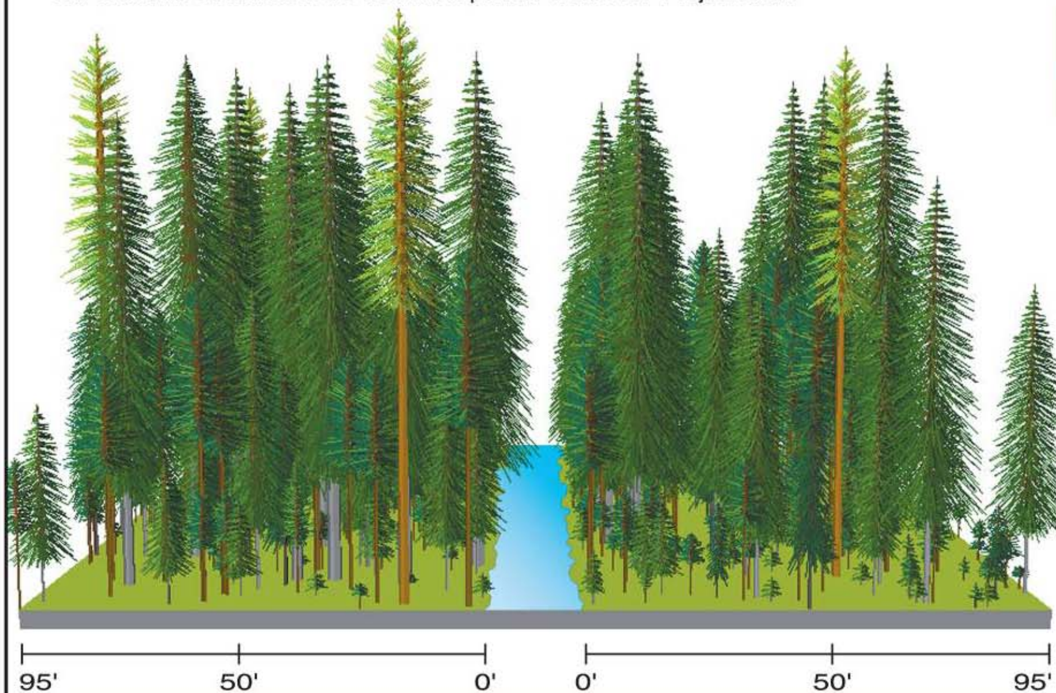
SUMMARY STAND DATA

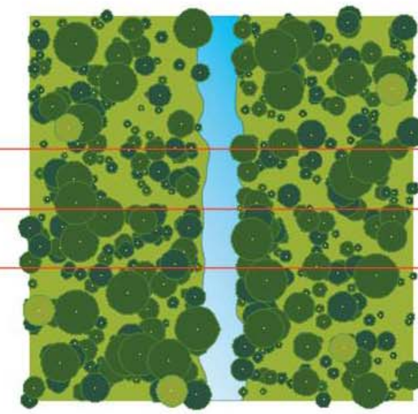
SPECIES	Trees per acre	Quadratic mean diameter (in.)	Basal area (sq. ft. / acre)
Douglas Fir	130	8.0	45.5
Lodgepole Pine	8	12.3	6.6
Spruce	516	7.4	155.4
All Species	**654**	**7.6**	**207.5**

FIGURE 4.8-3. DINGLEY CREEK RIPARIAN STAND DESCRIPTION

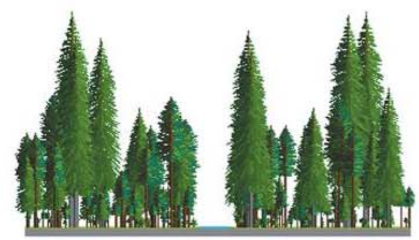
South Lost Creek Riparian Stand

The South Lost Creek Riparian Stand is located in the Swan River State Forest. This stand is a *Thuja plicata/Athyrium filix-femina* (western red cedar/lady fern) habitat type. The current stand is dominated by western red cedar and grand fir with lesser amounts of Douglas-fir, western larch and western white pine. These types of stands are found on stream terraces at low to middle elevations in the northwest portion of the HCP Project Area.





Site potential tree height of dominant and co-dominant species at 100 years = 117 ft.



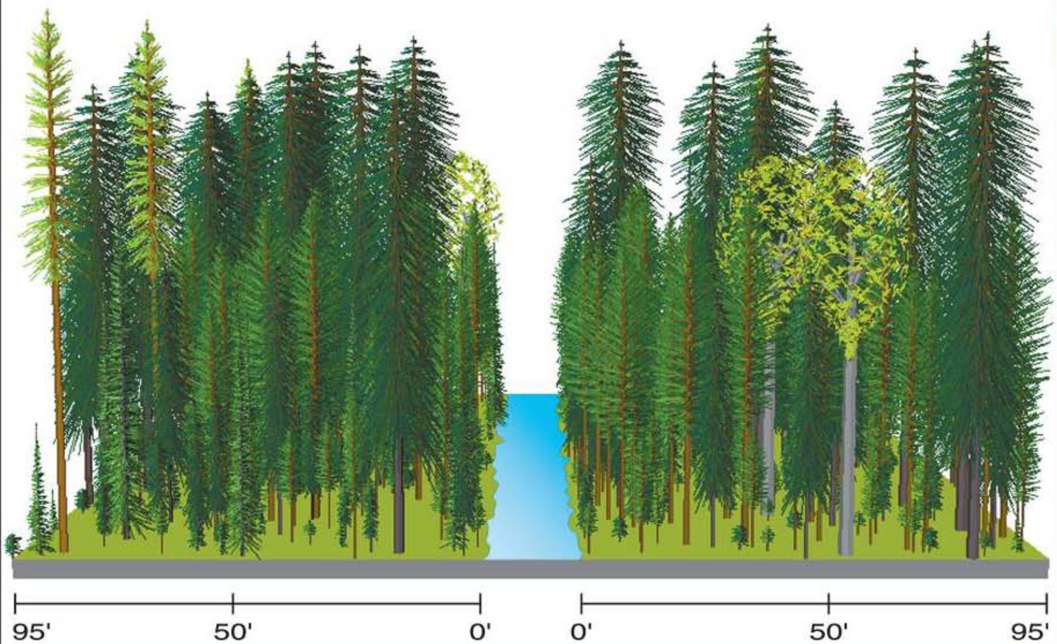
SUMMARY STAND DATA

SPECIES	Trees per acre	Quadratic mean diameter (in.)	Basal area (sq. ft. / acre)
Western Red Cedar	254	10.4	150.2
Douglas Fir	20	2.2	0.5
Grand Fir	308	4.8	39.2
Spruce	28	3.5	1.9
Western Larch	8	22.6	22.4
Western White Pine	10	0.0	0.0
All Species	**628**	**7.9**	**214.2**

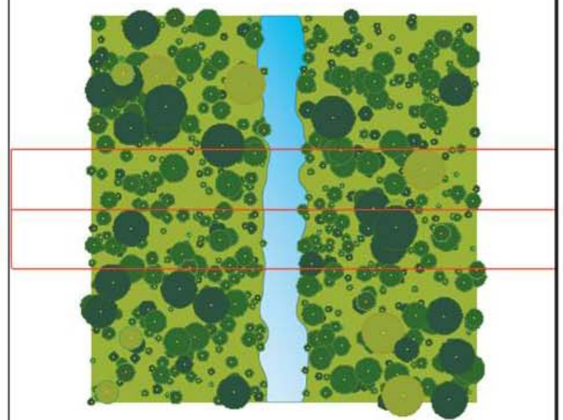
FIGURE 4.8-4. SOUTH LOST CREEK RIPARIAN STAND DESCRIPTION

Swede Creek Riparian Stand

The Swede Creek Riparian Stand is located in the Swift Creek drainage in the Stillwater State Forest. This stand is a *Abies lasiocarpa/Streptopus amplexifolius* (subalpine fir/twisted stalk) habitat type. The current stand is dominated by spruce and Douglas-fir with lesser amounts of subalpine fir, western larch and black cottonwood. This stand is representative of a common riparian community found along small streams and subirrigated alluvial terraces at middle elevations in the northwest portion of the HCP Project Area.



SUMMARY STAND DATA			
SPECIES	Trees per acre	Quadratic mean diameter (in.)	Basal area (sq. ft. / acre)
Black Cottonwood	5	35.0	33.4
Douglas Fir	440	5.4	69.5
Spruce	218	10.5	132.2
Subalpine Fir	99	5.0	13.5
Western Larch	5	16.0	7.0
All Species	**767**	**7.8**	**255.6**



Site potential tree height of dominant and co-dominant species at 100 years = 111 ft.

FIGURE 4.8-5. SWEDE CREEK RIPARIAN STAND DESCRIPTION

The Swede Creek Riparian Stand (Figure 4.8-5) is located in the Swift Creek drainage on the Stillwater State Forest. This stand is an *Abies lasiocarpa /Streptopus amplexifolius* (subalpine fir/twisted stalk) habitat type (Hansen et al.1995). The current stand is dominated by spruce and Douglas-fir with lesser amounts of subalpine fir, western larch, and black cottonwood. This stand is representative of a common type of riparian community found along small streams and sub-irrigated alluvial terraces at mid elevations in northwest portion of the HCP project area.

DNRC currently has scant existing data on current LWD loading in HCP project area streams. Furthermore, the data that DNRC does have is for streams within the Stillwater and Swan River State Forests in the NWLO. These data indicate that within these areas the current LWD frequency for Rosgen Type A, B, and C channels is 86, 85, and 70 pieces per 1,000 feet, respectively. However, LWD loading is a primarily a function of stand type and age, which vary throughout the physiographic regions that encompass the HCP project area. Therefore, in order to estimate the appropriate in-stream LWD loading for each of the five representative stand types, the LWD data from streams on trust land managed for forest harvest were compared to USFS LWD loading data for streams on five national forests representing areas that are not managed for timber harvest. These data indicate that overall, DNRC streams in reaches with adjacent timber harvest have 44, 69, and 100 percent as much in-stream LWD as streams on geographically similar unmanaged USFS ownership for Rosgen Type A, B, and C channels, respectively. Applying these ratios to the USFS dataset yields an approximation of the current in-stream LWD frequencies within the five representative stand types (Table 4.8-10).

TABLE 4.8-10. ESTIMATED EXISTING LWD LOADING RATES (PIECES PER 1,000 FEET) FOR THE FIVE REPRESENTATIVE STAND TYPES

	Rosgen Channel Type		
Tree List	**A**	**B**	**Other (C, D, F, G)**
Beaver Creek	32	35	43
South Lost Creek	87	85	61
Dingley Creek	32	35	43
Gird Creek	32	44	44
Swede Creek	87	85	61

Source: DNRC (2008g).

4.8.2.3 Stream Temperature and Shading

Daily and seasonal water temperatures are influenced by elevation, shade, water sources, streamflow, stream velocity, surface area, depth, undercut embankments, organic debris, and surface and ground water inflow (Allan 1995). However, there is not always a consistent link or interaction between these factors. For example, although the State of Idaho (IDL 2000) established a linear relationship between canopy cover, site elevation, and stream temperature, this relationship tended to overestimate stream temperatures at higher elevations and underestimate temperatures at lower elevations. Such inconsistencies are typically the result of local groundwater and climate (microclimates) conditions, which are influenced largely by geology, air temperature patterns, elevation, wind, and humidity.

Although canopy closure is one contributor to stream shading, there are other factors including the latitude of the stream, stream geomorphology, local topography, and stream channel orientation. It is possible to have a stream that is almost entirely shaded, with a canopy cover of zero, if the stream is located within a steep-walled canyon with no riparian vegetation while a wide stream oriented from north to south may have a high degree of canopy cover and relatively low levels of stream shading.

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, temperature variations tend to be greatest in small streams during low-flow periods, particularly where riparian shade is limited. 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.

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.

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 of 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 banks, as long as retention trees and trees that offer bank protection are left in place.

Importance of Stream Temperature and Shading to Fish

Stream temperature influences the behavior, growth, metabolism, and habitat utilization of fish and other aquatic organisms. 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.

Trout and other cold-water fish species 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 temperature is likely an important factor, other influential parameters likely include changes in streamflow, food availability, and day length.

Water temperature also influences egg incubation rates and the corresponding fry emergence timing. 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, water 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.

DNRC Activities Potentially Affecting Stream Temperature and Shading

Land use activities that alter the physical stream and riparian parameters can affect stream temperature and the corresponding distribution and viability of aquatic organisms, particularly for temperature-sensitive fish species. Temperature effects primarily result from the alteration of the microclimate in the riparian zone. Of the principal microclimate influencing factors, canopy cover, humidity, and wind conditions are most likely to be affected by riparian land use management. Some land use and land management activities known to influence water temperatures include: forest management practices, stream flow changes due to water discharge or diversion structures, construction and operation of reservoirs, grazing, and road density. These activities can have direct and indirect effects on stream temperature, but such effects can also vary seasonally.

Forest management practices include timber harvest activities located directly in the RMZ and in adjacent upland areas, as well as road building and maintenance activities. Livestock grazing activities also have the potential to directly affect riparian zone characteristics.

Timber harvest in the RMZ can have a substantial influence on stream temperature and other stream habitat conditions. Riparian trees moderate river and stream microclimate conditions, including stream temperature, by providing shade during warm weather conditions to reduce solar warming effects, and also reducing heat loss during cold weather conditions. This is particularly true for smaller streams, where greater stream surface areas could be affected by the changes to the microclimate conditions. Trees and other riparian vegetation help stabilize the banks from erosion, thereby reducing channel enlargement forces and maintaining water depths.

In addition to the potential for streambank erosion, riparian vegetation removal can result in increased erosion of riparian soils and increased sediment loading to the stream. Riparian vegetation also slows surface water runoff, potentially trapping sediments entrained in the runoff flows and increasing the potential infiltration and groundwater recharge rates on the area. Not only does this improve stream water quality and flow conditions during runoff periods, the subsequent discharge of groundwater results in higher flows and lower water temperatures during the natural low-flow periods. The removal of riparian vegetation can also result in increased soil compaction, which can also reduce water infiltration rates. Riparian harvest also reduces an important source of LWD to the stream.

Upland harvest activities typically have less impact to stream temperature than riparian harvest activities because they typically have little or no effect on shade and microhabitat conditions within the riparian zone. However, they can influence the amount and rate of groundwater recharge and surface water runoff. The building, use, and maintenance of forest roads also typically have limited influence on stream temperature, except for road-related activities in the riparian zone.

The volume and sources of stream inflow also influence stream temperature in several ways. The water volumes associated with high runoff periods result in greater water depths and faster flows, which help to minimize the effects of solar warming. Under such conditions, the effects of riparian cover condition (i.e., percent and density of canopy cover) might have limited influence. However, during low-flow conditions resulting from either natural runoff variations or man-made storage and diversion facilities, the effects of shade and stream velocities are likely greater. The influence of groundwater inflow during low-flow conditions is also expected to be greatest during low-flow conditions.

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 the surface area influenced by solar energy and other microclimate conditions.

Existing Stream Temperature and Shading in the HCP Project Area

Little data exist regarding existing stream temperature regimes or stream shade in the HCP project area. Therefore, to estimate the amount of shade provided by various stands of mature forest, a shade model was used to compare the shade levels provided by the five representative stand types. The shade model was adapted to the riparian aquatic interaction simulator (RAIS) constructed by Welty et al. (2002). Based on a riparian tree list, the shade model predicts total shade (percent blocking solar radiation) provided the stream by the riparian vegetation.

This model estimates the percent of the total solar radiation blocked from reaching the stream over a discrete time period. Percent blocking solar radiation is influenced by slope steepness, vegetation species composition, tree height, vegetation density, tree distance from the stream bank, and stream width. Although riparian vegetation is a physical barrier between the stream and incoming solar radiation, only a portion of the riparian canopy effectively contributes to shade. Model assumption and inputs are discussed in Section 4.8.2.2 (Habitat Complexity).

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 control stream temperatures. The relationship between channel width and shade potential is shown in Table 4.8-11, which indicates the predicted shade levels of the five representative stand types. In addition, this table shows high shade levels for all stand types in A and B channels, which generally represent spawning and rearing reaches for HCP aquatic species. Based on these results, stream temperatures on most HCP project area lands would be expected to be within the range to support native salmonids. The model outputs data from Washington State (Washington State TFW 1990), which indicate that a minimum post-harvest stream shading level of 45 percent (700-meter [2,297-foot] elevation stands) to 70 percent (300-meter [984-foot] elevation stands) is generally adequate to ensure these stream reaches meet Washington State water quality parameters for salmonids. Other studies relate an estimation of canopy closure to the relationship between stream temperatures, elevation, and shading (IDL 2000).

TABLE 4.8-11. ESTIMATED EXISTING SHADING (PERCENT BLOCKING SOLAR RADIATION) FOR THE FIVE REPRESENTATIVE STAND TYPES

	Rosgen Channel Type		
Tree List	A	B	Other (C, D, F, G)
Beaver Creek	90	79	46
South Lost Creek	94	87	58
Dingley Creek	91	78	41
Gird Creek	75	64	31
Swede Creek	96	88	55

Source: Teply (2007).

4.8.2.4 Connectivity

Connectivity typically refers to providing or maintaining the opportunity for fish to move upstream and downstream within, as well as between, streams and/or watersheds at various times of the year. Although maintaining adequate connectivity conditions is also typically considered to be positive for maintaining viable fish populations, there are some circumstances where specific barriers to this movement should remain. Therefore, connectivity becomes a larger task related to fish population management.

Importance of Connectivity to Fish

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. 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 conditions, 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.

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.

DNRC Activities Potentially Affecting Connectivity

The primary DNRC activity affecting connectivity is related to road construction, operation, and maintenance at stream crossings. In these situations, improperly designed or inadequately maintained road-crossing culverts are 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.

Existing Connectivity Conditions in the HCP Project Area

There are an estimated total of 106 fish passage culvert barriers within the HCP project area, classified into four HCP priority levels (Figure D-9 in Appendix D, EIS Figures). The priority levels are based on the occurrence and genetic integrity of HCP fish species in the culvert barrier streams. The priority levels are based on culverts that block fish access to

- **Priority 1**. Habitat supporting any bull trout life stage
- **Priority 2**. Habitat supporting 100 percent, genetically pure, westslope cutthroat trout or Columbia redband trout
- **Priority 3**. Habitat supporting westslope cutthroat trout or Columbia redband trout of unknown genetic purity
- **Priority 4**. Habitat supporting 80 to 99 percent, genetically pure, westslope cutthroat trout or Columbia redband trout.

Within the HCP project area, there are three Priority 2 barriers, 99 Priority 3 barriers, and four Priority 4 barriers (Table 4.8-12). However, there are no Priority 1 barriers identified in the HCP project area. Priority 2 culvert barriers occur only in the Middle Clark Fork and Upper Missouri aquatic analysis units, blocking a total of about 11 miles of stream habitat. Most of the barriers are conservatively 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.

TABLE 4.8-12. DNRC FISH PASSAGE INVENTORY RESULTS BY EIS AQUATIC ANALYSIS UNIT FOR CULVERTS IN THE HCP PROJECT AREA

EIS Aquatic Analysis Unit	Identified Fish Passage Barriers	Stream Miles Upstream of Identified Fish Barriers	Priority 1 Fish Barriers	Stream Miles Upstream of Priority 1 Barriers	Priority 2 Fish Barriers	Stream Miles Upstream of Priority 2 Barriers	Priority 3 Fish Barriers	Stream Miles Upstream of Priority 3 Barriers	Priority 4 Fish Barriers	Stream Miles Upstream of Priority 4 Barriers
Bitterroot	3	3.2	0	0.0	0	0.0	3	3.2	0	0.0
Blackfoot	10	20.3	0	0.0	0	0.0	8	19.8	2	0.4
Flathead Lake	2	2.1	0	0.0	0	0.0	1	1.3	1	0.8
Lower Clark Fork	0	0.0	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	0	0.0
Middle Clark Fork	15	45.2	0	0.0	2	9.5	13	35.7	0	0.0
Middle Kootenai	3	5.8	0	0.0	0	0.0	3	5.8	0	0.0
North Fork Flathead	8	8.5	0	0.0	0	0.0	8	8.5	0	0.0
Rock Creek	0	0.0	0	0.0	0	0.0	0	0.0	0	0.0
Stillwater	49	41.3	0	0.0	0	0.0	48	37.5	1	3.7
Swan	8	7.3	0	0.0	0	0.0	8	7.3	0	0.0
Upper Clark Fork	3	6.1	0	0.0	0	0.0	3	6.1	0	0.0
Upper Kootenai	3	6.2	0	0.0	0	0.0	3	6.2	0	0.0
Upper Missouri	2	3.9	0	0.0	1	1.4	1	2.4	0	0.0
TOTAL	**106**	**149.9**	**0**	**0.0**	**3**	**11.0**	**99**	**134.0**	**4**	**4.9**

Source: DNRC (2006h).

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) aquatic analysis units. 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 (Table 4.8-12). With the exception of three analysis units with no identified barriers (Lower Clark Fork, Lower Kootenai, and Rock Creek analysis units), the other analysis units contain between two and eight barriers, which block between 2.1 and 8.5 miles of stream.

4.8.2.5 Other Habitat Factors

In addition to the specific habitat factors listed in the previous sections, a number of other factors can affect the HCP fish species or their habitat in the HCP project area. These include turbidity and other water quality parameters, nutrient and contaminant loading, organic material input, the introduction of non-native species, and fishing pressure. Many of these other factors tend to be specific components of the primary habitat considerations in the HCP (as addressed in the previous sections), or represent a different magnitude of occurrence. For example, sedimentation is one of the primary habitat considerations addressed in the HCP (see Section 4.8.2.1, Sediment), and refers to sediment loading levels that result in substantial alteration of the physical stream habitat (e.g., alter substrate characteristics, filling of pools, etc.). However, increased turbidity also occurs as a result of increased sediment loading, but often represents a lower magnitude of effects. Thus, a number of these other habitat factors are influenced by the same land use activities as the primary habitat considerations. Similarly, while these other habitat factors are influenced by the covered activities, they are also affected by activities such as agricultural practices, mining, residential development, and water diversion facilities.

Agricultural practices primarily affect water quality parameters, such as turbidity and pollutant and/or nutrient loading to the area streams. Increased nutrient loading can also indirectly reduce dissolved oxygen levels. Agricultural practices can result in the removal of riparian vegetation, potentially reducing the input of organic material to the stream, increasing temperatures, and sediment loading. Mining practices have the potential to substantially impact fish populations through contaminant and sediment loading.

While residential and commercial development can also affect water quality conditions, there are no substantial development areas within the HCP project area. Water diversion facilities have the potential to affect fish and their habitat in a number of different ways, including blocking the movement of fish (see subsection Existing Sediment Conditions in the HCP Project Area in Section 4.8.2.1, Sediment). Diversions reduce in-stream flow volumes, thereby potentially increasing or decreasing water temperatures, depending on the time of year. They can also trap gravel, thereby reducing or eliminating gravel recruitment to downstream areas. Storage reservoirs have similar effects, but can also alter the flow regime at various times of the year, resulting in the modification of habitat availability and quality. Storage reservoirs can also substantially change downstream water temperatures, depending on the reservoir size.

Importance of Other Habitat Factors to Fish

All of the above-mentioned habitat factors have the potential to directly or indirectly affect fish. These habitat factors are also influenced by the same land use activities, and in a similar manner as the primary HCP habitat considerations. Using the turbidity example again, the relatively low sediment loading levels typically considered under the turbidity parameter might affect the physiological and behavioral characteristics of fish by causing respiratory impairment (e.g., gill abrasion), reducing foraging success and associated growth rates, increasing predation rates, and affecting their distribution. While these sediment loading levels are not expected to substantially change the overall sediment characteristic of the stream, they might be sufficient to cause enough accumulation of fine sediment in fish spawning areas to cause increased embryo mortality by reducing inter-gravel water exchange rates.

DNRC Activities Potentially Affecting Other Habitat Factors

Although mining activities are excluded from the HCP, some road building and maintenance activities, such as local gravel mining operations for use on forest road surfaces, have been included in the HCP. These covered activities could lead to increased sediment loading to area streams from the road surface or the borrow area.

Existing Conditions of Other Habitat Factors in the HCP Project Area

The existing conditions of HCP project area streams in regard to water quality, including turbidity, nutrients, and contaminant loading are discussed in Section 4.6 (Water Resources). Fishing pressure, although generally not considered a substantial impact to HCP aquatic species, is discussed in Section 4.10 (Recreation).

Historically, the introduction of non-native species into some streams and rivers within the planning area and HCP project area has occurred. In most cases, these introductions have occurred to increase the number and/or distribution of sport fish species (i.e., eastern brook trout, smallmouth bass). These introductions have occurred through both the actions of fish management agencies, such as MFWP, and through the actions of members of the general public. In certain cases, fish passage barriers can act in a positive way to isolate genetically “pure” populations of native fish from non-native populations, as discussed in above (Section 4.8.2.4, Connectivity).

4.8.2.6 Cumulative Watershed Effects

Cumulative effects are the collective impacts on the human environment of a proposed action when considered in conjunction with other past, present, and future actions related to the proposed action by location or generic type (MCA 75-1-220). Thus, CWE represent the collective aquatic impacts specifically affecting watershed resource features. 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.

Analyzing CWE is not a new idea, and the concept has been part of the management philosophy of forested trust lands since the early 1980s. With respect to forested trust lands, however, 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.

ARM 36.11.423 requires DNRC to assess CWE when substantial vegetation removal or ground disturbance is anticipated from proposed actions on forested trust lands. MEPA also requires DNRC to assess cumulative effects as part of a review of potential impacts to the human environment. And as a signatory to the *Montana Cumulative Watershed Effects Cooperative Memorandum of Understanding*, DNRC has agreed to complete and share CWE analyses and data necessary to conduct CWE assessments with other cooperators.

Assessment results indicating a low potential for CWE, implies that a low likelihood of adverse CWE from a proposed action could be detected and foreseen by DNRC when considering past and present activities on all ownerships. Unacceptable CWE imply 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 that are under concurrent consideration by any state agency through environmental analysis or permit processing procedures.

Importance of Cumulative Watershed Effects to Fish

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.

Cumulative effects 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.

Existing Cumulative Watershed Effects in the HCP Project Area

For the 2004 DNRC SYC, DNRC identified all forested parcels that were located in watersheds that DNRC considered “sensitive.” Stands located within these parcels were assigned the status of “sensitive.” Sensitive watersheds were those watersheds where future DNRC harvest activities are likely to be constrained by existing or the potential for CWE. CWE of concerns were primarily related to the potential for increased water yields and increased magnitude and duration of peak flows. Harvests of stands located in sensitive watersheds were constrained in the forest management model for the 2004 SYC so that no more than 25 percent of the acres could be less than 40 years old at any point in time.

The sensitive watersheds were identified through a coarse-filter process that primarily relied on the knowledge of DNRC forest management program hydrologists. Criteria used to identify parcels likely to be constrained by CWE include (1) documented CWE concerns (from previous DNRC project analysis, existing or ongoing TMDLs or 303(d) listing), (2) watersheds with high levels timber harvest or stand-replacement fire, (3) watersheds in which a majority of the ownership is industrial timberland, and (4) municipal watersheds. Conversely, watersheds were also eliminated from consideration as being classified as sensitive if there were offsetting reasons thought to reduce the risks of future CWE constraints on DNRC timber harvest. These criteria included (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 were recent project-level analysis had demonstrated low risk of CWE.

There are currently 225 sensitive parcels within classified forest trust lands in the HCP project area, encompassing about 109,155 acres or approximately 19.9 percent of HCP project area acres (Table 4.8-13; Figures D-10A through D-10C in Appendix D, EIS Figures). The Stillwater aquatic analysis unit has more sensitive parcels (71 parcels) than any other analysis unit, and nearly 36 percent of all the sensitive parcel area in the HCP project area. Four other analysis units (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 analysis units each contain less than five 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 westslope cutthroat trout and 101,510 acres (93 percent) by bull trout (Table 4.8-13). There is a limited distribution of Columbia redband trout in the project area. Therefore, only 2,145 acres (2 percent) of the sensitive parcels occur in basins occupied by Columbia redband trout (Middle and Upper Kootenai aquatic analysis units). The Stillwater aquatic analysis unit contains about 38 and 36 percent of the total sensitive parcel acres occupied by bull trout and westslope cutthroat trout, respectively.

There are a total of about 1,578 miles of streams in the HCP project area (see Table E4-4 in Appendix E, EIS Tables), although only about 374 (24 percent) of these stream miles occur within sensitive parcels (Table 4.8-14). This is also similar to the proportion of sensitive parcel area (20 percent) within the HCP project area (Table 4.8-13). About 33 percent (123 miles) of the sensitive area stream miles occur in the Stillwater analysis unit. An additional 55 percent of the sensitive parcel stream miles occur in four other aquatic analysis units (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 (see Table E4-4 in Appendix E, EIS Tables), about 36 percent (162 miles) of this HCP fish habitat occurs in sensitive parcels (see Table 4.8-14). While westslope cutthroat trout 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 Columbia redband trout habitat occur in the sensitive area parcels in the HCP project area.

4.8.2.7 Effects of and Trends in Climate Change

This section summarizes how climate change may affect the key aquatic habitat factors. Species-specific information on the effects of and trends in climate change is provided in the subsequent sections. Alterations in climate can directly affect aquatic habitat factors such as stream temperature and sediment transport (through changes in runoff patterns). Climate change may result in long-term changes in the vegetation community and riparian areas, resulting in tree species having to tolerate dryer conditions. Changes in the size, number, and type of trees in the riparian communities could directly affect aquatic habitat factors, including habitat complexity (LWD frequency),

TABLE 4.8-13. DNRC SENSITIVE PARCELS IN THE HCP PROJECT AREA BY EIS AQUATIC ANALYSIS UNIT

EIS Aquatic Analysis Unit	Sensitive Parcels in the Project Area[1]	Acres of Sensitive Parcels	Percent of Total Sensitive Parcel Acres in the Project Area	Total Project Area (Acres)	Percent of Total Project Area Occurring in Sensitive Parcels by Aquatic Analysis Unit	Acres of Sensitive Parcels Within Bull Trout Habitat[2]	Acres of Sensitive Parcels Within Westslope Cutthroat Trout Habitat[2]	Acres of Sensitive Parcels Within Columbia Redband Trout Habitat[2]	Acres of Sensitive Parcels Within HCP Fish Species Habitat[2]
Bitterroot	30	14,757	13.5	27,743	53.2	14,757	14,757	0	14,757
Blackfoot	32	13,477	12.3	56,528	23.8	10,710	12,837	0	12,837
Flathead Lake	4	2,230	2.0	10,470	21.3	0	2,230	0	2,230
Lower Clark Fork	0	0	0	4,185	0.0	0	0	0	0
Lower Kootenai	1	324	0.3	3,527	9.2	324	324	37	324
Middle Clark Fork	6	2,724	2.5	88,512	3.1	2,724	2,724	0	2,724
Middle Kootenai	4	2,500	2.3	28,767	8.7	2,498	2,500	1,855	2,500
North Fork Flathead	40	16,716	15.3	18,499	90.4	16,716	16,716	0	16,716
Rock Creek	1	476	0.4	4,592	10.4	476	476	0	476
Stillwater	71	38,860	35.6	87,321	44.5	38,860	38,074	0	38,860
Swan	19	11,291	10.3	44,613	25.3	11,291	11,291	0	11,291
Upper Clark Fork	12	5,189	4.8	47,173	11.0	2,543	5,077	0	5,189
Upper Kootenai	5	611	0.6	11,153	5.5	611	611	252	611
Upper Missouri	0	0	0.0	115,441	0.0	0	0	0	0
TOTAL	**225**	**109,155**	**100**	**548,525**	**19.9**	**101,510**	**107,617**	**2,145**	**108,515**

[1] Individual parcels were double counted if the parcel straddled two or more analysis units. The total number of unique sensitive parcels in the project area is 213 parcels.
[2] Defined as a sixth-order HUC with known HCP fish species present.
Source: DNRC (2008a).

TABLE 4.8-14. STREAM MILES AND FISH USE ON SENSITIVE PARCELS IN THE HCP PROJECT AREA

EIS Aquatic Analysis Unit	Total Stream Miles	Bull Trout	Westslope Cutthroat Trout	Columbia Redband Trout	One or More HCP Fish Species
Bitterroot	67.4	15.8	18.8	0.0	18.8
Blackfoot	42.8	7.5	14.2	0.0	14.2
Flathead Lake	7.7	0.0	3.0	0.0	3.0
Lower Clark Fork	0.0	0.0	0.0	0.0	0.0
Lower Kootenai	1.5	1.1	1.1	0.0	1.1
Middle Clark Fork	9.9	1.5	1.6	0.0	1.6
Middle Kootenai	9.7	2.3	2.7	1.2	2.7
North Fork Flathead	50.9	32.6	34.7	0.0	34.7
Rock Creek	1.3	0.1	0.1	0.0	0.1
Stillwater	123.2	61.1	61.0	0.0	61.1
Swan	42.8	19.9	21.6	0.0	21.6
Upper Clark Fork	14.1	0.3	2.0	0.0	2.0
Upper Kootenai	2.4	1.3	1.3	0.0	1.3
Upper Missouri	0.0	0.0	0.0	0.0	0.0
TOTAL	**373.5**	**143.5**	**162.2**	**1.2**	**162.3**

Source: DNRC (2008a).

sedimentation, and other habitat functions such as microclimate. As the scope and scale of such changes are unknown, the effects (positive or negative) on aquatic species would likely be variable across the landscape. These predicted changes in Montana's ecosystems may even occur within the next 50 years (CCS 2007; Pederson et al. 2009; USGS 2010a,b).

The general effects of climate change on freshwater systems will likely be increased water temperatures, decreased dissolved oxygen levels, and the increased toxicity of pollutants due to higher pollutant concentrations in streams with reduced streamflow. In riverine systems, altered hydrologic regimes and increased groundwater and stream temperatures could affect the quality of fish habitat (Ficke et al. 2007). Decreasing streamflows directly influence the quantity and quality of habitat for aquatic species, and represent an increasingly frequent and severe loss of summer habitat (Sabo and Post 2008).

A warming climate can have important effects on the regional distribution and local extent of habitats available to salmonids because local climates influence surface water (Stoneman and Jones 1996; Mohseni and Stefan 1999) and groundwater temperatures (Meisner 1990; Shuter and Meisner 1992). For example, Isaak et al. (2010) compiled a large stream temperature database for a river network in central Idaho to assess possible trends in summer temperatures and thermal habitat for two native salmonid species between 1993 and 2006. During the study period, basin average mean summer stream temperatures increased by 0.38° C (0.68° F) (a rate of 0.27° C [0.49° F] per decade), primarily due to long-term (30- to 50-year) trends in air temperature and stream flow. Solar radiation increases following wildfires accounted for 9 percent of basin-scale temperature increases despite burning 14 percent of the basin. However, within wildfire perimeters, stream temperature increases were two to three times greater than basin averages, and radiation gains accounted for 50 percent of warming. These increases were predicted to affect fish species differently. Although the total length of thermal habitat for rainbow trout was minimally affected by temperature increases, bull trout were estimated to have lost 11 to 20 percent of the headwater stream lengths that were cold enough for spawning and early juvenile rearing.

Streamflow reductions decrease available living space for aquatic organisms and can also reduce stream productivity by decreasing terrestrial interactions and throughputs of organic materials (Harvey et al. 2006). In addition, streamflow exerts a strong control on stream temperature, and flow reductions will likely exacerbate stream temperature increases caused by increased incoming solar radiation.

The combination of diminished snowpacks feeding cool water to rivers and streams, higher temperatures of the air and water, more frequent and larger wildfires, and the proliferation of disease that can accompany these changes, global warming has the potential to transform and reduce trout habitat (Kinsella et al. 2008). A probabilistic risk assessment conducted for the effects of future climate change on United States cold-water habitat in the Rocky Mountains indicated median overall reductions in the amount of cold-water fish habitat of approximately 20, 35, and 50 percent in 2025, 2050, and 2100, respectively (Preston 2008).

Climate change has the potential to increase snowmelt rates in temperate snow climates, which in turn could potentially alter the magnitude of peak flow increases. Based on modeling a historical rain-on-snow event in two small basins in Idaho, Tonina et al. (2008) indicated that timber harvest caused a 25 percent increase in the peak flow of the modeled event and increased the frequency of events of this magnitude from a 9-year recurrence interval to a 3.6-year interval. The changes in hydrologic regime, with larger discharges at shorter recurrence intervals, were predicted to increase the depth and frequency of streambed scour, causing up to 15 percent added mortality of bull trout embryos. However, the level of harvest in the managed basin was high, with about 25 percent of the managed watershed non-forested and open (versus only 5 percent of the unmanaged watershed). In addition, the authors acknowledged that, although timber harvest increased scour depth and frequency, the magnitude of the estimated changes were not exceptionally large and that flood-induced scour might vary widely across different channels and among years.

4.8.3 Affected Environment - Fish Resources

There are about 86 species of fish known to occur in Montana, including 30 introduced or non-native species. Extensive information concerning the distribution of these fish species is available through the Montana Natural Resource Information System (NRIS) internet database (NRIS 2005b). While some of these species occur over a wide area of the state, others have relatively limited distributions. These variable distribution patterns occur because of the diverse habitat requirements of the different fish species. Some species have very specific habitat requirements or are physically confined to an area, resulting in limited statewide distributions, while others can tolerate a wider range of habitat conditions and have a correspondingly wider distribution. For example, the distributions of Kootenai River white sturgeon and torrent sculpin occur only in limited areas in the Kootenai River drainage. In contrast, rainbow trout have an extensive distribution within the HCP project and planning areas, because they can occupy a wide range of habitats and habitat conditions and are extensively stocked through the state hatchery program.

Fish resources are supported by river, stream, lake, and pond habitat, which includes the physical and chemical characteristics of both aquatic and associated upland habitats. However, these habitats (and associated fish communities) typically extend past the boundaries of individual land parcels, such that fish resources are typically categorized and/or quantified by individual watersheds or waterbodies rather than land ownership. The dispersed distribution of state-owned lands also results in fragmented ownership within these fish habitat areas, as well as a majority of the available fish habitat occurring on non-state-owned lands. Such fragmentation reduces the ability to coordinate the management of watershed- or landscape-scale protection programs, resulting in potentially inconsistent or incompatible land use practices within individual watersheds. This might reduce the efficiency and effectiveness of protection and conservation efforts within watersheds.

Because there is generally limited quantifiable information on fish population parameters throughout most of the state, it is more efficient and accurate to assess the effects of land use activities on specific habitat characteristics than on fish population parameters. Water quality parameters are frequently used as indicators of overall fish habitat quality, and can be systematically used over a wide range of habitat types. Water quality also indicates the health of the overall ecosystem, reflects land use activities, and generally responds quickly to changes in such activities. In addition, some water quality standards are established specifically to meet fish habitat requirements, as in ARM 16.20.618 stipulating that "water quality must be suitable for propagation of salmonid fishes and associated aquatic life." Therefore, water quality protection through land use and watershed management activities directly protects fish and their habitat.

Land use activities such as agriculture, timber harvest, livestock grazing, residential and industrial development, and resource extraction (mining) can directly affect water quality and fish habitat through changes in runoff conditions. Such changes include increased runoff volumes and/or increased sediment, nutrient, and contaminant loading to rivers, streams, and lakes. Other land use activities affect fish resources by altering water quantity parameters through reservoir operations and water diversion systems. These changes can have both immediate and long-term impacts to fish resources and their habitat. Land use activities can also indirectly affect water quality and fish habitat through associated activities such as road construction and maintenance, irrigation practices, and non-point source water pollution activities.

In the simplest terms, the statewide distribution of fish can be partitioned based on the predominant aquatic habitat characteristics. A typical partitioning process uses general fish categories based on general water quality requirements. These categories are referred to as cold-, cool-, and warm-water species. Use of such broad classifications allows a number of fish species, with similar habitat requirements and potentially similar or overlapping distributions, to be grouped to assess potential project effects. While the definition of cold-water species is relatively consistent in the literature, the distinction between warm- and cool-water species is very inconsistent. Therefore, only two fish classifications (cold- and warm-water) are used to assess general fish habitat requirements across the HCP and non-HCP landscape, with the warm-water classification including both warm- and cool-water fish species.

Because all the salmonid (trout) species require clear, cold-water habitats, their distribution represents that of cold-water fish habitat. Mountain whitefish is one of the most widely distributed and abundant salmonid species in Montana. As such, the distribution of mountain whitefish can be assumed to represent the current extent of cold-water fish habitat in the state (DNRC 1996). Thus, the assumed distribution of cold-water fish habitat occurs primarily in the western half of the state. This distribution also generally corresponds to the planning area, such that much of the planning area is considered to be cold-water fish habitat.

Similarly, the majority of the non-planning area is generally considered warm-water fish habitat. Representative warm-water species include largemouth bass and goldeye (DNRC 1996). Despite these overall classifications, some cold-water species also exhibit limited distributions in areas classified as warm-water habitat, and some warm-water species also occur in cold-water habitat areas.

Of the 86 Montana fish species, 66 are known to occur in the HCP project area (Table E4-5 in Appendix E, EIS Tables). However, these species are not uniformly distributed across the entire planning area, with 58 species in the CLO area, 36 species in the NWLO area, and 21 species occurring within the SWLO area. The differences between land offices generally reflect the type and range of available fish habitat, with the CLO area apparently containing substantially greater warm-water fish habitat than either of the other two land offices.

4.8.3.1 HCP Fish Species

Three native trout species are included as HCP species: Columbia redband trout, westslope cutthroat trout, and bull trout. While all three are classified as sensitive species in the state of Montana, and have experienced substantial population declines compared to historical levels, only bull trout are listed under the ESA.

For the purposes of characterizing the affected environment in the EIS, the primary basis for determining HCP fish species presence was the 2003 NRIS database, based on fish population surveys completed by MFWP, USFWS, or other land management agencies and entities (Figure D-11 in Appendix D, EIS Figures). However, because DNRC recognizes that the known distribution layer is incomplete, DNRC assumed fish presence within additional areas. In perennial streams with known presence of HCP fish species (from the NRIS database), the analyses assumed that the occupied area extended upstream to the end of the perennial reach and connected perennial tributaries. Therefore, the final fish distribution GIS layers used for the EIS analyses are conservative by including known and presumed fish distribution.

Bull Trout

Population Status and Distribution

The bull trout (*Salvelinus confluentus*) in the contiguous United States was listed as threatened on November 1, 1999 (64 FR 58910-58933). Early rulemakings had listed DPSs of bull trout as threatened in the Columbia River, Klamath River, and Jarbidge River basins (63 FR 31647-31674, June 10, 1998, 63 FR 42757-42762, August 11, 1998, 64 FR 17110-17125, April 8, 1999). Bull trout are also ranked as an S2 SOC (imperiled because of rarity or other factors, making it very vulnerable to extinction throughout its range) in Montana by MFWP and MNHP, and as a sensitive species by the USFS.

In addition to a range-wide recovery strategy for bull trout, the USFWS also developed a draft recovery plan for specific recovery units, describing habitat conditions, recovery objectives and criteria, and specific recovery tasks for particular recovery units (USFWS 2002a). The overall objective of recovery planning is to ensure the long-term persistence of self-sustaining, complex, interacting groups of bull trout distributed across the species' native range so that the species can be de-listed.

MNHP data provide the best available information on bull trout distribution in Montana (Figures D-12A through D-12C in Appendix D, EIS Figures). However, due to sampling limitations and the low densities of smaller isolated populations, the data might under represent the true statewide distribution of bull trout in headwaters or isolated drainages.

Bull trout historically occurred in major river drainages in the Pacific Northwest from northern California and Nevada to the headwaters of the Yukon River in Canada, throughout the headwaters of the Columbia River drainage, and eastward into the Saskatchewan River in Canada (Cavender 1978). They are widely distributed across their range, but their distribution tends to be patchy, even in pristine environments (Rieman and McIntyre 1993). Bull trout have been extirpated from many of the large rivers within their historical range, and in many watersheds, remaining bull trout tend to be small, resident fish isolated in headwater (second- to third-order) streams.

Genetic investigations indicate that Montana bull trout lie within the upper Columbia River DPS, where a high level of genetic diversity occurs between drainages, but little variation exists within the individual drainages (Williams et al. 1997). This suggests that each major river drainage in the upper Columbia River region contains its own unique strain of bull trout, whose continued existence is important to the species as a whole (Kanda et al. 1997).

Bull trout distribution, abundance, and habitat quality have declined range-wide (Thomas 1992; Rieman and McIntyre 1993; McPhail and Baxter 1996). USFWS (2002a) identified the main threats to bull trout as habitat fragmentation and degradation, passage barriers that isolate populations, competition and predation from non-native fishes, angling mortality, and effects resulting from the small and isolated population sizes. Specific land and water management activities that depress bull trout populations and degrade habitat include dams and other diversion structures, forest management practices, livestock grazing, agriculture, agricultural diversions, road construction and maintenance, mining, and urban and rural development (USFWS 2002a).

Bull trout are native to the streams and rivers within the Columbia River basin in Montana, where they occur primarily in the Kootenai and Clark Fork River subbasins, west of the Continental Divide. They also occur in the Saskatchewan River subbasin, east of the Continental Divide. Within these subbasins, bull trout are found in several major river drainages, including the Blackfoot, Clark Fork, Swan, Flathead, and Kootenai Rivers (see Figures D-12A through D-12C in Appendix D, EIS Figures). In Montana, some resident headwater populations have become isolated or extirpated due to fish passage barriers. In addition, the migratory life history forms have lost access to large portions of their native habitat due to some of these fish passage barriers (e.g., Libby Dam).

The maintenance of migratory corridors for bull trout is essential to provide connectivity among local populations, and enables the re-establishment of extinct resident populations. If resident bull trout are extirpated or impacted by a disturbance to local populations or habitats, these populations cannot be replenished or the local habitat recolonized if limits to connectivity preclude migratory bull trout from entering the disturbed area (Rieman and McIntyre 1993).

Habitat Requirements

Bull trout have multiple life history strategies, including migratory forms, throughout their range (Rieman and McIntyre 1993). Resident and migratory forms may be found together, and either form may give rise to offspring exhibiting either resident or migratory behavior (Rieman and McIntyre 1993). Migratory forms appear to develop when habitat conditions allow movement between spawning and rearing streams and larger rivers or lakes where foraging opportunities may be enhanced (Frissell 1993).

Of the four life history forms generally recognized for bull trout—resident (non-migratory), adfluvial (lake rearing), fluvial (migratory stream and river rearing), and anadromous (saltwater migratory) fish—all but the anadromous form exist in Montana. Resident fish usually spend their entire lives in smaller tributaries and headwater streams, while sub-adult and adult migratory forms live in tributary streams for several years before migrating to larger rivers (fluvial form) or lakes (adfluvial form). All of these life history forms spawn only in small (second- through fifth-order) tributary streams in Montana (Shepard et al. 1984).

Bull trout have more specific habitat requirements than most other salmonids (Rieman and McIntyre 1993). Habitat components particularly important to bull trout distribution and abundance include

- Cold water temperatures
- Suitable substrate and lack of fine sediment
- Habitat complexity
- Habitat connectivity.

Habitat features that directly contribute to these components include high levels of shade, undercut banks, and LWD; high-quality gravel riffles with low levels of fine sediments; stable and complex stream channels; and connectivity within and between drainages. Other important general habitat factors that may have a large influence on bull trout distribution in Montana (Weaver 2003, personal communication) are:

- **Stream flow.** Particularly late summer low flows that coincide with bull trout spawn timing
- **Stream gradient.** Three to 5 percent gradient is the maximum for bull trout spawning, with less than 2 percent preferable.

Bull trout are likely to occur in colder, higher-elevation, low- to mid-order watersheds having low road densities (Rieman et al. 1997; Frissell et al. 1995; Quigley and Arbelbide 1997). Among a variety of effect mechanisms related to road density, roads may contribute to stream sedimentation, and roads adjacent to streams can reduce the amount of riparian vegetation, which may result in increased stream temperatures. Water temperatures above 59° F (15° C) are believed to limit bull trout distribution (Fraley and Shepard 1989; Rieman and McIntyre 1993), and this may partially explain why bull trout tend to exhibit patchy distributions within given watersheds. Small changes in temperature (1 or 2° F [0.6 to 1.1° C]) can have potential negative effects on native fish, including bull trout, by altering habitat conditions so they favor displacement or invasion from a non-native species (Shepard 2003, personal communication).

Spawning habitat almost invariably consists of very clean gravel, often in areas of groundwater upwelling or cold spring inflow (Rieman and McIntyre 1993).

Bull trout typically spawn in areas affected by groundwater (Shepard et al. 1984; Fraley and Shepard 1989). These areas (such as the Flathead drainage) tend to remain as open water through the winter, thereby reducing the risk of redd de-watering or freezing during harsh winter conditions. Groundwater-affected areas also allow bull trout embryos to develop and emerge faster than they would in drainages with colder winter water temperatures (Weaver and Fraley 1991).

Egg incubation temperatures can range up to 46º F (7.8° C), although optimal temperatures for survival are in the range of 35 to 40º F (1.7 to 4.4° C) (McPhail and Murray 1979; Goetz 1989). In-gravel incubation spans from 6 to 8 months, depending on water temperature. Hatching occurs in winter or late spring, and fry emergence occurs from early April through May (Rieman and McIntyre 1993).

Excessive sedimentation or substrate movement reduces bull trout production by increasing egg and juvenile mortality and reducing or eliminating habitat important to later life history stages (Fraley and Shepard 1989; Brown 1992). Prime sources of egg and fry mortality include scouring of redds due to high flows, freezing during low flows, superimposition of redds (overlapping nests in areas of limited spawning habitat availability), or deposition of fine sediment or organic materials that smother eggs or fry (MBTSG 1998).

Two of the life history forms of bull trout in the upper Columbia River (fluvial and adfluvial) migrate as a normal part of their life cycle. Downstream migration affords access to denser forage, better protection from avian and terrestrial predators, and alleviates potential intra-specific competition or cannibalism in rearing areas (Schlosser 1991). However, migratory juvenile bull trout face a variety of natural and human-caused threats to their survival after they leave their natal tributaries.

Migratory bull trout can move large distances (more than 150 miles) among lakes, rivers, and tributary streams. They often congregate in large, slow pools to feed. After they reach larger rivers, bull trout can remain there for brief periods, or for as long as several years, before either moving into lakes or returning to tributary streams to spawn. During their river residency, bull trout commonly make long-distance annual or seasonal movements among various riverine habitats, apparently in search of foraging opportunities and refuge from warm, low-water conditions in mid-summer and ice in winter (Elle and Thurow 1994; Swanberg 1997).

Bull trout require migratory corridors that link seasonal habitats for all bull trout life histories. 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, as it facilitates gene flow among local populations and may help re-establish populations in an area where the local population of bull trout has been extirpated (Rieman and McIntyre 1993).

Corridor Needs

Habitat alteration has fragmented bull trout habitats, eliminated migratory corridors, and isolated populations in tributary headwaters (Dunham and Rieman 1999; Rieman and Dunham 2000). Migratory corridors allow individuals access to unoccupied but suitable habitats, foraging areas, and refuges from disturbance. Maintenance of migratory corridors for bull trout are essential to provide connectivity among local populations, and enables the re-establishment of extinct populations (Saunders et al. 1991).

Lack of connectivity has been identified as a major threat to restoration of bull trout in several watersheds in Montana. Connectivity in and among these watersheds is obstructed by a variety of factors, including dams, diversions, culverts, barriers, de-watering, and stretches of unsuitable or inhospitable habitat. However, improving connectivity can also be detrimental to bull trout by allowing the introduction of species that can out-compete bull trout.

Key Biological Relationships

Introduced brook and brown trout threaten bull trout through competition for food and space, and possibly predation (Leary et al. 1993; MBTSG 1996a; Rieman and Mclntyre 1993). In addition, hybridization between brook trout and bull trout has also been reported in Montana (MBTSG 1995a,b; MBTSG 1996b,c). These introduced species tend to mature at an earlier age, have a higher reproductive rate, adapt better to degraded habitats, and tend to thrive in streams with higher water temperatures than bull trout. West of the Continental Divide, non-native lake trout also negatively affect bull trout in lakes by limiting foraging opportunities and reducing the distribution and abundance of migratory bull trout (Donald and Alger 1993; MBTSG 1996a). Non-native northern pike (*Esox lucius*) and introduced bass also have the potential to negatively affect bull trout (MBTSG 1996c).

Some introduced species, such as rainbow trout and kokanee, may benefit large adult bull trout by providing supplemental forage. However, introduction of non-native game fish can be detrimental due to increased angling and subsequent incidental catch and harvest of bull trout (Pratt 1992; MBTSG 1995c).

Bull Trout Core Area

A core habitat area represents the closest approximation of a biologically functioning unit for bull trout (USFWS 2002a). Core habitat is defined as habitat that contains, or if restored would contain, all of the essential physical elements to allow for the full expression of life history forms of one or more local populations of bull trout. Core habitat may include currently unoccupied habitat if that habitat contains essential elements for bull trout to persist or is deemed critical to recovery. Bull trout core habitat occurs primarily in the northern portion of the HCP project area in the Middle Clark Fork, Stillwater, Swan, and Upper Clark Fork EIS aquatic analysis units (Figure D-13 in Appendix D, EIS Figures; Table 4.8-15).

TABLE 4.8-15. ACRES OF HCP PROJECT AREA AND NON-HCP TRUST LANDS IN THE CLARK FORK AND KOOTENAI BULL TROUT RECOVERY UNITS BY EIS AQUATIC ANALYSIS UNIT

	Clark Fork Bull Trout Recovery Unit		Kootenai Bull Trout Recovery Unit	
EIS Aquatic Analysis Unit	**Total Acres Within the HCP Project Area**	**Total Acres Within Non-HCP Trust Lands**	**Total Acres Within the HCP Project Area**	**Total Acres Within Non-HCP Trust Lands**
Bitterroot	27,743	12,334	0	0
Blackfoot	56,528	11,225	0	0
Flathead Lake	10,470	8,723	0	0
Lower Clark Fork	4,185	308	0	0
Lower Kootenai	0	0	3,527	123
Middle Clark Fork	88,467	24,510	46	0
Middle Kootenai	18	0	28,749	2,413
North Fork Flathead	18,499	978	0	0
Rock Creek	4,592	2,138	0	0
Stillwater	87,304	14,333	17	0
Swan	44,613	910	0	0
Upper Clark Fork	47,173	27,221	0	0
Upper Kootenai	10	0	11,143	1,215
Upper Missouri	7	85	0	0
Total	**389,609**	**102,765**	**43,482**	**3,751**
% of Recovery Unit	**2.62**	**0.69**	**1.63**	**0.14**

Source: DNRC (2008a).

The core areas are further divided into primary and secondary core areas. The distinction between primary and secondary core areas is made not to infer a different level of importance for recovery purposes, but to indicate that a different set of recovery standards are needed for addressing population abundance relative to the landscape. Primary core areas are typically located in watersheds of major river systems, often contain large lakes or reservoirs, and have migratory corridors that usually extend 30 to 60 miles or more. Each primary core area includes several identified local populations of bull trout. In recovered condition, a primary core area is expected to support at least five local populations with 100 or more spawning adults and contain 1,000 or more adult bull trout. Secondary core areas are based in smaller watersheds and typically contain adfluvial populations of bull trout that are naturally isolated and have restricted spawning and rearing habitat extending only a few miles. This spawning and rearing habitat is normally upstream of a lake, which provides extensive rearing, foraging, and overwintering habitat. For portions of watersheds in Montana, the primary core areas are functionally equivalent to the Restoration/ Conservation Areas designated by the Montana Bull Trout Restoration Team (MBTRT 2000). The secondary core areas generally represent the waters referred to as “disjunct” by the Montana Bull Trout Scientific Group.

Recovery units are major units for managing recovery efforts. Factors considered in identifying recovery units include biological and genetic factors, political boundaries, and ongoing conservation efforts. Most recovery units consist of one or more major river basins, and may include portions of some mainstem rivers (e.g., Columbia and Snake Rivers) when biological evidence warrants inclusion. Biologically, the recovery units consist of bull trout groupings for which gene flow was historically or is currently possible. There are three primary bull trout recovery units in Montana, the Clark Fork, Kootenai, and St. Mary River drainages.

There is an overall total of about 17,534,198 acres of bull trout core habitat in the Clark Fork and Kootenai Recovery Units, with about 85 percent (14,861,978 acres) of the core habitat occurring in the Clark Fork Recovery Unit (Table 4.8-16). Overall, trust lands represent only 3.1 percent of the Clark Fork and Kootenai Recovery Units, while the HCP project area represents only 2.5 percent (Table 4.8-16). However, the percentage of HCP project area land in each individual core area ranges between 0 and 53 percent in the Clark Fork Recovery Unit, and between 0 and 7.9 percent in the Kootenai Recovery Unit. The largest percentage of HCP project area land in the Clark Fork Recovery Unit occurs in the Upper Whitefish Lake (53 percent), Whitefish Lake (47.2 percent), Cyclone Lake (40.3 percent), and Upper Stillwater Lake (35.9 percent) core areas. However, HCP project area land consists of less than about 10 percent of the other Clark Fork Recovery Unit core areas and all of the Kootenai Recovery Unit core areas.

Bull Trout Critical Habitat

On September 26, 2005, the USFWS published the final rule designating critical habitat for bull trout for the Klamath River, Columbia River, Jarbridge River, Coastal-Puget Sound, and Saint Mary-Belly River populations of bull trout (70 FR 56211-56311). In Montana, critical habitat for bull trout occurs within three critical habitat units: the Clark Fork, Kootenai, and St. Mary-Belly River basins (70 FR 56211-56311, September 26, 2005). These include 1,136 stream or shoreline miles in the Clark Fork River basin, 56 miles in the Kootenai River basin, and 37 miles in the St. Mary-Belly drainage. On January 14, 2010, the USFWS published a proposed rule in the Federal Register (75 FR 2269-2431) to revise the critical habitat designation for bull trout in the contiguous United States. The proposed revision would include an additional 2,036 stream miles and 9,460 acres of reservoir and lake habitat within Montana. This would result in the HCP project area containing only 2.8 percent of the bull trout critical habitat in the overall planning area (Table 4.8-17). The rule governing the final revised designation of critical habitat is expected to be published in September 2010, with an effective date of 30 days after publication. ~~However, not all critical habitat occurs within the Montana state boundaries or within the EIS aquatic analysis units (Table 4.8-17).~~ Critical habitat in the HCP project area is primarily concentrated in three analysis units (Stillwater, Swan, North Fork Flathead), accounting for ~~79~~74 percent of the HCP project area critical habitat (Figure D-14 in Appendix D, EIS Figures). ~~However, the HCP project area only contains 9 percent of the bull trout critical habitat in the overall planning area.~~

Critical habitat designations are based on the best available information on known bull trout presence within the last 20 years, and areas with features essential to the conservation of the species and in need of special management protection. Critical habitat areas contain one or both of the following: (1) spawning, rearing, foraging, or over-wintering habitat to support essential existing bull trout local populations; and (2) movement corridors necessary for maintaining essential migratory life history forms of the species. Critical habitat consists of the width of the stream at the ordinary high water mark (OHWM). Although adjacent floodplains and riparian areas are not designated as critical habitat, it is recognized that land use activities within these areas can have substantial effects on the physical and biological features of the designated aquatic habitat (70 FR 56211-56311, September 26, 2005).

TABLE 4.8-16. ACRES OF HCP PROJECT AREA AND TOTAL TRUST LANDS, AS A PERCENTAGE OF BULL TROUT CORE AREAS WITHIN THE CLARK FORK AND KOOTENAI BULL TROUT RECOVERY UNITS

Bull Trout Recovery Unit	Bull Trout Core Area	Total Acres	Total Acres in HCP Project Area	Percent of Bull Trout Core Area (within Montana) as HCP Project Area	Total Acres on Trust Lands	Percent of Bull Trout Core Area (within Montana) on Trust Lands
Clark Fork	Akokala Lake	1,423	0	0.00	0	0.00
	Arrow Lake	5,090	0	0.00	0	0.00
	Big Salmon Lake	49,986	0	0.00	0	0.00
	Bitterroot River	1,627,046	27,427	1.69	39,738	2.44
	Blackfoot River	1,271,091	49,243	3.87	56,949	4.48
	Bowman Lake	27,731	0	0.00	0	0.00
	Cabinet Gorge Reservoir	233,323	772	0.33	772	0.33
	Cerulean, Quartz & Middle Quartz Lakes	15,082	0	0.00	0	0.00
	Clark Fork River (Section 1)	1,793,079	47,027	2.62	74,349	4.15
	Clark Fork River (Section 2)	1,266,844	19,326	1.53	31,566	2.49
	Clark Fork River (Section 3)	760,952	38,758	5.09	41,502	5.45
	Clearwater River & Lakes	211,316	7,990	3.78	11,509	5.45
	Cyclone Lake	6,616	2,669	40.33	2,669	40.33
	Doctor Lake	9,396	0	0.00	0	0.00
	Flathead Lake	2,195,786	40,280	1.83	60,352	2.75
	Frozen Lake	1,910	0	0.00	0	0.00
	Harrison Lake	13,791	0	0.00	0	0.00
	Holland Lake	7,233	0	0.00	0	0.00
	Hungry Horse Reservoir	1,001,245	0	0.00	0	0.00
	Isabel Lakes	1,273	0	0.00	0	0.00
	Kintla Lake	15,462	0	0.00	0	0.00
	Lake McDonald	104,965	0	0.00	0	0.00
	Lake Pend Oreille	1,138,750	0	0.00	0	0.00
	Lincoln Lake	1,657	0	0.00	0	0.00
	Lindbergh Lake	25,784	0	0.00	0	0.00
	Logging Lake	19,899	0	0.00	0	0.00
	Lower Flathead River	1,277,834	30,447	2.38	39,993	3.13
	Lower Quartz Lake	3,161	0	0.00	0	0.00
	Noxon Rapids Reservoir	372,615	2,784	0.75	3,092	0.83
	Rock Creek	569,326	4,592	0.81	6,714	1.18
	Swan Lake	436,105	44,695	10.25	45,605	10.46
	Trout Lake	5,283	0	0.00	0	0.00
	Upper Kintla Lake	15,596	0	0.00	0	0.00
	Upper Stillwater Lake	82,057	29,477	35.92	29,994	36.55
	Upper Whitefish Lake	10,041	5,322	53.01	5,322	53.01
	West Fork Bitterroot River	201,776	321	0.16	321	0.16
	Whitefish Lake	81,456	38,479	47.24	41,927	51.47
	Subtotal	**14,861,978**	**389,609**	**2.62**	**492,373**	**3.31**
Kootenai	Bull Lake	126,540	2,273	1.80	2,397	1.89
	Kootenai River	1,759,582	31,036	1.76	33,531	1.91
	Lake Koocanusa	780,869	9,760	1.25	10,837	1.39
	Sophie Lake	5,227	413	7.90	468	8.96
	Subtotal	**2,672,220**	**43,482**	**1.63**	**47,233**	**1.77**
	TOTAL	**17,534,198**	**433,091**	**2.47**	**539,606**	**3.08**

Sources: USFWS (2002a); DNRC (2008a).

TABLE 4.8-17. MILES OF BULL TROUT CRITICAL HABITAT IN THE HCP PROJECT AREA AND NON-TRUST LANDS BY EIS AQUATIC ANALYSIS UNIT

EIS Aquatic Analysis Unit	HCP Project Area (Stream Miles)	Non-HCP Trust Lands (Stream Miles)	Non-DNRC Ownership (Stream Miles)	Total Critical Habitat (Stream Miles)	Percent of Critical Habitat in the HCP Project Area[1]
Bitterroot	1.3	4.1	509.1	514.5	0.3
Blackfoot	5.4	8.0	339.5	352.9	1.5
Flathead Lake	0.1	1.5	51.5	53.0	0.2
Lower Clark Fork	0.0	0.0	130.8	130.8	0.0
Lower Kootenai	1.0	0.0	61.2	62.2	1.7
Middle Clark Fork	6.4	8.7	465.0	480.2	1.3
Middle Kootenai	1.6	3.5	144.8	149.9	1.1
North Fork Flathead	15.7	0.1	189.6	205.4	7.6
Rock Creek	0.3	1.9	187.0	189.2	0.2
Stillwater	35.4	2.4	20.2	58.0	61.1
Swan	16.4	0.0	130.7	147.2	11.2
Upper Clark Fork	1.5	0.6	185.3	187.3	0.8
Upper Kootenai	0.0	0.0	38.8	38.8	0.0
Upper Missouri	0.0	0.0	0.0	0.0	0.0
Outside Aquatic Analysis Units	0.0	0.2	526.2	526.5	0.0
TOTAL	**85.3**	**31.0**	**2,979.7**	**3,095.9**	**2.8**

[1] Miles of critical bull trout habitat in the project area divided by the total critical habitat.
Source: DNRC (2008a).

Specific Risk Factors to Bull Trout

Although similar to all salmonids, bull trout tend to be particularly dependent on cool, clear water for spawning and rearing, as well as clean substrate for spawning. Land use activities that may adversely affect these required habitat elements include mining, road building, and forestry practices. In addition, competition and hybridization with non-native species is also a major threat to the maintenance and restoration of most bull trout populations. The isolation and fragmentation of bull trout populations by dams and road systems, and the relatively low population sizes in many areas, likely reduces the ability of bull trout populations to recover from natural and human-induced impacts.

Fisheries management risks include poaching, introduction of non-native species, and growing angler use of both rivers and lakes, resulting in incidental hooking and handling mortality. These risks also tend to increase as development increases in some locations, although the development location can be more of a concern than the magnitude of development.

Clark Fork Recovery Unit

The historical distribution of bull trout is relatively intact in the Clark Fork Recovery Unit, except for some headwater areas, but abundance has been reduced and some populations are highly fragmented.

The Clark Fork Recovery Unit is the largest and one of the most diverse recovery units in the species' range, and includes the following primary recovery core areas: the upper Clark Fork River, Rock Creek, Blackfoot River, Bitterroot River, lower Clark Fork River, Lake Pend Oreille, Priest Lakes and Priest River, Flathead Lake, Swan Lake, and Hungry Horse Reservoir. The secondary recovery core areas include the Clearwater River and associated chain of lakes, West Fork Bitterroot River upstream of Painted Rocks Dam, and 22 lakes in the Flathead Recovery Subunit.

Hydroelectric and irrigation dams interrupted established bull trout migration routes and affected habitat conditions, although some dams resulted in preventing the potentially negative interactions with non-native fish species, particularly lake trout and brook trout populations. The risk of core area and local population extirpation from isolation and fragmentation of habitat in the Clark Fork Recovery Unit is generally increasing, especially where bull trout populations are in decline.

In addition to the impacts of dams, past forestry practices have caused major impacts to bull trout habitat, including road construction, log skidding, riparian tree harvest, clearcutting, and splash dams. Because forestry was one of the primary landscape activities in the planning area, the impacts have been widespread. Specific impacts include increased sediment loading to area streams, increased peak flows, hydrograph and temperature modifications, reductions in in-stream woody debris, channel instability, and increased access by anglers and poachers. Many of these impacts are also the result of other road and transportation activities.

Some isolated areas in this recovery subunit have been impacted by grazing (particularly in the lower Flathead River portion of the unit, Thompson River, Elk Creek, Pilgrim Creek, and portions of the Bull River), but overall grazing is not one of the high-risk factors. However, water diversions and use for livestock has had a substantial impact to bull trout in the upper portion of the Clark Fork Recovery Unit. The legacy of mining, particularly in the upper portions of the Clark Fork River drainage, will also continue to impact bull trout.

Increased human population growth in western Montana and northern Idaho may be one of the biggest threats to the recovery of bull trout in the recovery units. Angling (both legal and illegal) has directly impacted bull trout populations despite restrictive fishing regulations and substantial educational efforts. These issues are intensified in stream corridors where roads provide easy access to areas with adult fish.

<u>Kootenai River Recovery Unit</u>

Lake Koocanusa and the Kootenai River/Kootenay Lake complex have been designated as primary core areas, representing recovered status in the Kootenai River Recovery Unit. Secondary core areas in the Kootenai River Recovery Unit are Bull Lake and Sophie Lake. They each include one identified local population of bull trout. The bull trout in the Bull Lake core area are known to express a unique phenotypic trait (i.e., downstream spawning), and bull trout in the closed basin of Sophie Lake also represent a unique resource in the Kootenai River Recovery Unit. Perpetuating both populations is a high priority in this recovery unit.

The Kootenai River Recovery Unit forms part of the range of the Columbia River population segment. The Kootenai River Recovery Unit is unique in its international configuration, and recovery will require strong international cooperative efforts. Within the Kootenai River Recovery Unit, the historical distribution of bull trout is relatively intact. However, abundance of bull trout in portions of the watershed has been reduced, and remaining populations are fragmented. The Kootenai River Recovery Unit includes four core areas and about 10 currently identified local populations.

Libby Dam has been one of the most important factors affecting bull trout in the Kootenai River Recovery Unit. The completion of the dam in 1972 severed the migratory corridor between the upper Kootenai River watershed (Montana and British Columbia) and the lower Kootenai River basin in northern Idaho, which drains into Kootenay Lake in British Columbia. The dam blocks all upstream migration and essentially bisects the United States portion of the Kootenai River drainage into two reaches. The upstream reservoir section of Lake Koocanusa is isolated from a downstream riverine reach. The habitat in the riverine reach is dramatically altered as a result of Libby Dam and is characterized by unnatural flow patterns, water temperatures, and water quality parameters. These changes, combined with other impacts to the lower river habitat, led to chronic reproductive failure of Kootenai River white sturgeon (known to have historically inhabited the drainage only downstream of Kootenai Falls). In 1994, it was listed as an endangered species. Native burbot populations in the Kootenai River have also collapsed.

Forestry practices also rank as a high risk to bull trout in the Kootenai River Recovery Unit, largely because forestry is the dominant land use in the basin. Virtually all drainages supporting bull trout in the Kootenai River Recovery Unit are managed timberlands. Although current forestry practices have improved, the risk is still high because of the existing road system, mixed land ownership, lingering results of past activities, and inconsistent application of BMPs.

The Kootenai River drainage has a history of mining on both sides of the international border. Libby, Montana, and many other communities in the Kootenai River valley were located at their present sites due to mining interests. Several mines have caused site-specific impacts on local populations of bull trout, but widespread negative impacts to water quality (such as those occurring in the Clark Fork Recovery Unit) due to mining have not occurred in the Kootenai River drainage. There are several active and proposed mining operations in the watershed, some of large dimension.

Fisheries management risks include poaching, introduction of non-native species, and growing angler use of both the lake and river. Lake Koocanusa is currently the most heavily fished lake or reservoir in western Montana. Illegal harvest of bull trout has been well-documented in the Kootenai River Recovery Unit and is considered a high risk because of the traditional focus on well-known and limited spawning areas. Introduced species are widespread throughout the drainage, and the proliferation of brook trout is currently thought to present the greatest non-native species risk to bull trout because of the threat of hybridization. Angler misidentification of species and incidental take by anglers due to hooking mortality is a growing concern.

St. Mary - Belly River Recovery Unit

Population isolation and fragmentation are substantial risk factors for bull trout in the St. Mary River and Belly River drainages, although the presence of migratory life forms in the primary core areas results in diminished risk. Irrigation system impacts also remain as high-risk factors, particularly the Milk River Irrigation Project, which has caused entrainment of fish, disruption of migratory corridors, de-watering of in-stream habitat, and alteration of stream temperature regimes since its inception in about 1920.

Localized habitat impacts occur in some of the watersheds from forestry, livestock grazing, agriculture, mining, transportation corridors, and human development. These impacts are generally site-specific and less pervasive than the impacts due to the diversions.

Interactions (hybridization, competition, and predation) with non-native fish tend to reduce maintenance or recovery of bull trout populations. In addition, lake trout and northern pike, two species with the potential to compete with bull trout, are native in the St. Mary River drainage.

Illegal harvest of bull trout has been well documented in the St. Mary - Belly River Recovery Unit, and in the past has been a major mortality factor due to a traditional focus on well known and limited spawning areas. Forestry management has some potential to negatively affect bull trout habitat in the St. Mary - Belly River Recovery Unit, but is not considered a high risk overall. The low density of human occupation in the St. Mary River and Belly River drainages, along with a high percentage of public land, minimizes the potential impacts from development.

Effects of and Trends in Climate Change

Optimal stream temperatures for bull trout are substantially lower than those for other salmonids (Selong et al. 2001), and water temperatures above 15° C (59° F) are believed to limit bull trout distribution (Fraley and Shepard 1989; Rieman and McIntyre 1993). In addition, inter-stream distributions of juvenile bull trout have been strongly associated with elevation and temperature (Dunham and Rieman 1999; Paul and Post 2001; Dunham et al. 2003). This temperature sensitivity may partially explain why bull trout have a generally patchy distribution within a given watershed.

Habitat alteration has fragmented habitats, eliminated migratory corridors, and isolated bull trout in the headwaters of tributaries (Dunham and Rieman 1999; Rieman and Dunham 2000). Maintenance of migratory corridors for bull trout is essential to provide connectivity among local populations, and enable the re-establishment of extinct populations (Saunders et al. 1991). Lack of connectivity has been identified as a major threat to restoration of bull trout in several watersheds in Montana. Connectivity in and among these watersheds is obstructed by a variety of factors, including dams, diversions, culverts, barriers, dewatering, and stretches of unsuitable or inhospitable habitat.

Isolation of bull trout populations is anticipated to become a growing threat as climate change impacts that are predicted to increase water temperatures may restrict bull trout distributions to smaller fragments of habitat suitable for this cold-water specialist (Hammond 2004; Rieman et al. 2007).

Based on modeling, Rieman et al. (2007) indicated that the effects of climate change on bull trout populations in the United States are more pronounced in some regions than in others because bull trout are distributed across a broad range of environments and landforms of varied relief. 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 (> 10,000 ha) habitat patches. 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.

Westslope Cutthroat Trout

Population Status, Distribution, and Seasonal Presence

The USFWS reviewed the status of westslope cutthroat trout (*Oncorhynchus clarki lewisi*) and determined that a listing under the ESA was not warranted based on a 1999 status review (USFWS 1999) as well as a 2003 updated status report prepared by the fish and game departments of the states of Idaho, Montana, Oregon, and Washington and the USFS (Shepard et al. 2003). However, the species is listed as an S2 SOC in the state of Montana by MFWP and MNHP, and as a sensitive species by DNRC, the USFS, and BLM.

The westslope cutthroat trout is one of 14 sub-species of cutthroat trout native to interior regions of western North America. The historical range of westslope cutthroat trout is the most geographically widespread among these inland cutthroat trout (USFWS 1999). West of the Continental Divide, the sub-species 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 westslope cutthroat trout includes the headwaters of the South Saskatchewan River drainage (United States 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.

Westslope cutthroat trout currently occupy about 33,500 stream miles, equivalent to 59 percent of their historical range of about 56,500 stream miles (Shepard et al. 2003). Genetically pure westslope cutthroat trout occur in approximately 10 percent of the currently occupied stream miles (Shepard et al. 2003). All populations of westslope cutthroat trout are recognized as a single population rather than being composed of DPSs (USFWS 1999). Habitats of historical stocks of westslope cutthroat trout ranged from cold headwater streams to warmer, mainstem rivers (Shepard et al. 1984; Behnke 1992).

Today, self-sustaining westslope cutthroat trout stocks remain widely distributed throughout the historical range of the sub-species, but remaining stocks occur primarily in colder, headwater streams that are largely found on lands administered by federal agencies, particularly the USFS.

In Montana, westslope cutthroat trout are found in the Oldman, Missouri headwaters, lower Missouri, Kootenai, Clark Fork, and Flathead River drainages. Figures D-15A through D-15C in Appendix D (EIS Figures) show the westslope cutthroat trout distribution within the EIS aquatic analysis units in the HCP project area. The only substantive limitation of the current distribution map is the substantial amount of stream length not surveyed to-date (Table 4.8-18).

TABLE 4.8-18. CURRENT AND HISTORICAL DISTRIBUTION OF WESTSLOPE CUTTHROAT TROUT IN MAJOR RIVER DRAINAGES IN MONTANA

River Drainage	Drainage Area (Square Miles)	Historical Distribution (Stream Miles)	Surveyed Reaches (Stream Miles)	Current Distribution (Stream Miles)	Percent of Surveyed Miles Occupied
Oldman	671			Isolated	
Missouri Headwaters	14,034	18,634	6,290	2,279	36.2
Lower Missouri[1]	24,041	29,027	9,787	1,791	18.3
Kootenai	4,815	4,119	1,615	1,051	65.1
Clark Fork	13,188	16,667	5,847	5,166	88.4
Flathead	8,436	10,288	3,489	2,609	74.8

[1] River drainage outside the HCP project area.
Source: USFWS (1999).

The distribution of westslope cutthroat trout within the major Montana river drainages (Table 4.8-18), based on the USFWS status review (USFWS 1999), is as follows:

- **Oldman River.** Principal tributaries include the Belly and St. Mary Rivers, in north-central Montana. However, westslope cutthroat trout survive only as isolated stocks in a few headwater streams along the east boundary of Glacier National Park, north of St. Mary Lake.
- **The Missouri River headwaters.** Stream surveys have documented westslope cutthroat trout in about 340 tributaries or stream reaches, including the principal watersheds of the Red Rock, Beaverhead, Ruby, Big Hole, Jefferson, Boulder, Madison, and Gallatin Rivers.
- **The lower Missouri River.** Westslope cutthroat trout have been documented in about 617 tributaries or stream reaches in this drainage, including the upper Missouri, upper Missouri-Dearborn, Smith, Sun, Two Medicine, Teton, Judith, and Upper Musselshell Rivers and the Belt, Arrow, Flat Willow, and Box Elder Creeks.
- **The Kootenai River.** Westslope cutthroat trout have been documented in about 227 tributaries or stream reaches, distributed among five watersheds that include the upper Kootenai, Fisher, Yaak, lower Kootenai, and Moyie Rivers.
- **The Clark Fork River.** Westslope cutthroat trout have been documented in about 1,291 tributaries or stream reaches, among six primary watersheds, including Flint-Rock Creek, and the upper Clark Fork, Blackfoot, middle Clark Fork, Bitterroot, and lower Clark Fork Rivers.
- **The Flathead River.** Westslope cutthroat trout have been documented in about 676 tributaries or stream reaches among seven watersheds, including the North Fork Flathead, Middle Fork Flathead, South Fork Flathead, Stillwater, Swan, and Lower Flathead Rivers, and Flathead Lake.

Habitat Requirements

Westslope cutthroat trout 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 into lake tributaries to spawn and rear (Shepard et al. 1984; 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 adult fluvial or adfluvial fish 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. 1984). 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. 1984).

In addition to the seasonal movements related to spawning and rearing, westslope cutthroat trout often move in response to seasonal changes in habitat conditions and habitat requirements. Fluvial and adfluvial westslope cutthroat trout may migrate distances of over 60 miles in response to habitat needs (Bjornn and Mallet 1964; Liknes 1984); in particular, there can be considerable movement to find suitable overwintering pool habitat (Brown and Mackay 1995). Resident westslope cutthroat trout typically exhibit less extensive movement, although seasonal movements may occur in response to changing habitat requirements and conditions, particularly water temperatures. Although westslope cutthroat trout tend to exhibit limited movement within stream reaches with numerous pools, movement may be more extensive in stream reaches with few pools (Peters 1988; McIntyre and Rieman 1995).

Westslope cutthroat trout usually mature at 4 or 5 years of age and always spawn in streams. Spawning typically occurs between March and July, when water temperatures warm to approximately 50° F (10° C) (Trotter 1987; Behnke 1992; McIntyre and Rieman 1995). Spawning habitat for westslope cutthroat trout occurs in low-gradient stream reaches with gravel substrate ranging from 0.08 to 3.0 inches in diameter, water depths near 0.7 feet, and mean water velocities from 1.0 to 1.3 feet per second (Liknes 1984; Shepard et al. 1984). Proximity to cover, such as overhanging stream banks, is an important habitat component for adult spawning fish. Fertilized eggs incubate for several weeks before hatching, with the actual time period inversely related to water temperature (Liknes 1984). Several days after hatching, westslope cutthroat trout fry (approximately 1 inch long) emerge from the gravel into the stream and disperse.

The survival of westslope cutthroat trout 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). Magee et al. (1996) reported low 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, but that recruitment was apparently not a limiting factor in the system. Ireland (1993) reported higher densities (0.6 to 28.8 fish per 120 square yards) of westslope cutthroat trout in the Taylor's Fork basin than streams in the upper Flathead basin (0.7 to 17.7 fish per 120 square yards), where stream substrates contained lower amounts of fine sediments (Shepard et al. 1984).

After they emerge from the spawning gravel, westslope cutthroat trout fry generally occupy shallow waters near stream banks and other low-velocity areas (e.g., backwaters, side channels) (McIntyre and Rieman 1995). Juvenile westslope cutthroat trout (3 to 5 inches) are most often found in pools and runs that have summer water temperatures of 42 to 60° F (5.6 to 15.6° C)and a diversity of cover (Fraley and Graham 1981; McIntyre and Rieman 1995). Adult westslope cutthroat trout in streams are strongly associated with cold, high-gradient waters that have pools and cover (Shepard et al. 1984; Pratt 1984; Griffith 1988; Peters 1988; Ireland 1993; McIntyre and Rieman 1995). During winter, adult westslope cutthroat trout congregate in pools (Brown and Mackay 1995; McIntyre and Rieman 1995), while juvenile fish often use cover provided by boulders and other large in-stream structures (Peters 1988; McIntyre and Rieman 1995). During the summer in lakes and reservoirs, adfluvial westslope cutthroat trout are often found at depths where temperatures are less than 60° F (15.6° C) (McIntyre and Rieman 1995).

Westslope cutthroat trout 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. Westslope cutthroat trout rarely feed on other fishes (Liknes and Graham 1988; Behnke 1992).

Habitat use by westslope cutthroat trout is diverse, and there is no clear hierarchy of critical life requisites. In general, westslope cutthroat trout have habitat requirements typical of salmonid species, but 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). Stream shading and riparian buffers, clean spawning gravels, low levels of fine sediments, backwaters, undercut banks, and LWD all contribute to cold water temperatures, enable the formation of pools, provide cover, and/or support different westslope cutthroat trout 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 (Griffith 1972; De Staso and Rahel 1994; Novinger 2000). Other important habitat factors for westslope cutthroat trout include substrate stability, stream flow, and changes in flow timing. In addition, natural and artificial barriers strongly influence the distribution of some populations.

Corridor Needs

The current distributions of westslope cutthroat trout are frequently limited to tributaries with relatively high gradients and stream reaches above natural and artificial barriers. Under ideal conditions, removal of all artificial barriers would benefit westslope cutthroat trout populations by connecting habitats and populations. However, in some cases, it may be necessary to identify, monitor, and maintain existing barriers, or install new ones, to minimize the competition and/or hybridization with native and non-native salmonids (e.g., brook trout, rainbow trout, and Yellowstone cutthroat trout) (MFWP 1999, 2007a).

Key Biological Relationships

Historically, westslope cutthroat trout in the Columbia River basin shared habitats with several potentially predatory fish species, including northern pikeminnow (*Ptychocheilus oregonensis*), bull trout, Chinook salmon (*Onchorhynchus tshawytscha*), and rainbow trout (including steelhead). In the Missouri River basin, which westslope cutthroat trout have inhabited for 7,000 to 10,000 years (Behnke 1992), westslope cutthroat trout formerly coexisted with relatively fewer species of fish, all of them essentially non-predatory, such as Arctic grayling (*Thymallus arcticus*) and mountain whitefish (*Prosopium williamsoni*). Inland redband trout (*Onchorhynchus mykiss*), sculpins (*Cottus* spp.), suckers (*Catostomus* spp.), dace (*Rhinichthys* spp.), and other minnows are fish species that may occur in streams with westslope cutthroat trout.

In addition to changes in habitat and direct competition with other fish species, hybridization with rainbow trout and Yellowstone cutthroat trout has led to substantial proportions of genetically introgressed stocks of westslope cutthroat trout in most regions of the subspecies' range. While MFWP (1999) reported that the majority of tested populations in the Clark Fork and Flathead Rivers (75 and 80 percent, respectively) were found to be 100 percent genetically pure, Hitt et al. (2003) found hybridization in 24 of 42 (57 percent) of Flathead River basin sites sampled between 1998 and 2001. In addition, Hitt et al. (2003) found rainbow trout introgression in 7 of 11 populations that were determined to be non-hybridized in 1984.

Research in the Kootenai River drainage indicated only 29 percent of the tested populations were genetically pure (MFWP 1999). The high degree of introgression in the Kootenai River system is of particular concern because hybridization between westslope cutthroat trout and inland redband trout, which are only found in the Kootenai River system, potentially impacts the genetic integrity of both species. In addition, MFWP indicates that genetically pure westslope cutthroat trout populations are found in only 3 percent of their native habitat in the upper Missouri River basin (MFWP 2007b).

Specific Risk Factors to Westslope Cutthroat Trout

As with all salmonids, westslope cutthroat trout require cool, clear water for spawning and rearing, as well as clean substrate for spawning. Land use activities that may adversely affect these required habitat elements include livestock grazing, mining, road building, and forestry practices. While existing regulations appear adequate to protect westslope cutthroat trout in most areas, the actual effectiveness of these regulations is dependent on appropriate funding and implementation. Although over utilization and whirling disease may present minor risks to westslope cutthroat trout in Montana, competition and hybridization with non-native species is likely the greatest existing threat to the maintenance and restoration of many westslope cutthroat trout populations (USFWS 1999). The USFWS (1999) also identified the primary land use risk factors within the major river drainages as

- **Oldman River.** While livestock grazing is a prominent risk factor affecting stream habitat conditions in the basin, this activity is generally limited in westslope cutthroat trout areas.

- **The Missouri River headwaters.** Principal land use risk factors include agricultural practices, mining, and forestry practices.

- **The lower Missouri River.** As with the upper Missouri River, the principal land use risk factors include agricultural practices, livestock grazing, mining, and forestry practices.

- **The Kootenai River.** Timber management activities, and the extensive associated road network, are the primary risk factors in this basin.

- **The Clark Fork River.** The principal land use risk factors in this basin include agricultural practices, livestock grazing, mining, and forestry practices. Mining effects are particularly evident in the Blackfoot River drainage, while water diversions, livestock grazing, and human development were identified as issues in the Bitterroot River watershed.

- **The Flathead River.** Timber management activities, and the extensive associated road network, are the primary risk factors in this basin. However, human development was also identified as a concern, particularly in the Flathead Lake area. The Flathead Lake basin also contains a particular threat from predation by non-native species.

Effects of and Trends in Climate Change

As with most trout species, westslope cutthroat trout physiology is directly regulated by temperature, and their life history stage-specific habitat requirements make them vulnerable to the many changes predicted to occur in aquatic habitats because of climate change (Rahel et al. 1996; Ficke et al. 2007). For example, less than 1 percent of the total distribution of westslope cutthroat trout and Colorado River cutthroat trout was found in streams with an average July air temperature greater than 22° C (72° F) (Williams et al. 2007).

Williams et al. (2007) modeled predicted population changes for cutthroat trout based on three key ecological elements directly affected by climate change: warmer summer temperatures, increased winter flooding (which can contribute to redd scour, physical harm, and fish stranding), and increased wildfires (which can cause large-scale changes in habitat suitability). The results indicated that, although only a relatively small to moderate percentage of westslope cutthroat sub-watersheds (3 percent) are at high or moderate risk from future predicted temperature increases, about a third of the sub-watersheds (35 percent) are at a high risk of winter flooding. In Montana, the thermal risks predicted by the model would occur mainly in the Upper Missouri and Clearwater River basins, while flooding would affect the Clearwater, Clark Fork, and Kootenai River basins.

Columbia Redband Trout

Population Status, Distribution, and Seasonal Presence

While the Columbia redband trout (*Oncorhynchus mykiss gairdneri*) 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 ESA was not warranted (65 FR 14932-14936, March 20, 2000).

The Columbia redband trout is a sub-species of rainbow trout (*O. mykiss*). Rainbow trout are widely distributed in western North America and segregated into three forms: (1) coastal rainbow trout west of the Cascade/Sierra Mountain divide, (2) interior Columbia River redband trout (Columbia redband trout), and (3) the Sacramento-San Joaquin redband trout (Behnke 1992). Historically, redband trout were widely distributed in fresh waters west of the Rocky Mountains from northern California to northern British Columbia, including habitats ranging from desert basins to high mountain coniferous forests (Behnke 1992). Columbia redband trout are native to the upper Klamath River basin, isolated interior basins of Oregon, and the Fraser and Columbia River drainages east of the Cascade Mountains extending upstream to barrier falls on the Pend Oreille, Spokane, and Snake Rivers (Allendorf et al. 1980; Behnke 1992).

Redband trout exhibit several life history forms, including anadromous (ocean migratory), adfluvial (lake migratory), fluvial (river migratory), and non-migratory resident forms (Lee et al. 1997). In addition, Lee et al. (1997) subdivided the resident redband trout into those that are sympatric or allopatric with the anadromous form (steelhead). Allopatric redband trout are those that evolved outside of the historical range of steelhead, whereas sympatric redband trout either occur within the steelhead range or were evolved from steelhead populations.

Columbia redband trout 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. Columbia redband trout 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 Columbia redband trout forms than of other salmonids. This is due to lack of information and the inability to differentiate juvenile steelhead, sympatric redband trout, and non-native strains of rainbow trout (Lee et al. 1997). Among allopatric Columbia redband trout, substantial populations occur in about 9 percent of the historical range and 18 percent of the current known distribution.

In Montana, Columbia redband trout only occur in the Kootenai River drainage and are the farthest inland population of Columbia redband trout in the Columbia River basin. Figure D-16 (Appendix D, EIS Figures) shows the distribution of Columbia redband trout 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, personal communication). According to genetic surveys, historical Columbia redband trout populations were likely native to low-gradient, valley-bottom streams throughout the Kootenai River drainage (Knudsen et al. 2002; Muhlfeld 2003, personal communication).

The Kootenai River population of Columbia redband trout in Montana primarily consists of the resident form (Muhlfeld 1999). These resident Columbia redband trout 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, personal communication). In general, the present distribution of Columbia redband trout in Montana is characterized by widely disconnected remnant populations of genetically pure stocks (Muhlfeld 2003 personal communication). 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 Columbia redband trout populations (Allendorf et al. 1980; Muhlfeld 2003, personal communication).

Genetically pure populations of Columbia redband trout have been identified in Callahan Creek, Basin Creek, the upper north (British Columbia) and east forks of the Yaak River, upper Big Cherry Creek, Granite Creek, and portions of the upper Fisher River including Wolf, Pleasant Valley, Island, and Silver Butte Creeks (Allendorf et al. 1980; Huston 1995; Hensler 2004, personal communication). Populations of Columbia redband trout 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 Columbia redband trout capable of re-establishing their historical distribution in Montana downstream of Kootenai Falls. Extensive ongoing genetic sampling is being conducted, which will aid in more accurately identifying the current distribution of genetically pure strains of Columbia redband trout in the Kootenai River basin (Muhlfeld 2003, personal communication).

The Kamloops strain of Columbia redband trout is native to Kootenay Lake in British Columbia but spawn upstream in Kootenai River tributaries, downstream from Kootenai Falls. The Kamloops strain attains a large body size due to their piscivorous diet of kokanee salmon (*Oncorhynchus nerka*) in the lake. Migratory fluvial and/or adfluvial components of the population may be undetectable due to hybridized populations inhabiting the lower portions of the Kootenai River drainage (Muhlfeld 2003, personal communication).

Habitat Requirements

Throughout their entire range, redband trout are found in a wide variety of habitat conditions that are often more extreme than conditions associated with other trout species (Lee et al. 1997). In particular, some redband trout populations are found in turbid and alkaline waters that range from near freezing to over 77° F (25° C) in the deserts along the southern margin of the Columbia River basin. Although redband trout are adapted to a wider range of environmental conditions than other salmonids, some general observations can be made. Redband trout typically migrate to spawning areas in the spring, although migration timing is affected by water temperature and stream flow.

After spawning, resident redband trout maintain restricted home ranges until migrating to overwintering areas in the fall (Thurow 1990). Juveniles of migratory forms typically move downstream to lakes or rivers after 1 to 3 years in natal streams. As with other salmonid species, redband trout abundance has been strongly correlated with riparian cover components, including undercut banks, LWD, and overhanging vegetation (Lee et al. 1997). It is also generally assumed that populations within streams and rivers rely heavily on aquatic and terrestrial invertebrates as food sources (Lee et al. 1997).

In Basin and Callahan Creeks, fourth-order tributaries of the Kootenai River, juvenile and adult redband trout strongly preferred pool habitat and avoided riffles (Muhlfeld et al. 2001a). They typically selected microhabitat with depths less than or equal to 1.3 feet, and low-to-moderate water velocities (less than or equal to 1.6 feet per second). Age-0 (young-of-year) redband trout selected slower (less than or equal to 0.3 feet per second) and shallower (less than or equal to 0.7 foot) habitat located along stream margins. Run habitats were also used by juveniles and adults, in proportion to habitat availability, but were used more than expected by age-0 fish. In general, it was determined that low-gradient, mid-elevation reaches with an abundance of complex pools were critical areas for the production of redband trout (Muhlfeld et al. 2001a). During the fall and winter, adult redband trout occupied small home ranges and utilized deep pools dominated by cobble and boulder substrate and/or LWD (Muhlfeld et al. 2001b).

Corridor Needs

Due to the spatially fragmented current distribution of redband trout in headwater stream areas, removal of all artificial barriers might benefit redband trout populations by providing connection among habitats and populations. However, redband trout 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 redband trout 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 redband trout stocks.

Where necessary, new barriers may even be warranted to minimize or prevent impacts to redband trout populations through competition and/or hybridization with native and non-native salmonids (such as rainbow trout, brook trout, and westslope cutthroat trout). However, the effects of such actions on other native fish species that occupy headwater habitats (e.g., bull trout and westslope cutthroat trout) must also be considered.

Key Biological Relationships

In the Columbia River basin, redband trout 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 redband trout 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).

In particular, there is concern that the Kootenai River basin redband trout population is at risk of extinction. 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, personal communication). 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 redband trout.

Specific Risk Factors to Columbia Redband Trout

The Kootanai River population of Columbia redband trout 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). 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.

Forestry practices are of concern because forestry is the dominant land use in the basin. Although current forestry practices have improved, the risk is still high because of the existing road system, mixed land ownership, lingering results of past activities, and inconsistent application of BMPs. The Kootenai River drainage has a history of mining, which likely impacted the population and distribution of redband trout.

Effects of and Trends in Climate Change

Although the response of redband trout to global climate change has not been specifically modeled, the reponse of these organisms would likely be similar to that discussed above for westlope cutthroat trout, as the physiology of both trout species is directly regulated by temperature.

4.8.3.2 Special Status Species

In addition to the three HCP fish species (Columbia redband, westslope cutthroat, and bull trout), there are 18 other special status fish species known or suspected to occur in the HCP project area (Table E4-6 in Appendix E, EIS Tables). Of these 18 species, 11 are listed as SOC by MFWP, and the other seven have the potential of becoming SOC. While these species occur or may occur in the planning area, several have limited distributions and might not occur within or near HCP project area lands. These species of concern are described in the following subsections.

Species of Concern

Montana SOC are native animals breeding in the state that are considered to be “at risk” due to declining population trends, threats to their habitats, and/or restricted distribution.

Arctic Grayling

The fluvial or river-dwelling Arctic grayling population in the upper Big Hole River represents the last remnants of this native in the contiguous United States. This species is found primarily in small, cold, clear lakes with tributaries suitable for spawning that are scattered through western Montana (both east and west of the Continental Divide).

Decline of fluvial Arctic grayling throughout their native range is attributed to four factors: (1) habitat degradation, (2) introduction of non-native salmonids, (3) climatic change, and (4) exploitation by anglers (AFS 2008). The distribution of Arctic grayling in the Big Hole basin suggests that they are displaced by non-native brown, brook, and rainbow trout.

The lake-dwelling form of grayling, which is typically stocked, is fairly common in 30 or more lakes across the western half of the Montana. These lake fish are genetically, but not visibly, different from the native fluvial grayling. Grayling are spring spawners and broadcast their eggs over a gravel bottom in moving streams. They are generalists, eating a variety of aquatic invertebrates.

Blue Sucker

The blue sucker was listed by the USFWS as a Category 2 species in 1994, and listed as an SOC by the State of Montana in 1996. This species may be susceptible to population declines in Montana due to its longevity, relatively low recruitment rate, migratory life history, and reliance on high flows in tributary streams for spawning. Blue suckers have been adversely affected by habitat changes, particularly those caused by large dams that block passage to spawning grounds, alter streamflow, and eliminate peak flows that initiate spawning runs. Dams also discharge cold, clear water as opposed to the warm, turbid waters in which these species evolved. Current monitoring information indicates the populations are in stable condition.

The only documented occurrence of blue sucker in the planning area is downstream of Morony Dam in the Missouri River and downstream of the Tiber Dam in the Marias River. These two areas consist of about 10 miles of mainstem habitat that might support blue sucker. However, they are unlikely to occur in the HCP project area because there are no HCP project area lands in these general areas.

Northern Redbelly X Finescale Dace

The northern redbelly X finescale dace hybrid is designated as a species of special concern in Montana, primarily due to its limited distribution. They prefer quiet water habitat in beaver ponds, bogs, and clear streams, although finescale dace are also found in larger lakes and reservoirs. The distribution is relatively unknown in the planning area, but may occur along with the small isolated populations of northern redbelly dace.

Paddlefish

The paddlefish is a long-lived game fish with low reproduction rates, making them susceptible to the effects of habitat loss and recreational harvest. The greatest threat to paddlefish is loss of spawning habitat. Habitat includes slow or quiet waters of large rivers or impoundments. In addition, they tolerate, or perhaps seek, turbid water (Holton 2003). They spawn on the gravel bars of large rivers during spring high water. While paddlefish may occur in the planning area, they are unlikely to occur in the HCP project area because there are no HCP project area lands in proximity to where paddlefish may occur.

Pearl Dace

The pearl dace is native to eastern and northern drainages in Montana. Typically found in small, cold-water tributaries north of the Missouri River, from Glacier National Park to the North Dakota border. Because there are no HCP project area lands in this area, pearl dace may occur in the planning area, but not in the HCP project area.

Sauger

The sauger is a native game fish that might occur in limited areas of the planning area, but not in the HCP project area. Sauger inhabit the larger turbid rivers and the muddy shallows of lakes and reservoirs, although it is primarily a river fish. They exhibit particularly long migrations in the Yellowstone and Missouri Rivers.

Spoonhead Sculpin

The spoonhead sculpin is a native species found only in the St. Mary and Waterton River drainages of Glacier National Park. They occur in the planning area, but not within the HCP project area. They inhabit deep lakes as well as streams and provide forage for lake trout, burbot, and other species.

Torrent Sculpin

The torrent sculpin is found only in the fast headwater streams of the Kootenai River drainage of northwest Montana. Torrent sculpin might occur in a small portion of the HCP project area, although most of Kootenai River in Montana occurs within the Kootenai National Forest. These fish are typically found in the riffles of cold, clear streams, but are also taken in lakes.

Trout-Perch

Trout-perch is a non-game fish species native to the northern drainages in Montana and, because of their limited distribution, have been designated a species of special concern. It is an important forage fish in some North American lakes but of minor consequence in Montana.

The entire known range of trout-perch in Montana is within Glacier National Park and the Blackfoot Indian Reservation. As such, they occur in the planning area but not in the HCP project area. They prefer shoals of lakes and deep pools in streams, over clean sand, gravel, or rubble substrate. Trout-perch are sensitive to pollution and sedimentation associated with agriculture, channelization, and warm water temperatures.

White Sturgeon

The Kootenai River white sturgeon population was listed as endangered under the ESA (59 FR 45989, September 6, 1994), due to a lack of juvenile recruitment to the population since the mid-1960s. Almost no recruitment occurred after Libby Dam began regulating flows in the Kootenai River in 1972 (USFWS 1999).

The population is landlocked in Montana and lives in large cool rivers (Kootenai River). Their range extends from Kootenai Falls (Montana), located about 50 river kilometers (31 river miles) downstream of Libby Dam, to Corra Linn Dam at the outlet from Kootenay Lake (British Columbia). Therefore, white sturgeon might occur in a small portion of the HCP project area, downstream of Kootenai Falls, although most of this area is within the Kootenai National Forest. A natural barrier at Bonnington Falls downstream of Kootenay Lake isolates the Kootenai River white sturgeon from other Columbia River populations.

Recovery of the Kootenai River white sturgeon population is contingent upon re-establishing natural recruitment, minimizing additional loss of genetic variability, and successfully mitigating biological and habitat alterations that continue to harm the population. Initial empirical white sturgeon research suggested that reduced spring flows, unnatural flow fluctuations, and altered thermal regime caused by Libby Dam operation may have interrupted spawning behavior and recruitment. More recently, along with altered physical habitat conditions, a suite of post-fertilization early life mortality factors (embryo suffocation, predation on early life stages, and resource limitation) and possible intermittent female stock limitation have been reported as possibly contributing to observed recruitment failure for Kootenai River white sturgeon.

Yellowstone Cutthroat Trout

The Yellowstone cutthroat trout is one of two cutthroat trout sub-species in Montana, and as the name implies, is native to the Yellowstone River drainage of southwest and south-central Montana. Originally their range was as far downstream as the Tongue River, but today pure, un-hybridized populations are limited to some headwater streams and Yellowstone National Park. Yellowstone cutthroat trout are a popular game fish, and are used extensively for mountain lake stocking on the east slope of the Rocky Mountains and in the Absaroka-Beartooth Wilderness. The USFWS published a determination of "not warranted" finding for Yellowstone cutthroat (71 FR 8818-8831, February 21, 2006).

The complex life history behavior of many Yellowstone cutthroat trout populations (similar to bull trout) requires movement among diverse habitats, and disruptions in habitat quality or availability may reduce their diversity or lead to extinction of isolated populations.

The presence of non-native fish species is considered the greatest threat to the persistence of Yellowstone cutthroat trout, as well as the widespread stocking of non-indigenous populations of Yellowstone cutthroat trout (AFS 2008). Other factors affecting Yellowstone cutthroat trout include irrigation, dam and culvert barriers, poor reservoir habitat, river channelization and riprap, grazing, mining, logging, and road building. Unfortunately, most remaining populations in Montana are isolated and are at risk of extinction from natural and human-caused events (AFS 2008). The broad stocking program throughout western Montana indicates that Yellowstone cutthroat trout likely occur within and near HCP project area parcels.

<u>Potential Species of Concern</u>

Potential SOC are species for which current, often limited, information suggests potential vulnerability or for which additional data are needed before an accurate status assessment can be made.

Brassy Minnow

This native species occurs east of the Continental Divide, with only spotty distribution in the planning area. However, there is no indication that they occur on or near any HCP project area lands. The brassy minnow prefers clear, slow streams but have occasionally been taken in larger rivers with high turbidities and in lakes. These fish tend to be abundant in habitats with few predators, as they seem to be very vulnerable to fish predation.

Brook Stickleback

The brook stickleback is native east of the Continental Divide in northeastern Montana. However, there are also several isolated populations within the planning area, such as Tiber Reservoir and Swan River. As a result, it is likely that they occur in small portions of the HCP project area. Sticklebacks live in slow streams and lakes with submerged plants, and they are forage fish for other predatory fishes.

Burbot

The burbot (ling) is native to most of Canada and northern United States, and it is usually found in larger streams and cold, deep lakes and reservoirs in Montana. Within the planning area, burbot occur in the northwest; southwest portions of the state; and the Missouri, Teton, and Marias Rivers. As a result, they are expected to occur within or near HCP project area parcels.

Northern Redbelly Dace

The northern redbelly dace is native to Montana, and found in small, clear, plains streams and ponds. The northern redbelly dace hybridizes with its close relative, the finescale dace. Northern redbelly dace are found in the lower Missouri River drainage and in a small grouping of tributaries in the upper Missouri River. As a result, they may occur in the planning area but are unlikely to occur in the HCP project area.

Plains Minnow

The plains minnow is native to Montana, and appears to prefer large streams, with sand or silt substrate, over rocky creeks and impoundments. They are found in the same major drainages and even at the same sites as the western silvery minnow. While the majority of the distribution occurs in eastern Montana, the distribution might extend into the Teton River. Thus, although plains minnow may occur in the planning area, they do not occur in the HCP project area (i.e., no HCP project area lands occur in this drainage).

Pygmy Whitefish

Pygmy whitefish are native to clear, cold lakes of northwest Montana, particularly around the Flathead River drainage. Therefore, pygmy whitefish likely occur within or near HCP project area parcels. This species is an important forage fish, especially for lake and bull trout, and live in the same deepwater habitat as lake whitefish.

Shorthead Sculpin

Shorthead sculpin occupy cold, swift riffle reaches of small high-elevation streams, primarily in the Flathead River drainage. As a result, they likely occur in only a small portion of the HCP project area. They spawn primarily in April by depositing their adhesive eggs in clusters on the undersides of rocks. After hatching, the larvae become benthic dwellers, feeding primarily on aquatic insects.

Special Status Species Specific Risk Factors

Many of the special status fish species in western Montana are subject to the same factors that affect the HCP fish species. These include changes in the natural hydrograph and water temperatures from dams, water diversion projects, and forest management practices. Increased siltation and decreased water quality occur from land use practices, particularly range, mining, forest, and transportation management activities. Habitat fragmentation from natural and man-made passage barriers and changes in in-stream habitat from channel and streambank modifications (channelization, riparian vegetation removal, and riprap stabilization), as well as overharvest from legal and illegal fishing, and the introduction of non-native fish species also contribute to the biological integrity of these sensitive fish species populations.

4.8.3.3 Other Fish Species

Fish species are often generally characterized as cold-, cool-, or warm-water species based on their overall habitat requirements. Using such general classifications provides a mechanism for assessing the potential effects of the proposed HCP on fish and aquatic habitat without needing to address a large number of individual species. For assessing the potential effects of the HCP, the overall fish communities are grouped as either cold-water or warm-water species, with cool-water fish included under the warm-water classification. As such, the cold-water species generally require similar habitat conditions as the HCP fish species, and they are most predominant in western Montana. In contrast, the warm-water species tend to occur in a broader range of habitats, and they also tend to occur east of the Continental Divide.

Cold-water Fish Species

Salmonids (salmon, trout, chars, whitefishes, and graylings) frequently serve as indicator species for cold-water habitat quality, due to their sensitivity to environmental conditions, diverse life stage habitat requirements, position as top aquatic predators, and high value to the public. They require cold, clean water with high levels of dissolved oxygen for survival and growth, and clean, stable, and permeable gravel substrate for spawning and egg incubation. Their persistence depends on properly functioning ecosystem components (biological, chemical, and physical), and healthy populations are frequently associated with properly functioning cold-water ecosystems (i.e., having high native fish and invertebrate diversity). Therefore, the presence of native species indicates high ecological integrity within a system. Because the HCP fish species are cold-water species, the discussions related to the HCP fish species would generally apply to the other species in this category.

The dominant cold-water fish species in the state are rainbow, brown, and brook trout, although none of these are native to the state. Their dominance is due in large part to being more tolerant to habitat conditions and to their ability to hybridize with, or out-compete, some of the native species. The relatively small populations of the HCP fish species place them at particular risk from these factors.

Human activities frequently modify natural watershed processes (i.e., hydrologic, sediment, thermal, and nutrient regimes), which can degrade salmonid habitat quantity, quality, and connectivity over time. Some of the major human activities that modify watersheds and degrade habitat include roads, timber harvest, mining, and livestock grazing. These activities are discussed in detail above, in Section 4.8.3.1 (HCP Fish Species).

Warm-water Fish Species

For this EIS, warm-water and cool-water fish species have been combined to represent the group species that are not generally confined to the cold-water habitats occupied by trout. While many of these species are solely or primarily located in eastern Montana, several exhibit relatively large distributions across the state. Other statewide assessments have used largemouth bass and goldeye to represent warm-water fishes (DNRC 1996, 2004c). The distribution of goldeye is limited to locations east of the Continental Divide, and primarily to large mainstem rivers. They tolerate and seem to prefer turbid habitat and tend to avoid cold-water habitat. Largemouth bass exhibit a wider distribution than goldeye, primarily because they occur in many lakes throughout the state. Thus, goldeye and largemouth bass represent warm-water species that occur in rivers and lakes.

While warm-water species can also be affected by the same land use factors that affect the cold-water species, they typically tolerate a wider range of habitat conditions, particularly with regard to temperature and turbidity.

Effects of and Trends in Climate Change

Habitat for cold-water aquatic species will decrease, and habitat for warm-water aquatic species will increase as a result of climate change (USGCRP 2001). For species such as salmonids that depend on cold, clean, connected streams, the shift toward warmer temperatures and lower water levels could adversely affect both individuals and populations. Cold-water species will also be put at risk of habitat encroachment, as warm-water species expand their range into streams that have historically provided cold-water habitat. Fish species range shifts will likely occur on a species level, not a community level, resulting in potentially large changes in fish communities (Ficke et al. 2007). These changes are expected to lead to the loss of native species from extensive areas and result in increasingly scarce and fragmented populations in many others (Ruggiero et al. 2008).

In addition, warmer climatic conditions could favor range expansion and enhanced growth of warm-water fishes. For example smallmouth bass, a warm-water fish, have moved upstream in the Yellowstone River in recent years. Brook trout, a non-native competitor of native trout species, are also affected by increased water temperatures and changing flow regimes; however, this species has a somewhat higher tolerance to higher temperatures than do some native trout, particularly bull trout. Higher water temperatures facilitate upstream encroachment of and displacement of trout species by species with even higher temperature tolerances, such as brown trout and rainbow trout.

Global climate change may ultimately be a significant threat to the persistence of native fishes because it will add to the current adverse effects of invasive aquatic species and habitat degradation while increasing water temperatures to potentially unsuitable thresholds (Williams et al. 2007).

4.8.4 Environmental Consequences

The potential effects on fish and other aquatic resources in the planning and HCP project areas are reflected in the potential changes in aquatic habitat conditions due to the forest management activities. The emphasis for assessing the environmental consequences of the four EIS alternatives is through the quantitative and qualitative changes in key aquatic habitat parameters as they relate to supporting the HCP fish species and other aquatic species. The alternatives analysis focuses on habitat parameters because these parameters are often directly affected by land management activities, and they can typically be measured and monitored more effectively than biological parameters (e.g., fish population size). While there are few instances where a land management activity could cause a direct or measurable effect on an individual or population of fish, such effects are more likely to occur to habitat parameters.

In addition to the limited ability to effectively measure or monitor general biological parameters, there is often a limited basis for accurately assessing habitat parameters for individual fish species. This is particularly true for the three HCP fish species, which all have similar habitat requirements. In addition, the effects on habitat of the different alternatives will vary depending on existing site-specific conditions. For example, an area with marginally acceptable water temperature conditions for supporting the HCP fish species, due to previous land management activities, is likely to be affected to a greater extent by additional temperature impacts than an area with an undisturbed water temperature regime.

While the alternative comparisons are restricted primarily to the potential effects on aquatic habitat parameters, the link to the different species can be made by quantifying the location or extent of the effects of an alternative. For example, upgrading a culvert identified as a fish passage barrier would enhance conditions for all the fish species occurring in the drainage that would benefit from improved passage conditions. However, if only one of the HCP fish species occurs in that particular drainage there would be no benefit to the other two species. The potential benefit would also vary by how much available habitat is provided by upgrading the culvert. Therefore, it is impractical to compare the alternatives based on the potential effects to the individual species, or changes in species population levels. In this case, the alternative analysis focuses on the rate of problem culvert upgrades and the mechanism for selecting particular culverts for upgrading, as a way to differentiate the alternatives without attempting to assign a quantifiable benefit.

The four primary habitat components examined in this analysis are sediment delivery, stream temperature, in-stream habitat complexity, and connectivity among sub-populations of fish species. Additional habitat components considered include stream channel stability, form, and function and microclimate. The potential additive effects of these components on aquatic habitat and fish resources are examined in Chapter 5 (Cumulative Effects).

Another advantage of using habitat components as the basic unit for alternative comparison is that these components represent meaningful ecological endpoints with known relationships to the fish species they support. For example, the evaluation of a DNRC activity, such as grazing management practices, will involve an evaluation of the potential alteration or loss of riparian vegetation, physical damage to stream banks, maintenance of channel stability, and channel morphological characteristics. These factors affect both the quality and the quantity of available fish habitat, including water temperature, substrate characteristics, pool-riffle ratios, and water depth.

4.8.4.1 Alternative Analysis Approach

The comparison of alternatives relies on modeling evaluations or qualitative assessments (depending on whether quantitative data are available or measurable) to identify the most likely direct and indirect effects of forest management activities on individual aquatic habitat factors. These discussions focus on the likely differences between the effects of existing forest management protocols stipulated by existing laws and regulations (no-action alternative), and the three different action alternatives. To minimize redundancy and improve comparative discussions between the four alternatives, we analyzed the alternatives by habitat factor.

The assessment of the riparian habitat component compares the potential effects of the different DNRC riparian timber harvest strategies on in-stream habitat conditions, relative to the needs of fish species. The assessment is designed to determine if important riparian functions are maintained at levels necessary to provide suitable habitat for the conservation of the HCP fish species. The evaluations are based 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 fish.

In the case of Alternative 2 (Final HCP), some commitments contained within the alternative have been strengthened, as compared to the Draft HCP Alternative 2, presented and analyzed in the Draft EIS/HCP. These changes were implemented to provide a higher degree of certainty that the individual riparian buffer functions would be maintained or improved. The riparian harvest strategy under Alternative 2 would now provide greater levels of protection (as compared to Draft EIS

Alternative 2) for all Class 1 streams (as defined under ARM 36.11.312.). Class 1 streams include those streams supporting both HCP fish species (referred to as Tier 1 streams in the Draft EIS/HCP) and non-HCP fish species (referred to as Tier 2 streams in the Draft EIS/HCP), as well as perennial tributaries to those streams. Furthermore, the no-harvest buffer on all Class 1 streams was increased from 25 to 50 feet for Alternative 2. This would result in a greater amount of stream buffer protection over a greater number of acres within the HCP project area.

The riparian harvest activities conducted under the four alternatives are expected to variably affect riparian functions relative to temperature; sedimentation; habitat capacity; and channel form, function, and stability. Riparian forest modeling was used to compare LWD recruitment and shading by alternative among a representative set of riparian stand types within the HCP project area. Because the Final HCP Alternative 2 commitments include a wider no-harvest buffer than originally analyzed in the Draft EIS, the modeling results for LWD habitat function and shading are expected to fall somewhere between the results for Alternative 2 (Draft EIS) and Alternative 3, and no additional modeling was warranted. The anticipated effects of Alternative 2 on LWD recruitment and function and streamside shade and instream temperatures are addressed under Section 4.8.4.2, Direct and Indirect Effects, subsections Habitat Complexity and Stream Temperature and Shading, respectively.

While sediment filtration is also an important riparian function, a detailed discussion of this subject is included under the sediment habitat component, for which the primary basis for alternative comparison was an assessment of road-generated sediment production and delivery, particularly relative to roads adjacent to streams that support, or potentially support, fish. In the case of the sediment modeling, the changes in the Alternative 2 commitments would not affect the results of the original modeling conducted for the Draft EIS analysis because the modeling results were based on the number of road miles and problem sites. Since these conditions did not change for Alternative 2, no additional modeling was warranted. Therefore, limited changes were made in the discussion of the modeling results for the action alternatives.

To assess the fish connectivity habitat component, the alternatives were compared based on the number of potential fish barriers that prevent or impede fish migration upstream or downstream of road-stream crossings. This comparison involves extrapolating existing fish passage structure inventory data through time for each alternative and comparing the relative rate of fish passage improvement projects between alternatives. In addition, differences in fish passage designs between the alternatives were evaluated.

The CWE assessment compares the ability of the various alternatives to minimize or eliminate the collective aquatic impacts that specifically affect watershed-level resource features, including water yield, flow regimes, channel stability, and in-stream and upland sedimentation due to surface erosion and mass wasting. However, CWE result from the collective influence of multiple independent management variables within a watershed, thereby making it extremely difficult to independently differentiate and measure individually. However, the evaluation of the overall effects of the other habitat components discussed above is expected to provide an indication of the cumulative effects of the different alternatives. The implementation of management and conservation actions relative to these various habitat components is also expected to have a compounding influence on the habitat associated with fish. For example, improving in-stream habitat conditions, along with improvements in the connectivity to that habitat, is expected to have an additive effect on fish species, which might not be entirely accounted for under the analysis for any one habitat component.

For some alternatives, the rate or scale of improvement in specific habitat components would be enhanced by the use of adequate effectiveness monitoring procedures, which would address both the implementation process and the effectiveness of individual habitat management strategies. Monitoring results would provide DNRC with the information required to effectively improve the implementation process in the future, resulting in greater cumulative gains in habitat quality.

4.8.4.2 Direct and Indirect Effects

The direct and indirect effects of the alternatives are assessed relative to existing and projected future aquatic habitat conditions (equivalent to the habitat conditions under Alternative 1). As indicated above, using habitat components to differentiate the alternatives is more practical and often more accurate than assessing biological parameters. There is ample scientific literature relating land-management- and timber-harvest-related activities to direct and indirect effects on the key individual components of aquatic habitat. There is also much literature that relates changes in habitat to direct effects on fish species. On the other hand, detailed information of the site-specific distribution and precise life history requirements of individual fish species, populations, and sub-populations within the project area is generally partially or completely lacking. Therefore, the habitat component approach is used to analyze effects on fish species, and to compare the effects between the various alternatives. In addition, the integral components of the proposed HCP aquatic conservation strategies consist of biological goals, conservation strategies, and specific conservation commitments. The proposed HCP conservation strategies were specifically developed to avoid, minimize, or mitigate potential impacts to the three HCP fish species as a result of forest management activities in the project area, and provide a comparative benchmark to assess differences between alternatives.

For all of the alternatives, DNRC will continue to collaborate with resource agencies and other stakeholders through participation in conservation agreements to conserve and protect the HCP fish species. These agreements include the *Westslope Cutthroat Trout Conservation Agreement and Memorandum of Understanding* and *Restoration Plan for Bull Trout in the Clark Fork River Basin and Kootenai River Basin, Montana*.

<u>Sediment Production and Delivery to Streams</u>

Forest management activities can increase the amount and rate of surface erosion and landslides by disturbing soils and vegetation, reducing the interception and infiltration of precipitation, and increasing surface runoff into streams (Swanson et al. 1987). Landslides are a minor source of sediment delivery within the HCP project area, while the two primary activities affecting sediment delivery within the HCP project area are roads and timber harvest (see Section 4.5.1, Geology and Soils – Affected Environment). Increased sediment yield from these forest management activities can increase sediment delivery to downgradient streams, lakes, and wetlands where it can negatively affect aquatic resources (Bisson et al. 1987). Forest practices can also affect streambank erosion by increasing surface water runoff rates and reducing the riparian vegetation density, which provides stabilizing effects on the stream banks.

Although a number of forest management activities can affect sediment delivery to streams, the primary mechanisms are associated with forest roads. This includes surface water runoff directly into streams at road crossings and indirectly through roadside ditches or downgradient transport, as well as increased erosion at road crossings associated with culverts (particularly from culvert failures or culvert installations or replacements). The other sediment delivery routes (i.e., timber harvest in riparian zones) are generally minimized through the implementation of SMZ regulations, which restrict activities in proximity to streams, thereby allowing natural filtration to minimize sediment delivery to the streams. Because of the substantial potential for sediment delivery associated with forest roads, this was the primary focus of the modeling effort to differentiate the alternatives.

Increased sediment loading to streams can result in the degradation of salmonid spawning and early rearing habitat (Bjornn et al. 1977; Cederholm et al. 1981; Plum Creek 2000), due to the accumulation of fine sediments. Increased sediment loading can also lead to increased turbidity, which can reduce the overall rearing habitat quality for juvenile salmonids and other native fishes.

Road Surface Sediment Production

The construction, use, and maintenance of forest roads are identified as primary sources of sediment delivery to streams and watersheds (Plum Creek 1999). Increased sediment delivery can directly and indirectly affect the HCP fish species, and other aquatic species sensitive to the effects of sediment loading. For example, many fish species, including the HCP aquatic species, are particularly dependent on gravel spawning habitat with a low incidence of fine-grained material. Fine-grained sediments tend to fill interstitial spaces in the substrate and interfere with the flow of water and oxygen through the gravel, and thereby reduce the survival rates of eggs. 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.

Existing roads are a major source of sediment within the planning area. There are approximately 4,570 miles of existing road located on trust lands within the planning area, with approximately 2,646 miles of road in watersheds supporting HCP fish species in the HCP project area (see Table 4.8-7). However, only a limited number of these roads have been inventoried for sediment delivery potential or drainage problems (DNRC 2006c). GIS analysis indicates that about 700 miles (27 percent) of the existing roads on HCP project area lands are located within 300 feet of a stream, although only about 9 percent of these road miles are within 300 feet of known HCP fish species streams. Road densities also vary by aquatic analysis unit, ranging from 1.7 to 5.5 mi/mi^2, with an overall average of 3.1 mi/mi^2. However, the average road density within 300 feet of a stream is about 0.8 mi/mi^2, and road density within 300 feet of a HCP fish species stream is only about 0.3 mi/mi^2.

DNRC has inventoried approximately 430 miles of 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 2008h). Although a total of 12.5 miles of road (3 percent of all inventoried roads) were identified 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.

Because the DNRC road inventory focused specifically on 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). 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 relief CMPs (19.5 percent). Within these two categories, the most common problems were inadequate capacity for relief CMPs, due to plugged inlets or improper sizing, and ineffective drain dips (DNRC 2006c).

Based on the distribution of the inventoried road problems, the comparison of alternatives on sediment production focused on surface runoff and road-stream crossings. The Water Erosion Prediction Project (WEPP) model was determined to be the best tool to quantitatively evaluate surface runoff and BMP applications, which vary by alternative, and the effect on sediment delivery for these identified problems. The WEPP model estimated sediment production and delivery from commonly observed problem road segments (see DNRC 2008a for details on the modeling). The modeling was applied to the specific conditions within the road network on trust lands, allowing a comparison of the relative rates of sediment production in each EIS aquatic analysis unit in the HCP project area, by alternative.

Common road parameters of grade, road width, and road segment length were calculated 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 percent, 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 2008h).

The modeling 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 EIS aquatic analysis units within the planning 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 trust lands.

The differences between the alternatives are primarily related to implementation schedules of BMPs to correct existing problem road segments. Therefore, the analysis modeled various BMP application scenarios to represent existing and future road conditions under each alternative. To achieve this comparison, 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 provide a solid base 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.

Because the existing inventory data are expected to represent the overall condition of all roads in the HCP project area, this will provide the basis for identifying the distribution and frequency of the various road problems on trust lands. While all of the alternatives would address these road problems to effectively reduce sediment delivery to area streams, the problems would be corrected at various rates and priorities, depending on the alternative.

Overall, the upgrades and BMP applications on existing problem road segments were estimated to have a large effect on reducing sediment production from road surfaces by an average of about 90 percent, if all problem road segments were upgraded, for each of the alternatives (Table 4.8-19). 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). Particularly important considerations for sediment reduction are the buffer size between roads and streams and road gradient.

The highest sediment production values occur in aquatic analysis units with the highest precipitation, and sediment production rates ranged from 1.62 to 7.32 pounds per linear foot of road (DNRC 2008h). Applying these sediment production rates to the estimated problem road segments within each aquatic analysis unit results in a range of 7 to 407 tons per year of sediment production, with an average of 137 tons per year over all aquatic analysis units (Table 4.8-19). While the total sediment produced and the percent reduction rates are similar for all four alternatives at the end of the 50-year Permit term, the alternatives differ by the rate that the roads are inventoried, prioritized, and upgraded. As a result, alternatives that upgrade problem roads faster would have a greater cumulative sediment reduction effect over 50 years, despite similar total upgraded road miles at the end of the Permit term.

Because the number of road miles that underwent upgrades and BMP improvements by the end of the Permit term would be similar under all alternatives, the primary difference regarding road surface sediment production between alternatives involves the amount of new road construction and the rate of BMP improvement. The amount of new road constructed in each aquatic analysis unit over the 50-year Permit term was estimated using the proportion of HCP project area lying within each aquatic analysis unit. In addition to the new roads, other existing roads would be reclaimed during the 50-year period. Thus, the actual or net increase in roads for each aquatic analysis unit was 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 4.8-20).

The alternatives all have generally similar increases in road miles over the Permit term, ranging from a low of 747 miles (Alternative 3) to a high of 834 miles (Alternative 1). Similar extrapolations estimated the amount of total roads within 300 feet of streams, most of which are also associated with stream crossings. The total number of stream crossing at 50 years, was estimated using the total projected roads and the existing proportion of stream crossings to road miles.

TABLE 4.8-19. COMPARISON OF THE ESTIMATED SEDIMENT PRODUCTION (WITH AND WITHOUT APPROPRIATE BMPs) BASED ON EXPECTED ROAD MILES AT THE END OF THE 50-YEAR PERMIT TERM[1], BY ALTERNATIVE AND EIS AQUATIC ANALYSIS UNIT

Alternative	Bitterroot	Blackfoot	Flathead Lake	Lower Clark Fork	Lower Kootenai[12]	Middle Clark Fork	Middle Kootenai	North Fork Flathead[12]	Rock Creek	Stillwater[12]	Swan[12]	Upper Clark Fork[12]	Upper Kootenai	Upper Missouri	Total
Total Sediment Potential (Tons/Year)															
Alt. 1	98	156	34	7	17	237	92	86	8	370	289	350	35	177	**1956**
Alt. 2	98	155	34	7	18	217	91	80	8	370	288	348	35	176	**1925**
Alt. 3	97	153	33	6	17	209	87	85	8	366	287	341	31	175	**1896**
Alt. 4	98	155	34	7	18	235	91	80	8	370	288	348	35	176	**1943**
Predicted Sediment Production with BMPs (Tons/Year)															
Alt. 1	37	43	11	2	4	59	20	19	3	84	63	122	8	65	**540**
Alt. 2	37	43	10	2	4	59	19	18	3	84	63	121	8	65	**536**
Alt. 3	37	42	10	1	4	57	19	19	3	83	63	119	8	65	**528**
Alt. 4	37	43	10	2	4	63	19	19	2	84	63	121	8	65	**541**
Percent Sediment Reduction with BMPs (%)															
Alt. 1	62	72	70	77	75	75	79	78	68	77	78	65	77	63	**72.6**
Alt. 2	62	72	70	77	78	73	79	78	68	77	78	65	77	63	**72.6**
Alt. 3	62	72	70	77	78	73	79	78	68	77	78	65	75	63	**72.5**
Alt. 4	62	72	70	77	78	73	79	76	71	77	78	65	77	63	**72.7**

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.

TABLE 4.8-20. EXISTING ROAD MILES AND ROAD DENSITY, ROAD MILES AND ROAD DENSITY WITHIN 300 FEET OF STREAMS, AND STREAM CROSSINGS IN THE HCP PROJECT AREA, COMPARED TO THE ESTIMATED INCREASES IN THESE PARAMETERS AT THE END OF THE 50-YEAR PERMIT TERM, BY ALTERNATIVE AND AQUATIC ANALYSIS UNIT

Alternative	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	Total
Existing Miles of Road and the Net Increase by Alternative															
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**
Alt. 1	24.0	105.6	18.8	10.6	8.5	192.3	57.4	14.8	11.3	33.7	78.5	106.6	18.8	152.7	**833.7**
Alt. 2	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**
Alt. 3	21.6	95.8	14.6	8.9	7.1	162.7	46.0	13.5	10.5	29.1	76.6	98.5	14.4	147.7	**747.0**
Alt. 4	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 and the Net Increase by Alternative															
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**
Alt. 1	0.55	1.20	1.15	1.64	1.55	1.39	1.28	0.51	1.57	0.25	1.13	1.45	1.08	0.85	**0.97**
Alt. 2	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**
Alt. 3	0.50	1.08	0.89	1.37	1.29	1.18	1.02	0.47	1.46	0.21	1.10	1.34	0.83	0.82	**0.87**
Alt. 4	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 by Alternative															
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**
Alt. 1	2.1	10.0	1.6	2.0	1.1	38.5	9.0	3.3	2.7	3.2	18.3	23.4	1.2	26.0	**142.2**
Alt. 2	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**
Alt. 3	1.3	7.0	0.2	1.6	0.7	28.6	5.1	1.0	2.4	0.5	8.3	20.7	-0.4	24.4	**101.4**
Alt. 4	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 within 300 Feet of Streams and the Net Increase by Alternative															
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**
Alt. 1	0.05	0.11	0.10	0.31	0.19	0.28	0.20	0.11	0.37	0.02	0.26	0.32	0.07	0.14	**0.17**
Alt. 2	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**
Alt. 3	0.03	0.08	0.01	0.25	0.13	0.21	0.11	0.03	0.33	0.00	0.12	0.28	-0.02	0.14	**0.12**
Alt. 4	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 by Alternative															
Existing	204	323	78	7	5	423	180	60	11	303	169	177	99	219	**2,258**
Alt. 1	8	41	7	6	3	120	31	9	7	13	51	71	6	80	**453**
Alt. 2	8	39	6	5	2	113	28	5	7	11	42	69	4	78	**417**
Alt. 3	6	33	3	4	2	92	19	9	7	12	50	63	0	77	**377**
Alt. 4	8	39	6	5	2	113	28	5	7	11	42	69	4	78	**417**

Source: DNRC (2008a).

Road Surface Sediment Production at Road-Stream Crossings

In addition to the long-term delivery of sediment to planning area streams from road runoff, the DNRC road inventory indicates there is also a 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. 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 (see 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 2007e). 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. Analysis of the results indicate 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 2007e). 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 to catastrophic failure.

Road Surface Sediment Delivery

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 (FEMAT 1993). Buffer widths tend to be problematic for legacy roads, which were typically constructed adjacent to streams with numerous stream crossings. Current road construction practices regulate road location and design to minimize such impacts to streams and this practice would continue under any of the alternatives. For roads with inadequate available buffer area, DNRC can typically 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. Empirical studies indicate that correctly applied slash filter windrows can provide significant (75 to 85 percent) sediment filtration effectiveness, which is similar to the estimated filtration provided by buffers between 100 and 300 feet (Table 4.8-21) (Burroughs and King 1989).

TABLE 4.8-21. ESTIMATES OF AVERAGE PERCENT SEDIMENT REDUCTION FROM THE FILTRATION CAPABILITIES OF DIFFERENT SIZE BUFFERS FOR THREE ROAD GRADES

	Road Grade		
Filtration Buffer Width	**5 Percent**	**10 Percent**	**15 Percent**
300 feet	85.0 - 87.9%	88.6 - 93.1%	91.3 – 95.1%
100 Feet	73.5 – 79.1%	77.9 – 86.3%	82.2 – 89.9%
50 feet	61.4 – 66.1%	64.3 – 75.5%	70.0 – 80.9%
5 Feet	17.6 – 17.7%	18.0 – 23.7%	21.2 – 35.7%

Source: DNRC (2008h).

Grazing

The potential effects of grazing on sediment delivery to area streams can occur through the loss of riparian vegetation, physical damage to stream banks, changes to channel stability and channel morphological characteristics, and reductions in the diversity and health of riparian plant communities. Approximately 163 of the 391 parcels (42 percent) of classified forest trust land in the HCP project area that currently have grazing licenses, have stream segments known to support at least one of the HCP fish species (Table 4.8-5). 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 (Table 4.8-6).

The number of grazing parcels in the HCP project area varies substantially by EIS aquatic analysis unit. As a result, the potential benefits to HCP fish species would tend to vary in a similar manner. For example, about 30 percent of the total grazing license parcels in the HCP project area occur in the Middle Clark Fork analysis unit, as does 34 percent of the parcels containing any HCP fish species. In addition, the Blackfoot analysis unit 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, improvements in grazing parcel management would likely provide the greatest benefits to the HCP fish species in the Middle Clark Fork and Blackfoot EIS aquatic analysis units.

The primary differences between the alternatives regarding the effects of grazing activities, is the implementation of informal or formal training for DNRC staff on grazing license administration and the frequency of monitoring for grazing effects.

Timber Harvest Site Preparation and Slash Treatment

The potential effects of timber harvest activities on sediment delivery to streams occur primarily through soil disturbance and subsequent erosion, although this mechanism delivers relatively small amounts of sediment as compared to the construction and operation of forest roads. In addition, tThe existing SMZ Law and rules, ARMs, Montana Forestry BMPs, and DNRC forest management policies ~~are generally effective at minimizing the soil disturbance activities (DNRC 2005b)~~all provide for the use of appropriate BMPs to minimize or eliminate sediment delivery to streams. Existing timber harvest BMPs have been shown to be effective in reducing or eliminating sediment delivery to streams (Sheridan et al. 1999; Appelbloom et al. 2001; DNRC 2004c, 2005b). ~~In~~

~~addition~~Furthermore, existing harvest methods and procedures minimize soil disturbance, and existing riparian buffers provide adequate filtration of sediments.

Gravel Pits

The construction of forest management roads sometimes requires a source of road bed material in the vicinity. As a result, gravel pits and borrow sites are developed at various locations to supply this material. The exposed surface area of these pits could result in excessive sediment delivery to area streams if appropriate BMPs are not implemented. In general, most gravel operations associated with DNRC forest management road construction are relatively small borrow sites where native materials are excavated and used as fill or surfacing material without further processing, although some sites operate as sorting facilities where material such as pit run and gravel are processed and stockpiled.

Borrow sites are generally associated with road cuts and involve less than 0.1 acre of additional disturbance. While borrow sites may expand the effects of roadway development and disturb a greater area than a normal road segment, the effects are usually localized and adequately addressed with current BMP standards, as well as the existing SMZ Law and Forest Management ARMs.

There are currently 10 gravel operations on the Stillwater Unit with DEQ opencut mining permits, including two active and two undeveloped sites, and a number of inactive or reclaimed sites (DNRC 2007d). There are also two active operations on the Swan Unit. One is used both for pit run and gravel processing, with ongoing operations limited to 1 acre at any one time. The other pit is leased by the U.S. Department of Transportation (DOT) with some limited DNRC use. A third operation in the Swan Unit has been exhausted and reclaimed. However, some material has been stockpiled there that is periodically used by DNRC for its forest management road system. The Swan is also in the early reconnaissance stages of locating another future large gravel operation on the west side of Highway 83. There is also one small third-party pit within the Plains Unit, and a small inactive pit near Lynch Creek. The Libby Unit has about six small pits under permit to third parties, one of which is occasionally used by DNRC for small operations of up to 10 loads.

There are currently no large gravel operations on the SWLO that are used exclusively by DNRC, as recent trends involve ordering gravel and rock from private sources for delivery to the DNRC project sites. There are also no active gravel pits on HCP project area scattered parcels within the CLO. Borrow sites are used for culvert installations or road maintenance. The primary sources of gravel are located in the valley on non-HCP parcels. If a timber sale is proposed on an HCP project area parcel, a gravel pit may be developed near the project if suitable material is available, or it may be hauled from a pit in the valley that is located on a non-HCP parcel.

Alternative 1 (No Action)

Forest road conditions and sediment delivery problems will improve over time under Alternative 1, primarily through the implementation of current road management practices and application of sediment BMPs on new roads and gradually abandoning or upgrading existing roads. These measures already provide a large degree of conservation to HCP fish species and provide an effective means for minimizing sediment delivery to streams. However, improvements to existing roads would only occur as these roads are needed to achieve timber harvest objectives. As such, there would be no particular prioritization based on the extent or degree of problem areas related to sediment delivery rates to streams. As a result, the road conditions and sediment delivery problems would vary among watersheds, and thereby inconsistently influence fish populations within these watersheds.

While new road construction projects would use current design specifications and incorporate appropriate BMPs, they would still likely result in some additional deterioration of stream habitat, and improving existing roads would not necessarily result in correcting the most problematic roads, or the ones affecting fish-bearing streams. Therefore, overall conditions in the HCP project area are expected to remain similar to existing conditions or degrade slightly, until a substantial number of existing problem roads are eventually upgraded to current standards. This would result in some road surfaces continuing to drain directly to fish-bearing streams, including those supporting HCP fish species. As such, it is unclear how the expected changes in sediment delivery would affect fish and other aquatic species.

At the end of the 50-year Permit term, Alternative 1 would result in a net increase in road miles, ranging from 8.5 miles in the Lower Kootenai aquatic analysis unit, to about 192 miles in the Middle Clark Fork unit (Table 4.8-20). Overall, Alternative 1 would result in the largest net increase in the road system (about 834 miles) of any of the alternatives. This equates to a 32 percent increase in road miles within the project area after 50 years, with about a 20 percent increase (142 miles) in the road miles occurring within 300 feet of streams. The number of road-stream crossings would also increase by about 20 percent to 453 crossings. The estimated road densities at 50 years would also vary by aquatic analysis unit, ranging between 0.25 and 1.64 mi/mi^2.

The varying stipulations for buffer widths provided under the four alternatives would result in different sediment reduction potential (Table 4.8-19) (DNRC 2008h). Under Alternative 1, timber harvest is allowed in the SMZ buffer (50 to 100 feet wide) of 50 percent of trees greater than or equal to 8 inches dbh or 10 trees per 100-foot segment, whichever is greater. Along with the retained trees, shrubs, and sub-merchantable trees, there is also limited restriction to harvest directly adjacent to streams, but no requirement for a no-harvest buffer. Based on the ability of even a relatively narrow riparian buffer to effectively intercept and infiltrate water and sediment, and the removal of stream-side legacy roads over time under Alternative 1, there would be an overall reduction in sediment delivery by the end of the Permit term as compared to existing conditions, as well as a relatively steady rate of improvement over time (Table 4.8-19). Overall habitat conditions for fish, including HCP fish species, are expected to be maintained or slightly improved.

Alternative 1 would implement grazing management standards and numeric criteria established in the SFLMP to determine initial stocking rates and acceptable levels of riparian use and streambank impacts. DNRC would also evaluate grazing licenses midterm between license renewal inspections. Thus, Alternative 1 is not expected to present an increased risk of adverse effects if existing grazing management activities continue through the Permit term. Similarly, because existing timber harvest site preparation and slash treatment procedures are generally effective at minimizing in-stream sedimentation effects from these activities (DNRC 2004e), no substantial adverse effects to fish habitat or aquatic species are expected in either the short or long term.

In addition, all gravel pits and borrow sites would be operated according to existing rules and regulations, with no specific restrictions on the number of active sites. Therefore, no increased risk of sediment delivery should occur over time from Alternative 1 compared to existing conditions.

In summary, Alternative 1 would continue existing DNRC policies and procedures in regard to existing and new roads, riparian buffers, grazing practices, timber harvest site preparation and slash treatment, and gravel pits, which all can affect sediment production and in-stream delivery to various levels. Compared to current conditions, however, Alternative 1 would not result in substantial changes or increases in the potential to adversely affect fish habitat or fish species. In addition, some of these policies and procedures (i.e., relocation of stream-side legacy roads and placement of new roads away from streams) would result in less overall sediment delivery, so fish habitat functions affected by sedimentation would be expected to improve somewhat over the long term.

Alternative 2 (Proposed HCP)

The 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. As discussed above, the primary source of sediment delivery on forested trust lands is believed to be forest roads. Therefore, the HCP conservation strategy focuses on road management to benefit the HCP fish species and other aquatic resources. This includes inventorying all roads on forested trust land parcels in westslope cutthroat trout and Columbia redband trout watersheds within 20 years of HCP implementation, and all roads in watershed supporting bull trout within the first 10 years (commitment AQ-SD2). The comprehensive inventories would allow DNRC to minimize the number of open roads, ensure existing and new roads meet current standards, and prescribe that these roads incorporate site-specific BMPs and mitigation measures designed to minimize sediment production and delivery.

Alternative 2 would be similar to Alternative 1 for the construction of all new roads, as they would be constructed using current design practices, specifications, and BMPs to design efficient and environmentally sound forest roads (commitment AQ-SD3). The overall reductions in sediment delivery would be the same as those estimated under Alternative 1 by the end of the 50-year Permit term (Table 4.8-19). However, Alternative 2 would generally provide greater benefits to fish and aquatic habitat than Alternative 1 because of mandated rates of road inventory and corrective actions, and because fewer net miles of road would be added within the HCP project area. In addition, HCP aquatic species would benefit not only from a faster rate of problem identification and correction, but problem roads would be corrected based on a priority list, such that the roads having the greatest effects on streams occupied by HCP fish species would be corrected first (commitment AQ-SD2). Under this commitment, all high-risk sites in bull trout watersheds would be corrected within the first 15 years and within 25 years for westslope cutthroat trout and Columbia redband trout watersheds. This would result in the most substantial problem areas, and specifically those affecting HCP fish species, being corrected substantially earlier than expected under Alternative 1.

In addition to correcting problem roads sooner than Alternative 1, Alternative 2 would incorporate the inventory information to identify HCP fish species streams, which would facilitate the implementation of additional avoidance, minimization, and protection measures in the vicinity of these streams (i.e., reducing stream crossings, minimizing road construction, and maximizing buffer capacities). As a result, Alternative 2 is expected to reduce the overall sediment delivered to HCP fish species streams, over the course of the Permit term, as compared to Alternative 1.

The HCP process also ensures adequate review of proposed timber harvests by DNRC water resource specialists to minimize the potential delivery of sediments to streams, particularly those that support HCP fish species (commitment AQ-SD4). This includes (1) identifying site-specific harvest techniques in areas potentially affecting HCP fish species habitat; (2) designing and implementing site-specific road standards, contract specifications, BMPs, and other mitigation measures; and (3) providing adequate adaptive management feedback through implementation and effectiveness monitoring. Monitoring activities include quantitative assessments of the effectiveness of BMPs and other mitigation measures, BMP audits, and contract administration inspections.

The riparian harvest requirements for Alternative 2 require a 50-foot no-harvest buffer around Class 1 streams and the potential for expanding the 50 percent tree retention buffer to include the floodprone riparian area to accommodate stream channel migration (commitment AQ-RM1). Because the riparian buffer would be wider and denser than under Alternative 1, Alternative 2 is expected to reduce sediment delivery to streams, particularly Class 1 streams, including those that contain HCP fish species (FEMAT 1993) (Table 4.8-21). The riparian harvest strategy would also benefit HCP fish species and other aquatic species through harvest restrictions for CMZs, extended RMZs, and a restriction on the total riparian area in non-stocked or seedling/sapling structural stages. The protection for Class 2 and 3 streams would be similar to those for Alternative 1.

Alternative 2 includes ~~several~~ allowances ~~for salvage harvest of disease- or insect-infested trees from within the 25-foot no-harvest buffer on Tier 1 streams, and for salvage harvest of fire-killed trees to exceed the normal 50 percent retention requirement in that portion of a Tier 1 RMZ outside the 25-foot no-harvest buffer~~to no-harvest buffers and the 50 percent tree retention requirement for Class 1 streams (including salvage harvest for insects and disease, fire salvage, and harvests designed to emulate natural disturbance and to initiate early seral forest). ~~Alternative 2 also allows for the management of a portion of the total Tier 1 RMZ acreage using harvest prescriptions designed to meet the minimum retention tree requirement of the SMZ Law.~~ However, all allowances are limited to a maximum of 20 percent of the DNRC Class 1 RMZ acres for any given aquatic analysis unit. This limit includes stands harvested under allowances, as well as stands subject to natural disturbances that reduce RMZ -to non-stocked, seedling/sapling stands, or low-stocked poletimber size class and sawtimber size class stands (using standard DNRC SLI procedures). The allowance for cable yarding is subject to a separate limitation and is not expected to contribute substantially to the 20 percent allowance for RMZ harvest.

~~These allowances are limited in extent and scope and are not expected to have substantial effect on sediment delivery in HCP project area streams. For example, salvage allowances would be limited to harvest affecting less than 20 acres of RMZ, and the portion of RMZ managed down to the requirement of the SMZ Law would not exceed 15 percent of total Tier 1 RMZ area within each DNRC administrative unit.~~

The limited amount of RMZ area managed under these allowances would still be subject to the requirements of the SMZ Law~~; therefore, it is expected to have effects similar to those described under Alternative 1~~, including the minimum tree retention requirements.~~ In addition, salvage~~

harvest conducted under these allowances would also be required to retain a minimum of 10 trees per 100 feet of stream within the first 25 feet of RMZ. Therefore, management of these areas is expected to have effects similar to those described under Alternative 1. Salvage hHarvests conducted under these allowances would also be required to retain all streambank trees and all downed trees lying within the stream channel (ARM 36.11.425) or embedded within the stream bank (commitment AQ-RM1). Because of the proposed limits on the allowances, they are not expected to have substantial effects on sediment delivery in HCP project area streams.

DNRC would design and implement site-specific BMPs and other mitigation measures to reduce the risk of sediment delivery from all gravel pits to streams affecting HCP fish species (commitment AQ-SD5). A DNRC water resource specialist would make recommendations that would be integrated into the development of contract specifications, permits, and Plans of Operations (as required under ARM 17.24.217).

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 (commitment AQ-GR1). In addition to the grazing management rules and regulations, Alternative 2 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, Alternative 2 is expected to provide a more comprehensive and coordinated approach to minimizing grazing effects on fish habitat and species, compared to Alternative 1.

In summary, Alternative 2 would improve on existing DNRC policies and procedures through HCP conservation strategies that specifically apply to existing and new roads, riparian buffers, grazing practices, timber harvest, site preparation and slash treatment, and gravel pits, which all can affect sediment production and in-stream delivery to various levels. As compared to Alternative 1, the proposed HCP is expected to result in moderate to substantial short-term and long-term improvements in the sediment aquatic habitat component, which in turn would benefit all fish species. In addition, because of the tiered approach based on the sediment problem inventory and correction process established in the HCP sediment conservation strategy, aquatic habitat utilized by HCP fish species would likely benefit the most, although other aquatic species occupying these areas would also benefit from reduced sediment delivery to the area streams.

Alternative 3 (Increased Conservation HCP)

In general, Alternative 3 includes the same sediment reduction conservation commitments as Alternative 2, but would implement the commitments more quickly than Alternative 2. This includes completing the existing road inventory about twice as fast as Alternative 2 (5 years for bull trout watersheds and 10 years for the other HCP fish species watersheds). The corresponding corrective actions would be implemented at least 25 percent quicker than Alternative 2, including within 10 years for bull trout watersheds and 20 years for westslope cutthroat trout and Columbia redband watersheds. Specifically, because BMPs would be applied to existing problem road areas, large decreases in the amount of road-based sediment production and delivery would occur over relatively short time periods (Table 4.8-19). Additionally, Alternative 3 would provide greater benefit to fish and aquatic habitat than Alternatives 1 and 2, because fewer net miles of road would be added within the HCP project area (Table 4.8-20).

The sediment delivery rates resulting from Alternative 3 would be similar for all the alternatives. However, the faster implementation of problem road corrections would result in greater overall reductions in cumulative sediment delivery over the course of the Permit term than either Alternative 1 or Alternative 2. Because Alternative 3 would also prioritize problem roads in HCP fish species watersheds, greater reductions in overall sediment delivered to these streams would occur more quickly, relative to the other alternatives.

Alternative 3 expands the no-harvest buffer to encompass the entire RMZ, with the potential to include the entire floodprone width in some instances. Because this buffer would be substantially wider and typically denser than the other alternatives, Alternative 3 would likely reduce sediment delivery by a greater amount in streams that contain HCP fish species, providing a greater benefit to all three HCP fish species (FEMAT 1993) (Table 4.8-19). It would also benefit other aquatic species and other HCP species by incorporating riparian harvest components that include greater harvest restrictions for CMZs and a requirement of USFWS approval for any salvage harvest allowances.

Management of gravel pits and grazing activities would be similar to Alternative 2, although Alternative 3 would increase the frequency of monitoring for grazing effects from once every 5 years to annually and would include measurable targets for monitoring following implementation of corrective actions. This would result in a greater assurance that the grazing strategy was successful in minimizing sediment inputs and that grazing problem areas were promptly and successfully addressed

In summary, Alternative 3 would improve on the specific Alternative 2 conservation strategies as applied to existing and new roads, ~~riparian buffers,~~ grazing practices, timber harvest site preparation and slash treatment, and gravel pits, which all can affect sediment production and in-stream delivery to various levels. While Alternative 3 would require a wider no-harvest buffer on HCP fish-bearing streams, Alternative 2 would apply a 50-foot no harvest buffer over a larger portion of the HCP project area (all Class 1 streams and lakes). For some habitat elements, such as LWD recruitment and stream temperature regulation, these two alternatives may achieve similar landscape-level results using slightly different no-harvest buffer configurations, although site-specific conditions may vary. As compared to both Alternatives 1 and 2, Alternative 3 would result in moderate to substantial short-term and long-term improvement in the sediment aquatic habitat component, which in turn would benefit all fish species. In addition, because of the tiered approach of the sediment problem inventory and corrective actions, aquatic habitat utilized by HCP fish species would likely benefit the most, although other fish species also occupy these areas as well.

Alternative 4 (Increased Management Flexibility HCP)

Alternative 4 includes the same conservation commitments as Alternative 2, but would generally implement the commitments more slowly. This includes completing the existing road inventory about 25 percent more slowly than Alternative 2 (15 years for bull trout watersheds and 25 years for the other HCP fish species watersheds). The corresponding corrective actions would be implemented on a project-by-project basis, similar to Alternative 1. Management of gravel pit and grazing activities would be similar to Alternative 2. Based on these factors, Alternative 4 would likely result in a greater short- and long-term improvement in the sediment aquatic habitat component than Alternative 1, but less improvement than Alternatives 2 and 3.

Alternative 4 provides a 25-foot no-harvest buffer around Class 1 streams and lakes supporting HCP fish species, although the 50 percent tree retention provision would only extend for an additional 25 feet. Because of the relative buffer width and density, it would result in a greater improvement in sediment filtration than Alternative 1, but less improvement than Alternatives 2 and 3. Alternative 4 also includes the same ~~salvage~~ harvest allowances that are included in Alternative 2. These allowances are not expected to substantially affect levels of sediment delivery to streams.

In summary, Alternative 4 has similar strategies addressing sediment production and delivery as Alternative 2, although the specific commitments are somewhat less robust and allow implementation to extend for a somewhat longer timeframe. Overall, Alternative 4 would have a positive effect on the sediment habitat component, which would benefit fish and other aquatic species. This improvement would be greater than Alternative 1, but less than Alternatives 2 and 3.

Summary of Sediment Impacts

Based on differences in the commitments for road inventory and problem resolution, the density and width of riparian buffers, and the monitoring and adaptive management strategies for grazing, Alternative 3 would provide the greatest potential benefit to fish habitat and aquatic species, particularly in the short term. The potential benefits would decrease sequentially for Alternatives 2, 4, and 1, respectively. However, even under Alternative 1, the baseline condition for sediment would be expected to improve in the long-term (Table 4.8-19), although the rate of improvement would be slower than for the other alternatives in the short term. In addition, any risk of adverse effects from Alternative 1 would apply equally to all fish species, including HCP aquatic species, while the risk for HCP fish species from the other alternatives is reduced because the conservation commitments for Alternatives 2 through 4 focus inventory and corrective actions on watersheds that contain the HCP fish species. However, the difference between alternatives would diminish over time, and by the end of the Permit term, the habitat component of sediment production and delivery under Alternative 1 would be relatively equivalent to all other alternatives. Despite this expected equivalency at the end of Permit term, the action alternatives would reduce sediment production and delivery rates sooner than Alternative 1, resulting in greater cumulative benefits during the entire Permit term.

<u>Habitat Complexity</u>

Habitat complexity is influenced by a variety of factors related to timber harvest and forest management activities. In this instance, the term specifically refers to aquatic habitat, although upland factors also have a direct and indirect influence on the aquatic environment. In addition to sediment loading (described above), the other primary influencing factors are LWD recruitment, canopy cover (shading), streambank stability, channel form and function, and flow regimes.

Reducing LWD input to a stream by harvesting potential streamside recruitment material, may affect fish habitat by causing or contributing to channel instability, reducing in-stream habitat complexity, and influencing channel form and function. The potential recruitment of LWD to stream channels from adjacent forest stands is generally limited to an area located within a width less than or equal to the 100-year site index tree height as measured from the edge of the stream channel. As a consequence, rates of LWD recruitment typically vary considerably between localities and physiographic regions. Within each physiographic region, in-stream LWD counts can be compared to broad descriptions of channel characteristics, including bankfull width, gradient, and Rosgen channel type.

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). The RAIS (v3) model (Welty et al. 2002) was used to model shade conditions in the HCP project area. The RAIS model was used because it runs the forest growth simulator independent of the wood recruitment and shade models, allowing the use of any suitable growth model. Also, the model predicts both shade production and LWD recruitment and has a built-in three-dimensional visualization feature. In addition, the RAIS model was previously used by Plum Creek and Washington Department of Natural Resources to model LWD recruitment in their HCPs.

Model input consisted of Forest Vegetation Simulator (FVS) tree lists for five representative stand types (Beaver, Dingley, Gird, South Lost, and Swede Creeks) projected for the four alternatives. See Section 4.8.2.2 (Habitat Complexity) for physical descriptions of the representative stand types. ~~(Figures 4.8-6 through 4.8-10).~~Figures 4.8-6 through 4.8-10 show the conditions of these five representative stands at year 30 following the prescribed RMZ harvest for the corresponding alternatives. The LWD recruitment and shade simulations used these data to analyze all combinations of stand types and alternatives (5x4 analyses) over three Rosgen stream channel types that are representative of stream channels occurring in the planning area. Each simulation was run over a period of 100 years (Figures 4.8-11 through 4.8-13).

For the purpose of RAIS modeling, model inputs for the physical characteristics (stream width, slope, etc.) of streams within the 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 within the planning area, representing about 55 percent of stream channels on 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 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 between the four alternatives, as well as relative to a target recruitment level. These LWD targets were developed by analyzing reference LWD frequencies in unmanaged stands located on USFS land, stratified by Rosgen stream class and physiographic region. 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.

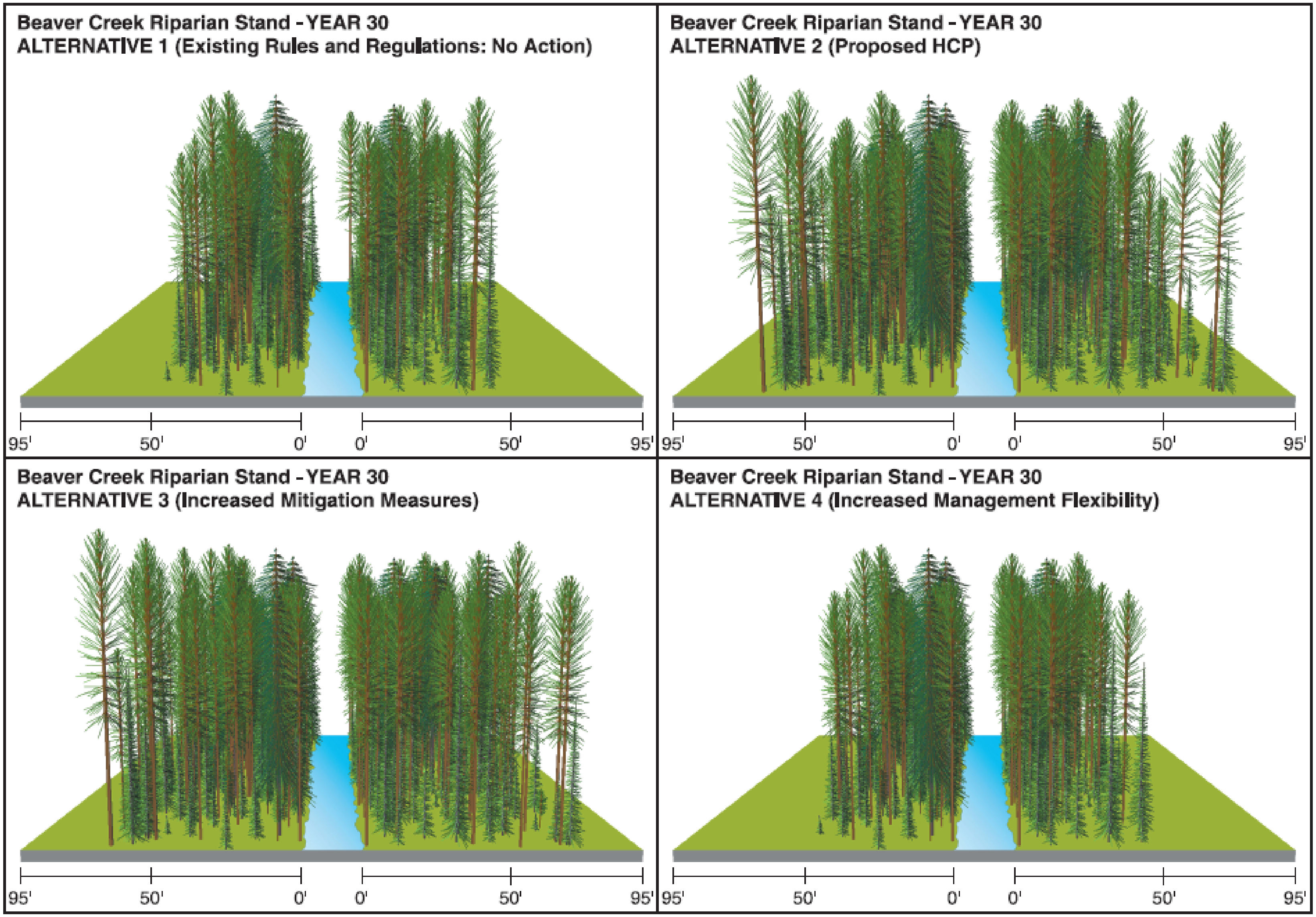


FIGURE 4.8-6. STAND VISUALIZATIONS OF RIPARIAN AREAS AT YEAR 30 UNDER ALL ALTERNATIVES FOR THE BEAVER CREEK STAND TYPE[PL1]

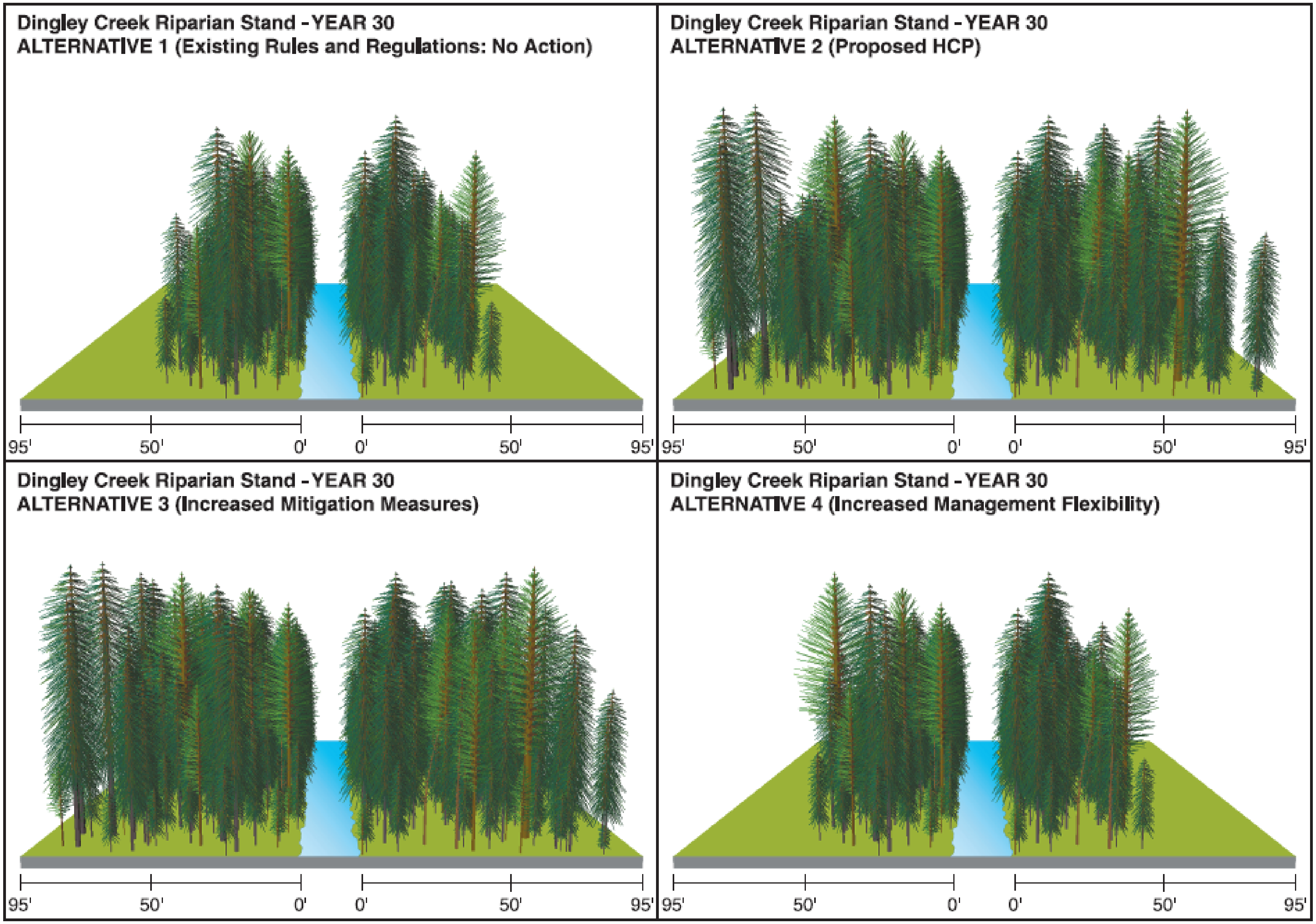


FIGURE 4.8-7. STAND VISUALIZATIONS OF RIPARIAN AREAS AT YEAR 30 UNDER ALL ALTERNATIVES FOR THE DINGLEY CREEK STAND TYPE

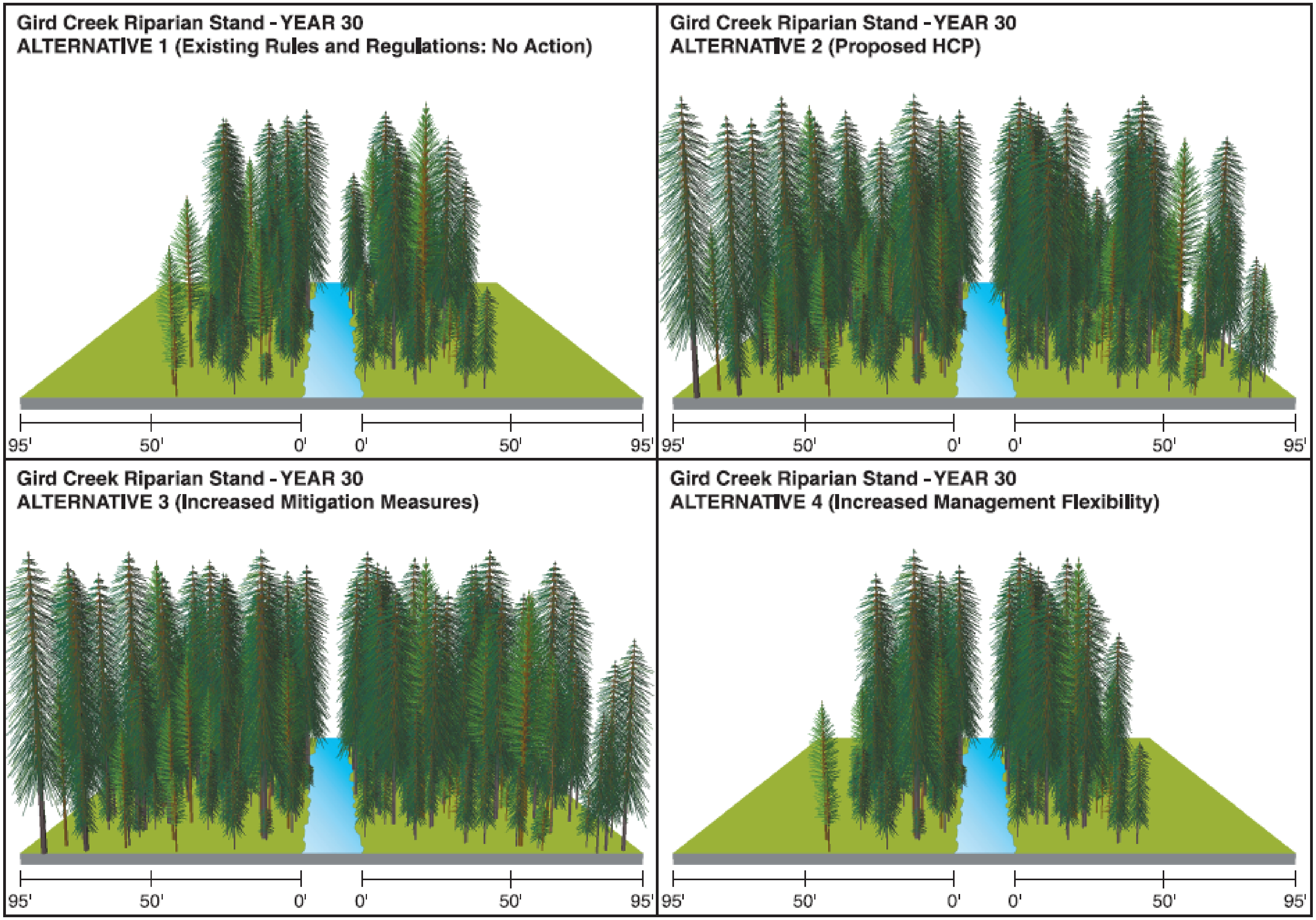


FIGURE 4.8-8. STAND VISUALIZATIONS OF RIPARIAN AREAS AT YEAR 30 UNDER ALL ALTERNATIVES FOR THE GIRD CREEK STAND TYPE

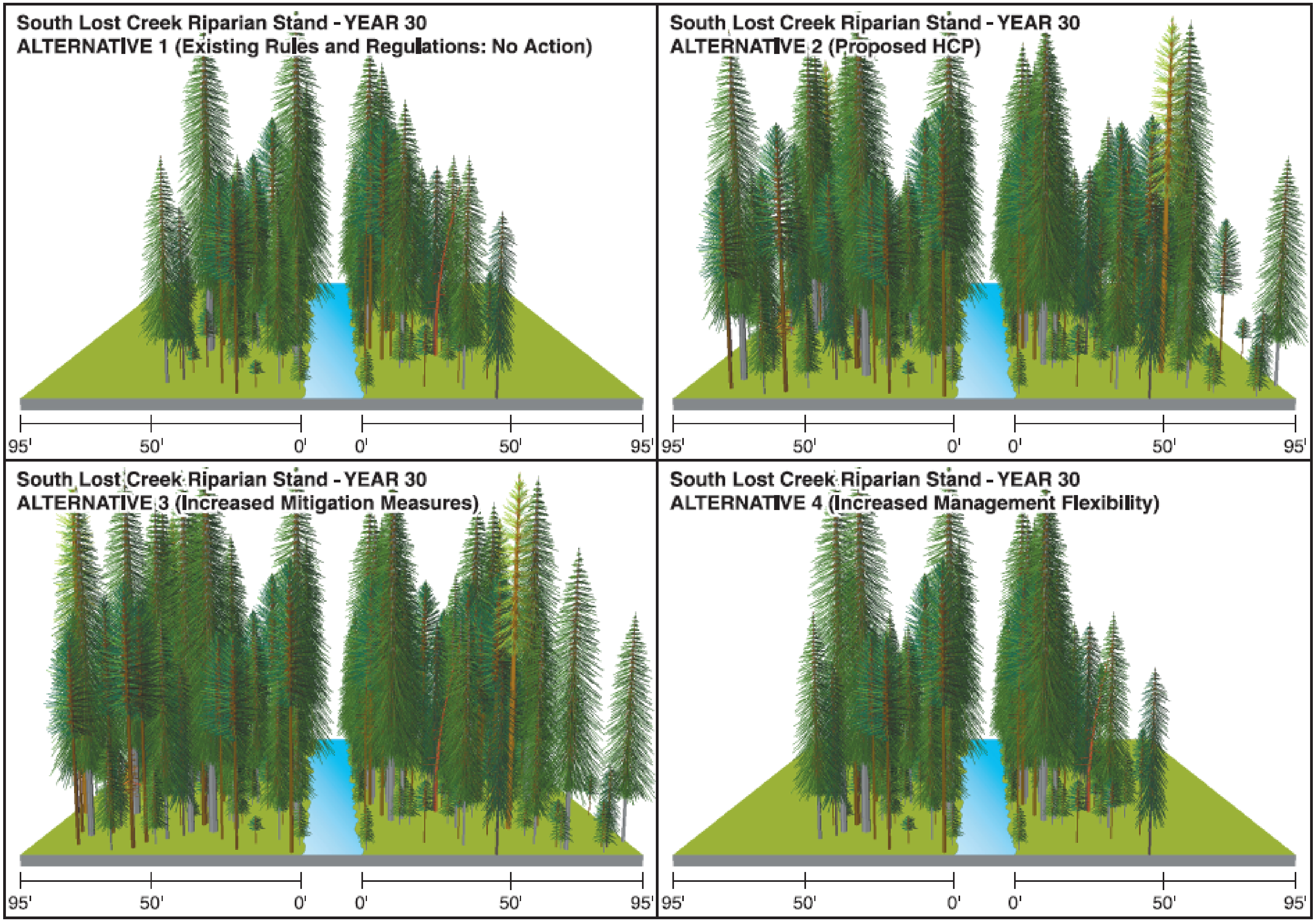


FIGURE 4.8-9. STAND VISUALIZATIONS OF RIPARIAN AREAS AT YEAR 30 UNDER ALL ALTERNATIVES FOR THE SOUTH LOST CREEK STAND TYPE

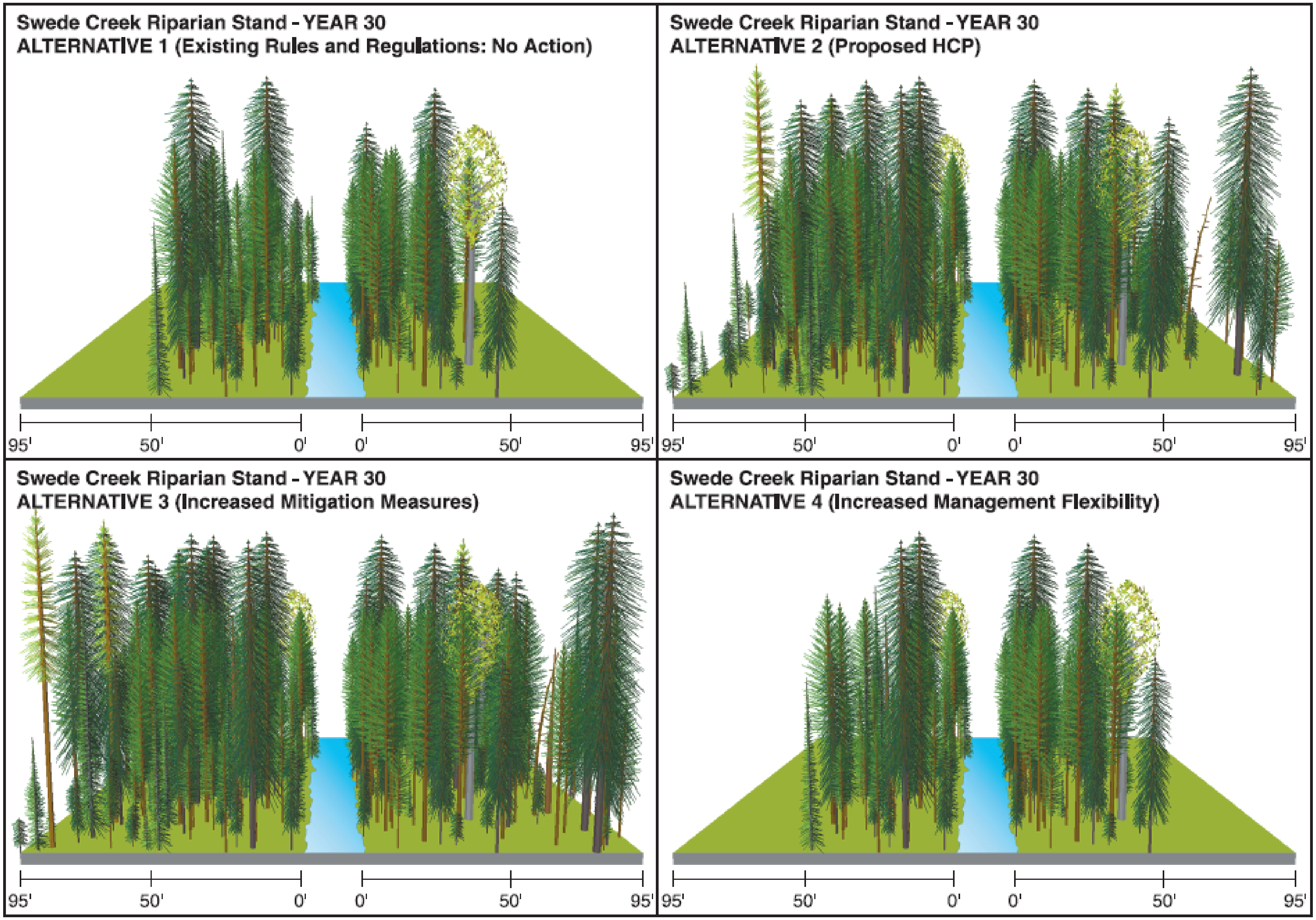


FIGURE 4.8-10. STAND VISUALIZATIONS OF RIPARIAN AREAS AT YEAR 30 UNDER ALL ALTERNATIVES FOR THE SWEDE CREEK STAND TYPE

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 (see 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).

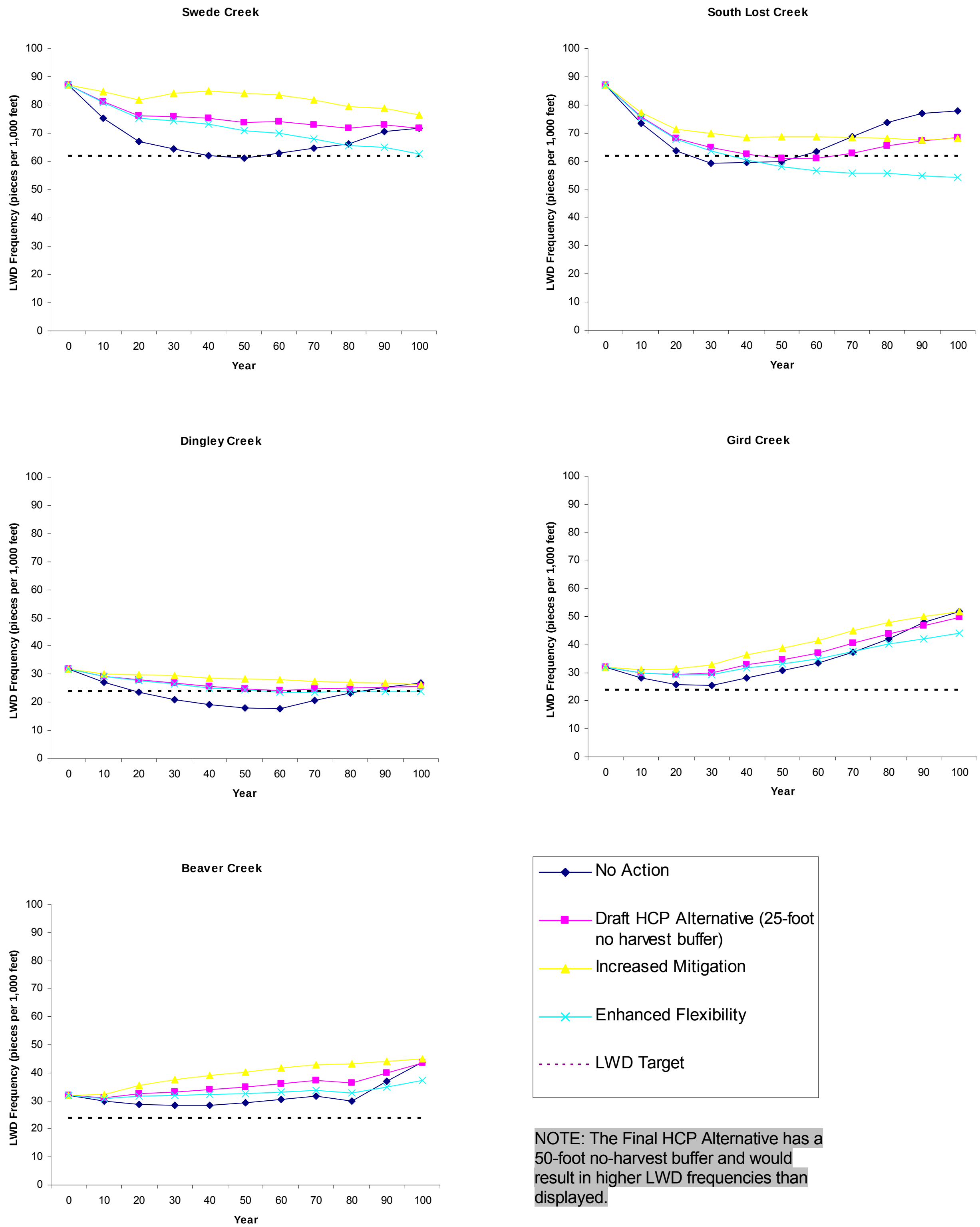
The RAIS model simulates tree mortality and subsequent windthrow, but does not include recruitment resulting from streambank erosion, mass wasting, floods, or fire. The FVS was used to predict stand characteristics, and tree lists generated for each 10-year step were used to provide estimates of tree fall from mortality. 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.

Alternative 1 (No Action)

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 LWD recruitment to fish-bearing streams. Adequate LWD recruitment levels are defined under the ARMs as those that maintain channel form and function. 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.

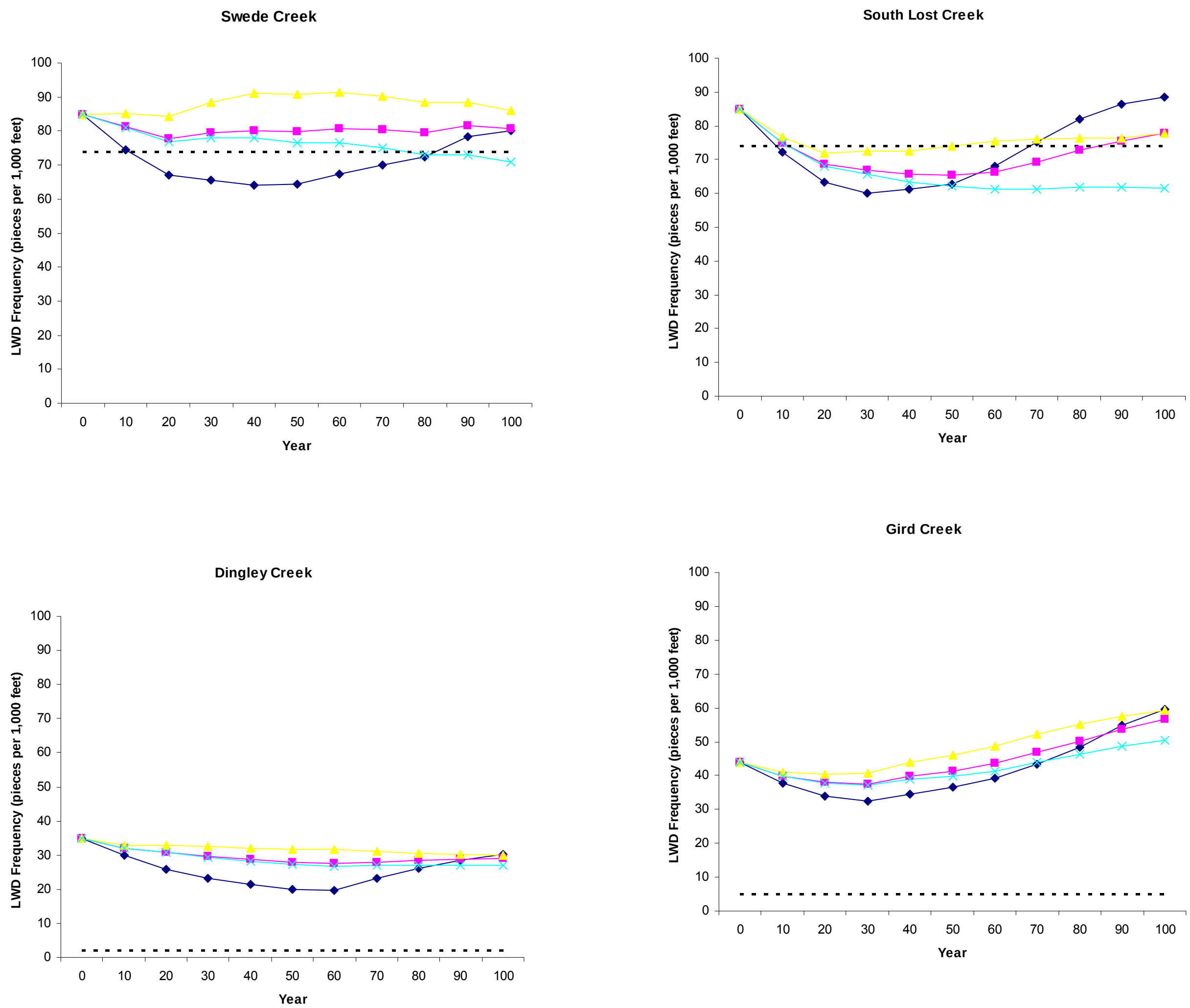
Despite the contribution to channel stability and habitat diversity, there is no specific standard pertaining to LWD recruitment under existing laws and regulations. As a result, the LWD recruitment estimates for the three modeled Rosgen stream channel types indicate that Alternative 1 typically results in relatively low LWD recruitment levels throughout a substantial portion of the 100-year period modeled for the five stand types representing the various physiographic regions within the planning area (Figures 4.8-11 through 4.8-13). Under Alternative 1, in-stream LWD levels decrease for all stand types during the early portion of the modeled period, although LWD recruitment potential generally increases during the later portion of the modeled period (typically after 25 to 50 years). This decrease is due to the removal of up to 50 percent of trees within the SMZ, including trees directly adjacent to the stream channel. The majority of recruited LWD occurs within this zone. Also, under Alternative 1, relatively intense harvest can occur in the RMZ portion of the riparian area (from the edge of the SMZ [50 to 100 feet from stream edge] out to the 100-year site index tree height), which can also serve to recruit LWD.

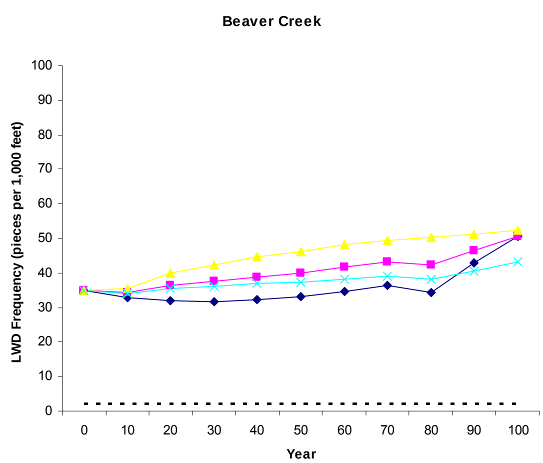
Despite having initially decreasing LWD levels, Alternative 1 typically exceeds the identified LWD target levels for most of the scenarios modeled (Figures 4.8-11 through 4.8-13). The only exceptions were the A and B stream channel types under the Swede Creek and South Lost Creek stand type scenarios, and A and C channel types under the Dingley Creek stand type scenario. However, both of these scenarios indicate LWD levels exceeding the target levels after about 50 to 70 years. Furthermore, trends show an increasing or stable in-stream LWD level by the end of the 100-year modeling period for all modeled scenarios. This is likely due to increased tree growth in the SMZ and RMZ due to increases in open canopy from the greater riparian harvest expected under Alternative 1.

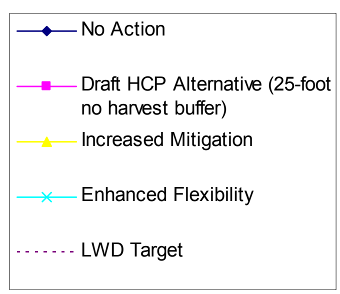


NOTE: The Final HCP Alternative has a 50-foot no-harvest buffer and would result in higher LWD frequencies than displayed.

FIGURE 4.8-11. MODELED IN-STREAM LWD FREQUENCIES (IN PIECES LWD PER 1,000 FEET) OF VARIOUS STAND TYPES IN ROSGEN CLASS A STREAMS BY DECADE

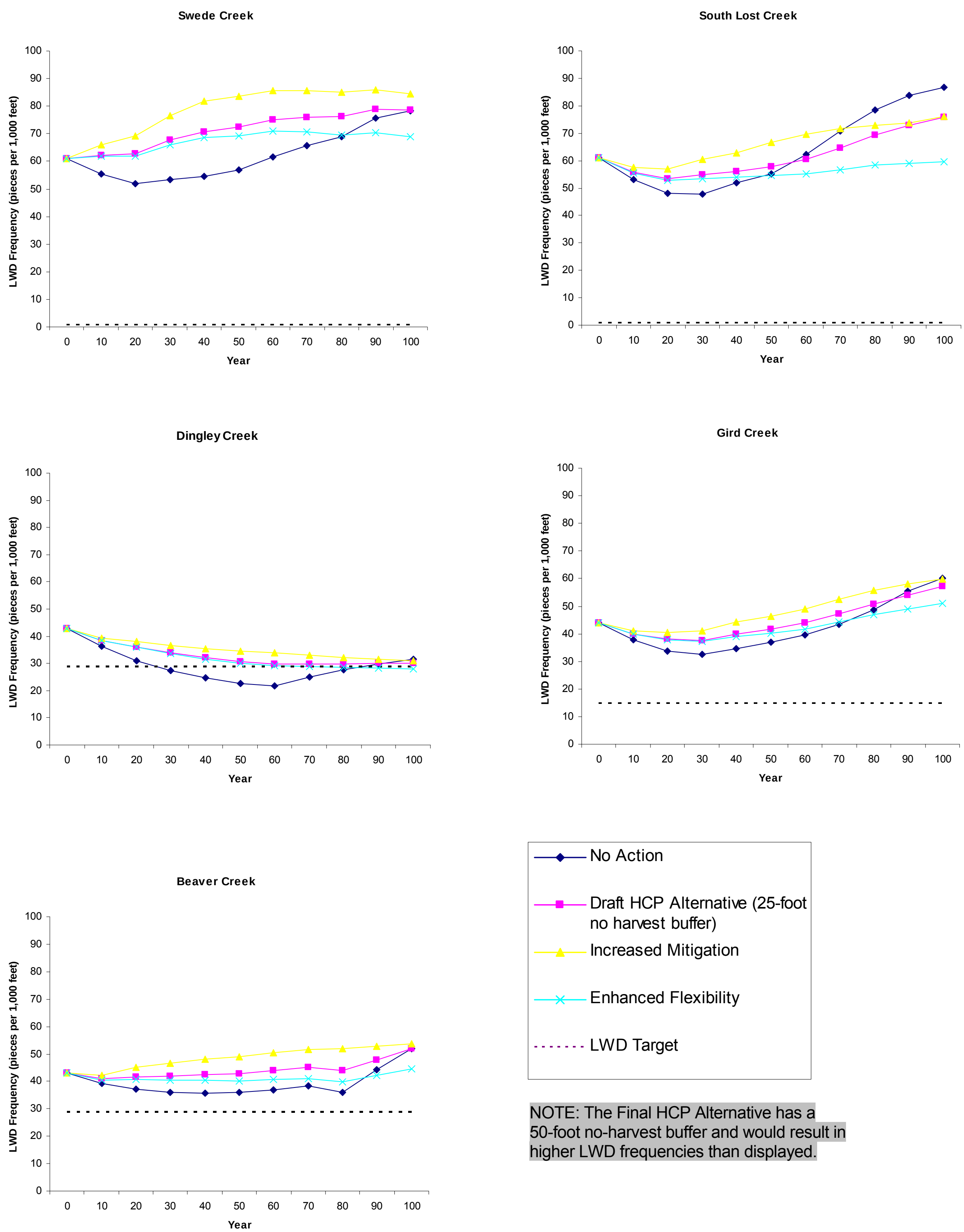






NOTE: The Final HCP Alternative has a 50-foot no-harvest buffer and would result in higher LWD frequencies than displayed.

FIGURE 4.8-12. MODELED IN-STREAM LWD FREQUENCIES (IN PIECES LWD PER 1,000 FEET) OF VARIOUS STAND TYPES IN ROSGEN CLASS B STREAMS BY DECADE



NOTE: The Final HCP Alternative has a 50-foot no-harvest buffer and would result in higher LWD frequencies than displayed.

FIGURE 4.8-13. MODELED IN-STREAM LWD FREQUENCIES (IN PIECES LWD PER 1,000 FEET) OF VARIOUS STAND TYPES IN ROSGEN CLASS D, F, AND G STREAMS BY DECADE

These data indicate that the existing laws and regulations are generally effective at maintaining adequate LWD levels within most stand and stream channel types. These 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; 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.

Maintaining adequate LWD recruitment levels is expected to support other stream channel form and function characteristics relative to fish habitat. The recruitment of wood provides complex in-stream habitat for fish by providing cover and organic material to the stream to maintain invertebrate production. Wood also adds channel roughness to reduce water velocities and allow flows to variably scour portions of the stream to form pools and undercut banks to increase the amount of available habitat for fish production.

Although Alternative 1 is expected to maintain adequate stream form and function characteristics, there would be no assurances of species conservation. This alternative provides no mechanism for adaptive management, which would allow changes in timber harvest prescriptions, without specific changes in the existing laws and regulations.

Alternative 2 (Proposed HCP)

In contrast to Alternative 1, Alternative 2 would result in generally greater LWD frequency estimates throughout most of the 100-year period modeled for Class 1 streams. LWD frequency levels would be expected to be higher than displayed in Figures 4.8-11 through 4.8-13, as this modeling effort assumed a no-harvest buffer of 25 feet in width, while the Alternative 2 no-harvest buffer would be 50-feet wide. ~~However, these~~The frequency estimates tend to be similar to Alternative 1 toward the end of the 100-year modeling period, as ~~discussed above~~the LWD frequency under Alternative 2 flattens out and meets the ascending LWD frequency line of Alternative 1. The differences in LWD frequency curves are based on the relationships between initial mature tree density following harvest (where more density equals greater short- and medium-term LWD recruitment) and tree growth rates over time as influcenced by canopy openness (where greater initial canopy openness equals increased tree growth and accelerated increases in long-term recruitment). This pattern was similar for all stream channel and stand types modeled, except for the South Lost Creek stand type (Figures 4.8-11 through 4.8-13).

Alternative 2 also has less of an initial decrease of in-stream wood, likely due 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 for Class 1 streams (commitment AQ-RM1). Alternative 2 also has harvest restrictions for CMZs, extended RMZs, and a restriction on the total riparian area in non-stocked or seedling/sapling structural stages (commitment AQ-RM1). 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 Alternative 2. The ~~estimated~~ period that these two exceptions ~~would~~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 year 30. Similar to Alternative 1, 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 (Figures 4.8-11 through 4.8-13).

Alternative 2 contains several allowances for salvage harvest of disease- or insect-infested trees from within the 25-foot no-harvest buffer on Tier 1 streams, and salvage harvest of fire-killed trees to exceed the normal 50 percent retention requirement in that portion of a Tier 1 RMZ outside the 25-foot no-harvest buffer. Alternative 2 also allows for the management of a portion of the total Tier 1 RMZ acreage using harvest prescriptions designed to meet the minimum retention tree requirement of the SMZ Law.

These allowances are limited in extent and scope and are not expected to have a substantial effect on LWD recruitment on streams within the HCP project area. For example, salvage allowances would be limited to harvest affecting less than 20 acres of RMZ, and the portion of RMZ managed down to the requirement of the SMZ Law would not exceed 15 percent of total Tier 1 RMZ area within each DNRC administrative unit.

Alternative 2 includes allowances to no-harvest buffers and the 50 percent tree retention requirement for Class 1 streams (including salvage harvest for insects and disease, fire salvage, and harvest design to emulate natural disturbance and intiate early seral forest). However, all allowances are limited to 20 percent of the DNRC Class 1 RMZ acres for any given aquatic analysis unit. This cap includes stands harvested under the allowances as well as stands subject to natural disturbances that reduce RMZ to non-stocked, seedling/sapling stands, or low-stocked, poletimber size class or sawtimber size class stands (using standard DNRC SLI procedures).

Some overstory canopy removal would also be allowed in the no-harvest buffer to provide clearance for cable yarding systems. Because the total acreage of RMZ affected by this allowance would be quite small (clearing would be limited to the minimum amount necessary to provide safe operation and no clearcutting would be allowed), the effect of this allowance on the no-harvest buffer would be minimal, and no measurable changes to aquatic habitat functions, including sediment interception and filtration, would be expected to occur.

The limited amount of RMZ area managed under these allowances would still be subject to the requirements of the SMZ Law, including the minimum tree retention requirements.; Ttherefore, it is expected to have effects similar to those described under Alternative 1. In addition, salvage harvest conducted under these allowances would also be required to retain a minimum of 10 trees per 100 feet of stream within the first 25 feet of RMZ. SalvageRMZ harvest conducted under these allowances would also be required to retain all streambank trees (ARM 36.11.425) and all downed trees lying within the stream channel or embedded within the stream bank (commitment AQ-RM1). Because of the proposed limits on these allowances, they are not expected to have a substantial effect of LWD recruitment in HCP project area streams.

As discussed above under Alternative 1, increased LWD recruitment is expected to increase in-stream fish habitat and/or improve existing habitat by increasing its complexity. In addition, since the 50-foot no-harvest buffer commitment under Alternative 2 (AQ-RM1) applies to all Class 1 streams, including non-fish bearing tributaries to fish-bearing streams, it would provide increased habitat complexity over a larger portion of the HCP project area than would Alternative 1 or the other action alternatives. The increased wood is also expected to improve the overall form and function of the stream channels, compared to existing conditions.

In addition to the increased fish conservation potential, Alternative 2 also provides an adaptive management process to measure the effectiveness of the strategy to meet meaningful LWD targets and to ensure appropriate changes in management to help to meet the conservation objectives of the proposed HCP. While the proposed HCP includes conservation commitments to maintain LWD in Class I streams, the commitments for Class 2 and 3 streams would be provided by existing regulations. Therefore, no differences are expected for LWD levels in Class 2 and 3 streams from those expected for Alternative 1. As discussed above, the existing laws and regulations are generally effective at maintaining adequate LWD levels within most stand and stream channel types. The primary aquatic functions of LWD in non-fish bearing, seasonal tributaries is to provide instream nutrients and aid in macroinvertebrate production, and the exisiting laws and regulations are expected to maintain these functions in non-fish bearing streams.

Alternative 3 (Increased Conservation HCP)

The in-stream LWD frequency estimates for Alternative 3 are generally greater throughout most of the 100-year modeling period than either Alternative 1 or 2 (Figures 4.8-11 through 4.8-13). Alternative 3 also meets the established LWD target levels for all channel and stand type combinations analyzed, with the exception of the B stream channel type under the South Lost Creek stand type scenario. As expected, the modeling results suggest that Alternative 3 would have the greatest increase in LWD frequency (or the lowest decrease in frequency) during the Permit term, as compared to Alternatives 1 and 2. In addition, the LWD frequencies for all modeled scenarios under Alternative 3 are greater at the end of the Permit term than Alternatives 1 or 2. However, as indicated above, a number of the modeled scenarios indicate similar LWD frequencies between alternatives at 100 years, with Alternative 1 at a higher LWD frequency at the end of the 100-year modeling period than Alternative 3 for some scenarios. The modeled LWD results for Alternative 3 are likely due to a wide (out to the 100-year site index tree height) no-harvest buffer, which would encourage maximum LWD recruitment in the short term, but would slow recruitment somewhat in the long term due to closed canopy conditions expected to reduce tree growth (Figures 4.8-11 through 4.8-13).

As discussed earlier, increases in LWD recruitment would be expected to improve in-stream habitat conditions, compared to either Alternative 1 or the other action alternatives in Tier 1 streams. However, no differences are expected for LWD levels in Tier 2 and 3 streams from those expected for Alternative 1. In addition, this alternative would provide the same adaptive management benefits identified above for Alternative 2.

Alternative 4 (Increased Management Flexibility HCP)

Modeled LWD estimates for Alternative 4 generally decrease over much of the modeled period. While these estimates are greater than Alternative 1, they are lower than Alternatives 2 or 3 throughout the Permit term. This alternative results in the lowest recruitment level of all the alternatives at year 100, for all modeled scenarios (Figures 4.8-11 through 4.8-13). Despite these comparatively low LWD frequencies, the LWD levels typically exceed the target levels (except for the A and B channel types under the South Lost Creek stand type).

These differences in short-term rates of in-stream wood (higher than Alternative 1, but not as high as Alternatives 2 and 3) versus those in the long term (less than Alternatives 1 through 3), are likely due to the combination of a 25-foot no-harvest buffer and relatively greater harvest in the remainder of the SMZ compared to the other action alternatives. In most cases, these riparian buffers would contribute to adequate in-stream LWD conditions, although these levels decline somewhat in years 50 to 100 due to a larger-scale removal of trees out to the 100-year site index tree height (Figures 4.8-11 through 4.8-13). In addition, this alternative does not apply the same adaptive management benefits identified above for Alternatives 2 and 3.

As discussed earlier, the differences in LWD recruitment between the alternatives would occur for Tier 1 streams. However, no differences are expected for LWD levels or recruitment in Tier 2 and 3 streams, as these functions would continue to be provided by existing regulations.

Summary

Overall, the modeling results indicate that all alternatives are generally effective at maintaining the key riparian function of in-stream LWD at a level that provides for fish conservation, including the HCP aquatic species. In most scenarios, all alternatives meet the established LWD targets based on actual data from unmanaged stands (Figures 4.8-11 through 4.8-13). However, there were differences between the alternatives for in-stream LWD frequencies over the Permit term, with Alternative 3 providing the greatest LWD levels, and sequentially decreasing for Alternatives 2, 4, and 1. These results are likely due to differences in the amount of initial riparian harvest immediately adjacent to the stream banks versus harvest extending to the 100-year site index tree height.

Most of the scenarios and alternatives analyzed for LWD frequencies indicate a generally declining trend through the first 10 to 50 years and a typically increasing or stable trend over the later part of the modeling period. This suggests that the depletion rate is exceeding the recruitment rate, and that all of the alternatives result in some reduction in the LWD loading potential due to varying harvest activities within the 100-year site index tree height. However, it should be noted that for LWD recruitment, Alternative 3 is effectively a “non-management” option because no harvest would occur within the 100-year site index tree height of ~~Tier 1~~HCP fish-bearing streams. As expected, Alternative 1 generally resulted in lower LWD frequencies during the Permit term, while Alternative 3 tended to provide the highest frequencies.

Despite generally declining LWD recruitment during the early portion of the modeling period, the results for most of the channel and stand type combinations suggest that recruitment levels would likely be similar, or even slightly greater for Alternative 1 after 100 years as compared to some of the other alternatives (Figures 4.8-11 through 4.8-13). This pattern is particularly evident for the South Lost Creek stand type, which shows a substantially higher LWD recruitment potential after about 80 years for Alternative 1 versus the other alternatives. This pattern is also consistent across all three channel types with this stand type. The relatively consistent recovery of LWD during the later years of Alternative 1 is likely the result of increased tree growth within the SMZ resulting from opening up the canopy through the thinning process, allowing additional recruitment of wood from riparian areas.

Based on the model assumptions, particularly the assumption that decadence alone produces LWD, the LWD frequency rates for all alternatives 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 for the action alternatives. This would likely result in higher LWD frequencies at some locations, at least over the Permit term.

In addition, to the differences in LWD frequency levels between the alternatives, the alternatives also differ in the extent of the HCP project area afforded the greatest extent of riparian harvest restrictions. For Alternatives 3 and 4, the modeled LWD frequency levels would apply to riparian areas immediately adjacent to streams and lakes supporting bulltrout, westslope cutthroat trout, or Columbia redband trout, while for Alternative 2 they would apply to riparians areas adjacent to all fish-bearing streams (including non-HCP fish species), as well as perennial non-fish bearing stream segments that contribute surface flow to fish-bearing streams. Based on these differences, Alternative 2 would provide increased LWD frequencies over a larger portion of the HCP project area than would either of the other action alternatives (Alternatives 3 and 4).

All of the action alternatives have some mechanisms for adaptive management, including monitoring, while Alternative 1 would not allow changes in timber harvest prescriptions, without specific changes in the existing laws and regulations. Therefore, although all of the alternatives are expected to maintain adequate stream form and function characteristics, the action alternatives would better ensure in-stream LWD levels to support native fish species. Also, because riparian buffer widths for these alternatives is greatest in situations where HCP aquatic species are present, these species would have an increased assurance of properly functioning LWD conditions.

Stream Temperature and Shading

Riparian vegetation has a direct influence on stream water temperature, particularly where the vegetation overhangs the water surface. The principal source of heat for small mountain streams is direct solar radiation striking the surface of the water (Moore et al. 2005); therefore, streamside canopy cover and shading have a primary influence on stream water temperatures. Harvesting trees near a stream may reduce the canopy cover and associated shade provided to a stream by that canopy. In addition, decreased canopy cover tends to cause lower winter stream temperatures, potentially reducing fish habitat by causing earlier, more extensive, and longer periods of ice formation.

The overall effectiveness of stream channel shading is 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. Therefore, the expected amounts of shading found within stream networks throughout western Montana are considerably variable. In addition to this variability, the effectiveness of various widths of riparian buffer in providing shade to streams is closely tied to the 100-year site index tree height.

The value of riparian buffers in mitigating stream temperatures has been recognized for several decades. Brown (1971) noted that on very small streams, adequate shade may be provided by brush species. Rishel et al. (1982) demonstrated that buffer strips help moderate stream temperatures following clearcutting in forests, and Dent and Walsh (1997) found that the 7-day maximum and average stream temperatures decreased as stream buffer width increased.

Simulation of stream shading processes was modeled using the RAIS model (Welty et al. 2002). This model predicted total shade (percent blocking solar radiation) for the same stand and stream channel types used for LWD simulation described above. As with the LWD simulations, consistent riparian zone widths improved comparability of results. However, 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 were based on DNRC watershed inventory data and stratified by Rosgen channel type classifications. 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, as discussed for the LWD recruitment modeling.

Shade targets were set based on the existing pre-harvest shade levels. 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 1.0 to 1.5^{o} C (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.

Using the pertinent literature and comparison to a no-harvest or unmanaged prescription, the data are expected to show that (1) the percent decrease in shade is relatively small under Alternative 1 (e.g., less than 15 percent[1]), and (2) this percent decrease is unlikely to adversely increase stream temperatures. The advantage of this analysis approach is that it is relatively simple and may show the harvest prescriptions are all similar in maintaining adequate levels of shade. Disadvantages include the lack of definitive and detailed information on the shade and temperature relationship.

Alternative 1 (No Action)

Under existing laws, harvest activities conducted within the combined SMZ and RMZ are not required to maintain a no-harvest buffer, but must retain all bank edge trees and retain enough other trees to ensure adequate levels of shade, which is defined as the ability to maintain natural temperature ranges. Sugden and Steiner (2003) studied 10 sites in western Montana, harvested under

[1] Washington State Timber, Fish, and Wildlife (1990) program data indicates that in medium-elevation stands (300 to 700 meters) a 15 percent reduction in shade, on average, will result in a 1.0 to 1.5^{o} C increase in maximum stream temperature and that a minimum post-harvest stream shading level of 45 percent (700-meter elevation stands) to 70 percent (300 meter elevation stands) is generally adequate to ensure these stream reaches meet Washington State water quality parameters for salmonids.

Montana's SMZ regulations, and found no statistically significant increases in stream temperatures compared to pre-harvest conditions. Although limited, these data suggest that Montana's current SMZ regulations are adequate to maintain stream temperature regimes, at least in some instances.

Although the existing regulations appear to be adequate to maintain stream temperatures, the modeling results indicate that a distinct initial decrease in stream shading would occur for all channel and stand types immediately after harvest under Alternative 1 (Figures 4.8-14 through 4.8-16). About half of the modeled scenarios for this alternative also result in the shade levels at 10 years being below the established shade target levels. The decreased shading would occur because existing regulations allow some harvest within the SMZ and RMZ immediately adjacent to the stream, thereby reducing riparian forest densities and shade levels. This is supported by the findings of Castelle and Johnson (2000) that the maximum shade to a stream was achieved within 50 to 100 feet of the stream channel.

For most modeled scenarios, the amount of stream shade under Alternative 1 remains below pre-harvest levels until about year 50 to 70 (after the Permit term). However, despite the initial decrease in shading, Alternative 1 shade levels steadily increase over time, and exceed the target levels by about year 30, for all model scenarios. These shade improvements occur at a relatively fast rate for Alternative 1 because the riparian forest densities are reduced due to SMZ and RMZ harvest, which provides greater light penetration and increased understory growth, increased vegetated structural heterogeneity, and faster tree growth (Anderson et al. 2007).

The reduced shading resulting from Alternative 1 could result in a corresponding increase in summer water temperatures and/or cooler winter conditions, although the extent of any potential measurable temperature changes (if any) is unknown. Based on other studies (Washington State TFW 1990; Sugden and Steiner 2003), it can be assumed that any temperature increase would be relatively small (i.e., less than 1.5^{o} C [2.7^{o} F] maximum temperature increase), if not unmeasurable. The shade modeling results suggest that the greatest potential for temperature effects would most likely occur within the first decade, and gradually diminish throughout the modeling period, taking about 50 to 70 years to return to the pre-harvest baseline conditions.

Alternative 2 (Proposed HCP)

On average, the riparian timber harvest conservation commitments provided by Alternative 2 are expected to result in the retention of about 80 percent of the ~~trees and shrubs~~tree basal area in the RMZs of Class 1 streams, including full retention in the 50-foot no-harvest buffer. As a result, the direct and indirect effects of Alternative 2 on stream shading are expected to be measurably reduced compared to Alternative 1. In all scenarios modeled, the shade levels resulting from the implementation of the Alternative 2 increased or were maintained throughout the Permit term (Figures 4.8-14 through 4.8-16).

In most of the scenarios modeled, the shade levels resulting from the implementation of Alternative 2 tend to increase slightly over time (Figures 4.8-14 through 4.8-16). The exceptions are the Swede Creek stand type for the A and B stream channel types, where there was only a slight decrease in shade over time. In contrast, after the initial post-harvest decrease in shade levels for Alternative 1, there was a gradual increase through the end of the 100-year modeling period for all stand and channel types. However, for all model scenarios over the entire modeling period, Alternative 2 provided equal or greater in-stream shade than did Alternative 1. In addition, all of the scenarios

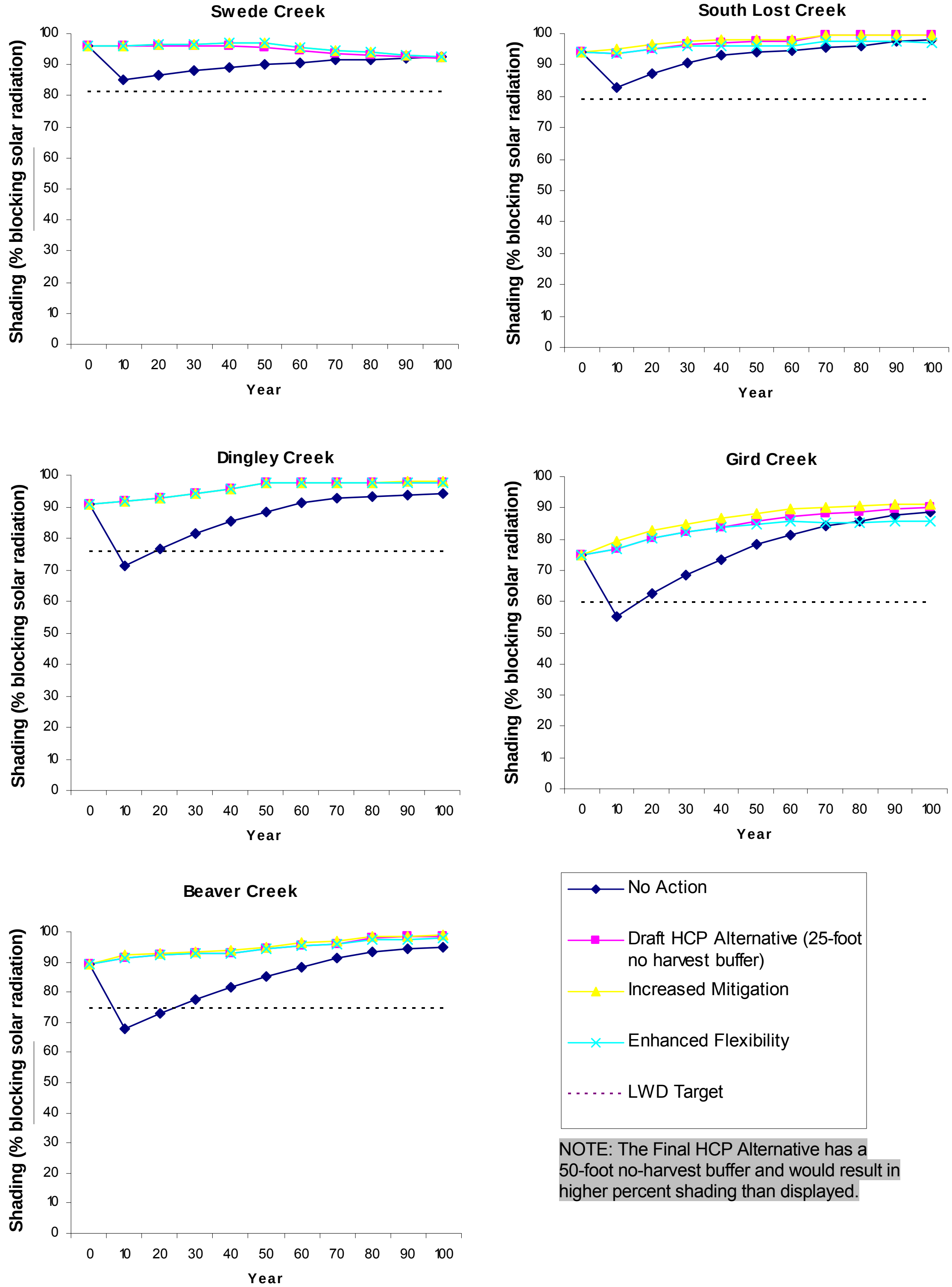


FIGURE 4.8-14. MODELED IN-STREAM SHADING (PERCENT BLOCKING SOLAR RADIATION) OF VARIOUS STAND TYPES IN ROSGEN CLASS A STREAMS BY DECADE

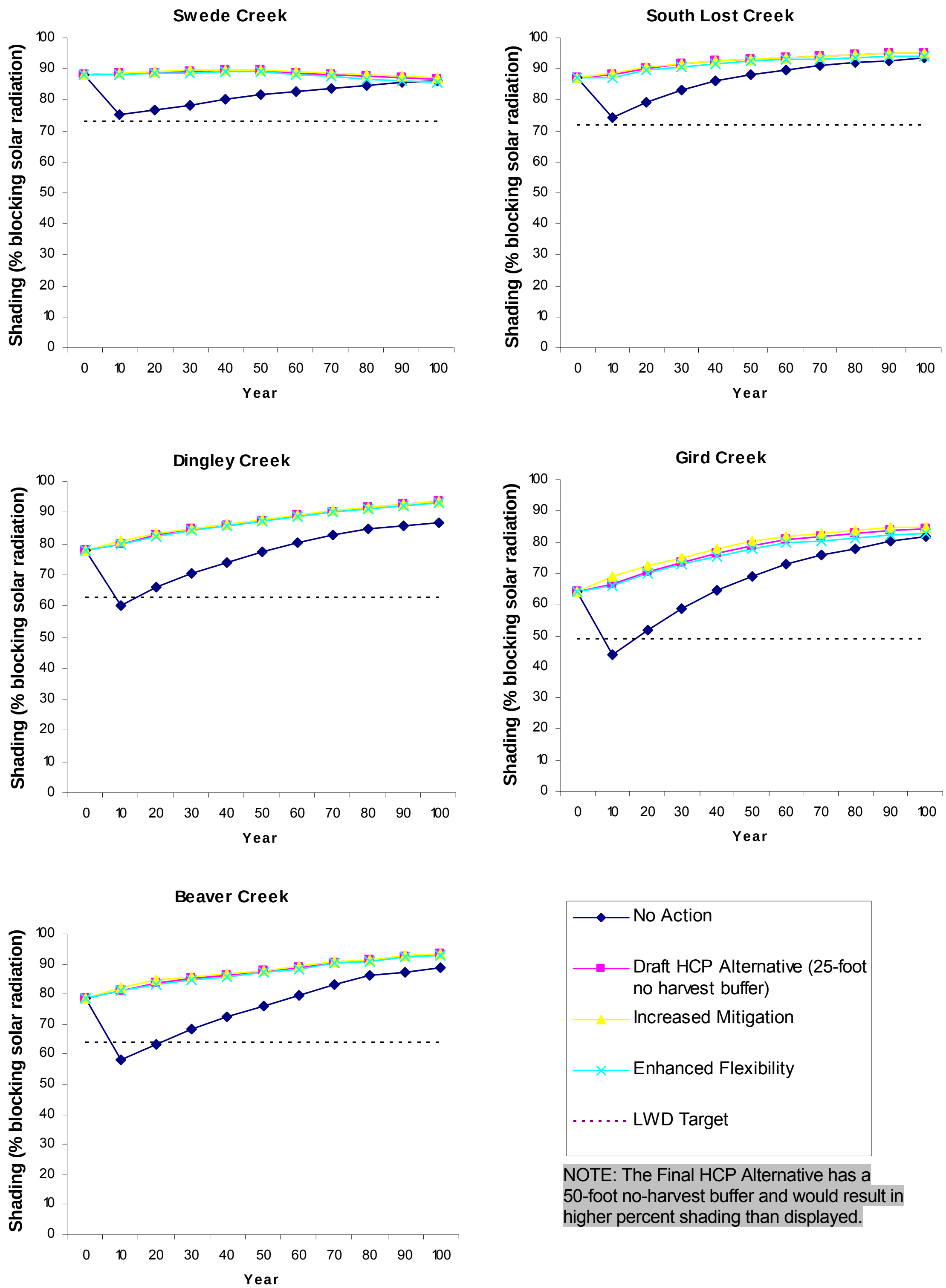
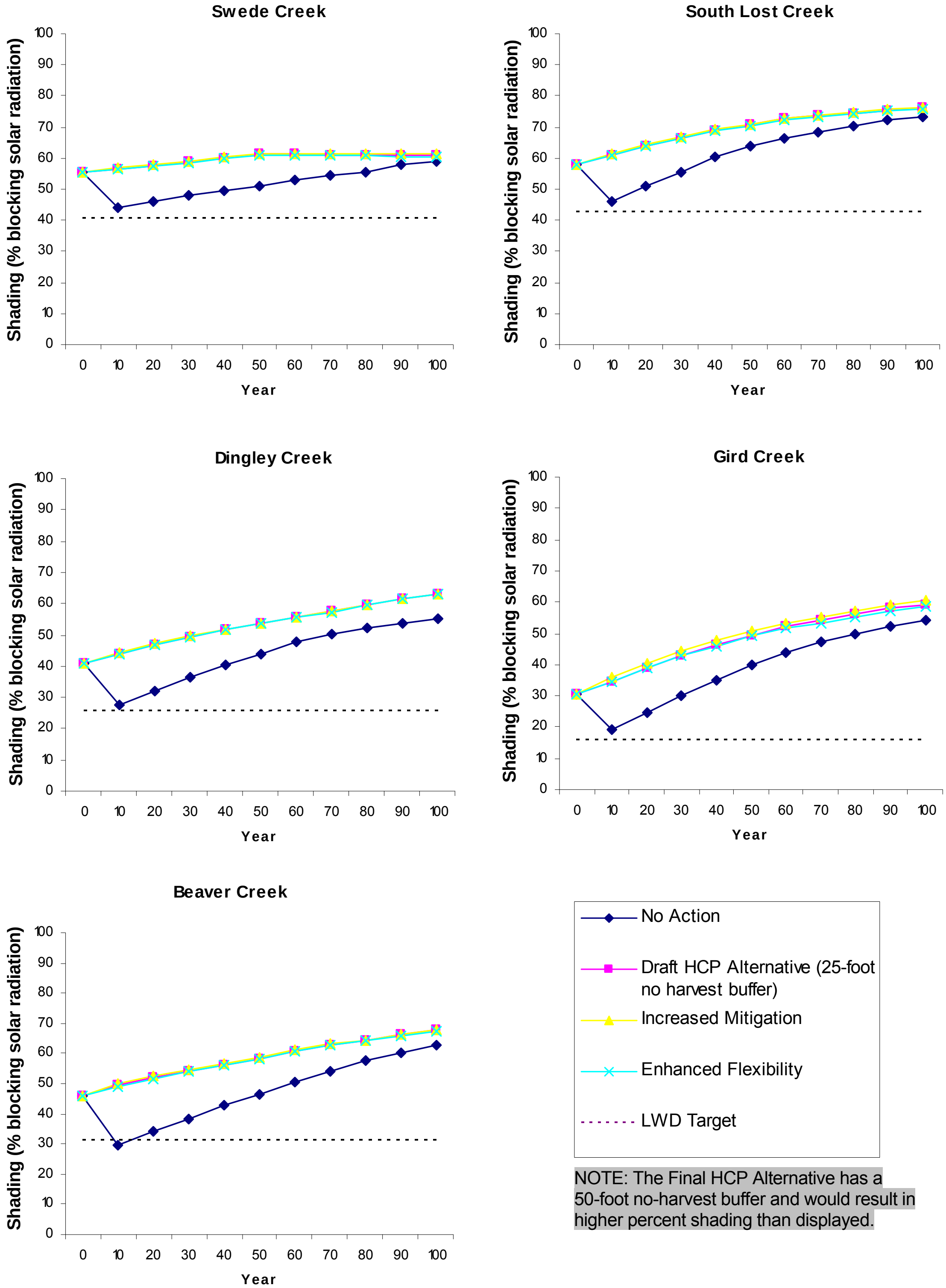


FIGURE 4.8-15. MODELED IN-STREAM SHADING (PERCENT BLOCKING SOLAR RADIATION) OF VARIOUS STAND TYPES IN ROSGEN CLASS B STREAMS BY DECADE



NOTE: The Final HCP Alternative has a 50-foot no-harvest buffer and would result in higher percent shading than displayed.

FIGURE 4.8-16. MODELED IN-STREAM SHADING (PERCENT BLOCKING SOLAR RADIATION) OF VARIOUS STAND TYPES IN ROSGEN CLASS D, F, AND G STREAMS BY DECADE evaluated for Alternative 2 indicate shade levels at least 10 percent greater than the established target levels.

~~Alternative 2 contains several allowances for salvage harvest of disease- or insect-infested trees from within the 25-foot no-harvest buffer on Tier 1 streams, and salvage harvest of fire-killed trees to exceed the normal 50 percent retention requirement in that portion of a Tier 1 RMZ outside the 25-foot no-harvest buffer. Alternative 2 also allows for the management of a portion of the total Tier 1 RMZ acreage using harvest prescriptions designed to meet the minimum retention tree requirement of the SMZ Law.~~

~~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. For example, salvage allowances would be limited to harvest affecting less than 20 acres of RMZ, and the portion of RMZ managed down to the requirement of the SMZ Law would not exceed 15 percent of total Tier 1 RMZ area within each DNRC administrative unit.~~

~~The limited amount of RMZ area managed under these allowances would still be subject to the requirements of the SMZ Law; therefore, it is expected to have effects similar to those described under Alternative 1. In addition, salvage harvest conducted under these allowances would also be required to retain a minimum of 10 trees per 100 feet of stream within the first 25 feet of RMZ. Salvage harvest would also be required to retain all streambank trees and all downed trees lying within the stream channel or embedded within the stream bank.~~

Alternative 2 includes allowances to no-harvest buffers and the 50 percent tree retention requirement for Class 1 streams (including salvage harvest for insects and disease, fire salvage, and harvest design to emulate natural disturbance and intiate early seral forest). However, under the Final HCP Alternative, all allowances are limited to a maximum of 20 percent of the DNRC Class 1 RMZ acres for any given aquatic analysis unit. This limit includes stands harvested under the allowances, as well as stands subject to natural disturbances that reduce RMZ to non-stocked, seedling/sapling stands, or low-stocked, poletimber size class or sawtimber size class stands (using standard DNRC SLI procedures).

The limited amount of RMZ area managed under these allowances would still be subject to the requirements of the SMZ Law, including the minimum tree retention requirements. Therefore, it is expected to have effects similar to those described under Alternative 1. RMZ harvest conducted under these allowances would also be required to retain all streambank trees (ARM 36.11.425). Because of the proposed limits on these allowances, they are not expected to have a substantial effect on stream shade and stream temperatures in HCP project area streams.

An additional expecption to the no-harvest buffer allows some overstory canopy removal to provide clearance for cable yarding systems. Because the total acreage of RMZ affected by this allowance would be quite small (clearing would be limited to the minimum amount necessary to provide safe operation and no clearcutting would be allowed), the effect of this allowance on the no-harvest buffer would be minmimal, and no measurable changes to aquatic habitat functions, including sediment interception and filtration, -would be expected to occur.

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. ~~Although t~~The analyses of Alternative 2 typically indicate increasing shade levels throughout the modeled period, ~~this situation applies specifically~~and these results apply to all Class 1 streams (both stream reaches supporting ~~or potentially supporting the HCP~~ 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 ~~reaches of HCP fish streams that do not directly support these fish species~~Class 2 and 3 streams which are both non-fish bearing, the management commitments would be the same as those identified under Alternative 1. Thus, the existing SMZ and RMZ harvest regulations would apply to these riparian areas. As a result, additional protection would be provided to stream reaches currently or potentially supporting the ~~HCP~~ fish species and those contributing non-fish bearing streams which support important temperature regulation functions, and current levels of protection would continue to occur for the other streams through the implementation of existing regulations.

Under Alternative 2, there would be a greater potential for short-term temperature effects in Class 2 and 3 streams, compared to Class 1 streams. However, the overall effects are expected to be less than for Alternative 1 due to the increased harvest restrictions on Class 1 streams (commitment AQ-RM1) and the same protection levels for all other streams as Alternative 1. In addition, Class 2 and 3 streams tend to be smaller headwater streams, either seasonal or disconnected, that can be effectively shaded by shrubs and brush and would recover substantially quicker than the taller trees required to shade larger stream reaches. While Alternative 2 emphasizes the protection of HCP fish species, the conservation commitments would also benefit all other fish species occupying the same habitat.

In addition to merely providing a mechanism for improving shade conditions in riparian areas, Alternative 2 includes stream temperature monitoring to verify the effectiveness of this conservation commitment (AQ-RM1). Under the HCP riparian timber harvest conservation strategy, DNRC would monitor stream temperatures to ensure that riparian harvest prescriptions maintain suitable shade and stream temperature regimes (less than a ~~1° C [1.8° F]~~1.0° F [0.6° C] increase from baseline conditions) in Class 1 steams that support HCP fish species. In most cases, a change in stream temperature of less than ~~1° C (1.8° F)~~1.0° F (0.6° C) 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 [15° C]). In addition, the ~~1° C (1.8° F)~~1.0° F (0.6° C) 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.

The results of the monitoring efforts are expected to provide substantial indications that the aquatic conservation strategy is effective at maintaining the key riparian functions influencing fisheries habitat at a level that provides conservation of HCP fish species and protection of other native aquatic species.

As discussed above, the proposed HCP includes conservation commitments to maintain stream temperatures in Class 1 streams (including all fish-bearing waters and those perennial streams flowing into such waters), but would rely on existing regulations for remaining Class 2 and 3 streams (commitments AQ-RM2 and 3). ~~While this is still~~This would result in a benefit to the HCP fish species, ~~there is some~~as well as to all other fish species within the HCP project area, and would minimize the potential for effects in the upper watersheds to measurably alter downstream conditions. ~~However~~In addition, streams in the upper watersheds are typically small enough to be protected (shaded) by low-level vegetation (i.e., shrubs and saplings). This type of vegetation would recover relatively quickly after a disturbance from forest management activities to restore adequate shade conditions.

As with other components of the proposed HCP, if the monitoring results indicate any deficiencies or inadequacies, DNRC would collaborate with the USFWS within the adaptive management framework to devise and implement alternative conservation commitments that would meet the management objectives and biological goals of the proposed HCP.

Alternative 3 (Increased Conservation HCP)

The shade modeling results for Alternative 3 are generally very similar to those for Alternative 2. Although Alternative 3 would provide slightly more shade for each time step interval, in most cases this increase is negligible (less than 1 percent) and in no cases is it greater than 4 percent (see Figures 4.8-14 through 4.8-16). These results indicate that the additional timber harvest restrictions provided by Alternative 3 do not substantially affect the stream shading characteristics of the RMZs of ~~Tier 1~~ streams supporting HCP fish species. Therefore, Alternative 3 is not expected to substantially improve water temperature conditions, compared to Alternative 2, for streams supporting HCP fish species, although it would improve conditions relative to Alternative 1. It should be noted however, that the no-harvest requirement within the 100-year site index tree height of a stream under Alternative 3 is comparable to a "no-management" scenario in regard to stream temperature. Shading and water temperature conditions for other streams (Class 2 and 3) adjacent to the timber harvest units would likely be similar to existing conditions due to the continued application of existing RMZ regulations. In addition, these streams are typically small enough to be protected (shaded) by low-level vegetation (i.e., shrubs and saplings), so the additional riparian protection provided by Alternative 3 is not expected to provide substantial differences in temperature conditions compared to the other alternatives. The monitoring and adaptive management provisions of the proposed HCP would also apply to this alternative, and provide a mechanism to evaluate the adequacy of this alternative to maintain stream water temperatures.

Alternative 4 (Increased Management Flexibility HCP)

The shade modeling results for Alternative 4 are generally very similar to those for Alternatives 2 and 3 (Figures 4.8-14 through 4.8-16). The modeling results indicate that the 25-foot no-harvest buffer component incorporated in all three of these alternatives is the primary factor in maintaining stream shade, and that management activities outside of this zone do not appear to substantially affect the shading characteristics of the riparian corridor. Because it is assumed that water temperatures are primarily affected by riparian shade, the potential temperature effects of Alternative 4 would be similar to the other action alternatives. Also similar to the other action alternatives, the monitoring and adaptive management provision in Alternative 4 would allow the evaluation of the adequacy of this alternative to maintain stream water temperatures. Because there are no specific commitments for Class 2 and 3 streams for any of the action alternatives, the water temperatures in these streams are expected to be similar to Alternative 1.

Summary

Overall, the modeling results indicate that all three action alternatives are similarly effective at maintaining the key riparian function of shading and stream temperature at a level that provides for the conservation of fish, including HCP aquatic species. Stream shading under Alternative 1 is substantially decreased by initial harvest, with decreases in stream shading in the first decade following harvest ranging from 11 percent to 20 percent, depending on the scenario. Although Alternative 1 stream shading showed a gradual increase through the end of the modeling period, the level of shading never exceeded the shade levels of the action alternatives.

Besides the modeled differences in shade levels (and thus potential for stream temperature effects) between the alternatives, the alternatives would also differ in the extent of the HCP project area afforded the higher levels of stream shading. For example, for Alternatives 3 and 4, the modeled shade levels would apply to riparian areas immediately adjacent to streams and lakes supporting bulltrout, westslope cutthroat trout, or Columbia redband trout, while for Alternative 2, the shade levels would would apply to riparians areas adjacent to all fish-bearing streams (including non-HCP fish species), as well as perennial non-fish bearing stream segments that contribute surface flow to fish-bearing streams. Based on these differences, Alternative 2 would provide increased stream shading over a larger portion of the HCP project area than would either of the other action alternatives (Alternatives 3 and 4).

Based on the projected levels of shading, none of the action alternatives would result in a measurable negative effect on maximum summer or minimum winter stream temperatures. While the HCP fish species would likely benefit more from these action alternatives, because of the specific conservation commitments for ~~Tier 1~~ streams containing HCP fish species and Class 1 streams (depending on the alternative), these alternatives also would be expected to protect other aquatic species. In addition, the action alternatives all have monitoring and adaptive management provisions that Alternative 1 lacks. These features would allow appropriate adjustments to the conservation strategy, based on the adequacy of these alternatives to maintain stream water temperatures. Conversely, the reduced shading resulting from Alternative 1, particularly in the first decades following timber harvest, may result in a corresponding increase in summer water temperatures and/or cooler winter conditions, although the likely magnitude of any such change would be relatively small.

Connectivity

A primary aspect of maintaining adequate fish connectivity is the proper installation, maintenance, and periodic replacement of culverts. An evaluation of fish passage conditions found 124 known culvert barriers to fish passage on trust lands[2]. Of these, 106 (85 percent) occur on streams supporting HCP aquatic species and 18 (15 percent) occur on other streams (DNRC 2006h) (Table 4.8-12). The evaluation also indicated that the oldest culvert was about 50 years old, although the estimated 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). Using the proportion of HCP to non-HCP fish species passage sites described above (0.85 HCP fish species sites), this replacement rate would result in replacing culverts at about 3.0 HCP fish species passage sites per year.

In addition, as the average lifespan of culverts is estimated at 35 years, 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).

Despite the increased efforts to improve habitat and connectivity conditions for native trout species throughout western Montana, other factors may be minimizing the potential gains. Some bull trout populations were depressed in drainages with no physical barriers to migratory fish, suggesting that other downstream mortality factors, such as predation or temperature, may be playing a bigger role in the extirpation of those stocks (Nelson et al. 2002). Efforts to improve connectivity are intended to reestablish adequate fish access to historical habitat areas by removing or modifying man-made structures. However, this also increases the risks of introducing or spreading diseases and non-native fish into areas currently unaffected by these factors.

Alternative 1 (No Action)

While the existing rules and regulations are directly or indirectly applicable to fish connectivity, the existing strategy does not identify a clear and detailed set of standards for providing or enhancing connectivity. However, the current regulations are intended to ensure fisheries connectivity for all species and life stages. Although there are no specific design criteria regulations or formal commitments, DNRC currently uses a standard of emulating the natural streambed form and function when installing or replacing road culverts. This is expected to provide adequate fish passage conditions to adult and juvenile bull trout, westslope cutthroat trout, and Columbia redband trout over a range of low to bankfull flow levels.

Habitat connectivity would gradually improve under Alternative 1, as blocking road culverts are repaired or replaced when existing roadways are upgraded to facilitate trust land management activities. These upgrades would only occur as particular roads, or sections of roads, would be required to conduct these management activities. The upgrades would comply with existing regulations, laws, and appropriate recovery plans. However, they would not necessarily follow a

[2] Culvert inventory data current as of March 2005.

comprehensive, coordinated, and effective conservation or recovery plan for the HCP fish species populations.

Problem culverts would be upgraded according to existing regulations and established BMPs. While this will likely include the continuation of the existing DNRC design protocols for providing adequate fish passage conditions over a range of flows (including bankfull with) and for a wide range of species and life stages, there would be no specific assurances of where and when these improvements would occur. Therefore, there would likely be sporadic and dispersed improvements in fish passage conditions and/or species distribution throughout the HCP project area.

In addition to improving fish passage conditions on existing roads, all new roads would be constructed to these same design standards, thereby minimizing new restrictions to the distribution and movement of fish in the future. However, there would be no particular emphasis or strategy for improving connectivity for bull trout, westslope cutthroat trout, and Columbia redband trout, or on streams occupied by these species. Therefore, correcting existing connectivity problems would be just as likely to occur on streams containing HCP fish species as on other fish-bearing streams, so some populations of HCP fish species currently affected by connectivity restrictions would continue to be affected for some undetermined time. Given the average useful lifespan of culverts (estimated at about 35 years), connectivity restrictions could extend for several generations of fish.

Alternative 1 would continue existing policy, which would result in a replacement rate of about 3.0 culverts per year on HCP fish species streams (Table 4.8-22). However, this schedule does not necessarily ensure that the most problematic culverts would be replaced first. Similarly, there would be no prioritization for replacing culverts that block or restrict access for the HCP fish species, or that would open up the largest habitat reaches for these species.

TABLE 4.8-22. ESTIMATED TIMEFRAME AND AVERAGE YEARLY REPLACEMENT RATE OF CULVERTS WITHIN THE HCP PROJECT AREA FOR ALL ALTERNATIVES

Alternative	Estimated Culvert Replacement Rate for All Known Barrier Culverts on Streams with HCP Fish Species in HCP Project Area (Number per Year)1	Estimated Timeframe to Replace All Known Barrier Culverts on Streams With HCP Fish Species in HCP Project Area (Years)	Estimated Culvert Replacement Rate for High-risk Culverts in HCP Project Area (Number per Year)	Estimated Timeframe to Replace All High-risk Culverts in HCP Project Area (Years)
Alternative 1	~3.0[1]	~35[1]	Unknown	Unknown
Alternative 2	3.5[2]	30[2]	9.5[4]	25[4]
Alternative 3	5.3[3]	20[3]	11.9[5]	20[5]
Alternative 4	~3.0[1]	~35[1]	Unknown	Unknown

[1] Based on the average (35-year) culvert lifespan, although the actual replacement schedule is unknown.
[2] Replacements completed in 15 years for bull trout streams and 30 years for westslope cutthroat trout or redband trout streams.
[3] Replacements completed in 10 years for bull trout streams and 20 years for westslope cutthroat trout or redband trout streams.
[4] Replacements completed in 15 years for bull trout streams and 25 years for westslope cutthroat trout or redband trout streams.
[5] Replacements completed in 10 years for bull trout streams and 20 years for westslope cutthroat trout or redband trout streams.
Source: DNRC (2006h).

In addition, Alternative 1 does not contain specific commitments to inventory or address road-stream crossing problems in the HCP project area. Therefore, although these problems are documented to exist, no estimate of the timeframe for problem identification or correction can be made for Alternative 1.

Furthermore, Alternative 1 does not provide specific monitoring or adaptive management programs. As a result, the culvert replacement project would be implemented using the most recent BMPs, with the assumption that adequate effectiveness was achieved. This alternative assumes that each culvert would be replaced, about once every 35 years, unless it failed due to hydrologic insufficiencies. Eventually, this alternative would likely restore connectivity for the HCP fish species, but there is considerable uncertainty of how effective this would be for the recovery or conservation of these species because there would be no specific coordination with species recovery plans.

Alternative 2 (Proposed HCP)

In addition to applying all existing stream crossing regulations, as in Alternative 1, Alternative 2 would 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 (commitment AQ-FC1 item (3)). These data would allow prioritization of road-stream crossing improvements for streams with HCP fish species based on existing levels of connectivity, HCP fish species status, and population conservation goals (commitment AQ-FC1 item (4)).

This alternative includes additional mitigation measures to minimize impacts to HCP fish species habitat resulting from construction associated with site improvements. This prioritization would lead to completing the connectivity improvements within 15 years for bull trout streams and 30 years for streams with westslope cutthroat trout or Columbia redband trout, with some allowances (commitments AQ-FC1 items (5), (6), and (7)). This commitment includes 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. While this is slightly greater than the rate expected under Alternative 1, the HCP fish connectivity commitments would ensure that the most problematic culverts would be improved first, thus improving connectivity for all HCP aquatic species within a defined timeframe.

The HCP commitments provide assurances that the problem culverts would be corrected in a more timely manner than Alternative 1, resulting in a longer period for fish to re-populate upstream areas previously blocked or restricted, as compared to Alternative 1. This improved connectivity is expected to reduce the isolation of potentially non-viable sub-populations and the associated risks of extinction.

The other HCP conservation strategies, including the sediment reduction conservation strategy, also would help to improve connectivity within the HCP project area. Under Alternative 2, there are specific commitments on timeframes for the identification and correction of road-stream crossings with a high risk of sediment delivery (commitment AQ-SD2). Because no such commitments apply to Alternative 1, an alternatives comparison of improvement rates for the at-risk road-stream site improvements cannot be directly made, although Alternative 2 would result in a substantially faster rate of improvement, due to the associated sediment reduction conservation strategy commitments.

The riparian timber harvest conservation strategy also would help to maintain quality fish habitat conditions in the HCP project area, and the fish connectivity conservation strategy would increase or improve fish access to these areas, thus allowing increased access of HCP aquatic species to improved habitat areas to support them. Alternative 2 also includes a fish connectivity monitoring and adaptive management commitment, which is in addition to those described under Alternative 1.

To verify that the road crossing improvements adequately provide the connectivity conditions necessary for viable HCP fish populations, DNRC would conduct post-installation effectiveness monitoring at improved road crossings on known or suspected HCP fish species streams, depending on the type of new structure. The monitoring schedule would include assessments at 2, 5, and 10 years following structure installation, as well as inspections after large flood events.

Alternative 2 also incorporates adaptive management practices by using 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.

Alternative 3 (Increased Conservation HCP)

This alternative is similar to Alternative 2, except that it would complete connectivity improvements within 10 years for known or suspected bull trout streams and 20 years for westslope cutthroat trout and Columbia redband trout streams, with some allowances. Because this increased rate of fish passage improvements would result in a replacement rate of about 5.3 culverts per year on HCP fish species streams, a longer time period would be provided for fish populations to re-colonize blocked habitats and for enhancement of isolated fish populations. Therefore, Alternative 3 would provide a somewhat greater benefit to the connectivity habitat component.

In addition, this alternative includes commitments governing the identification and correction of road-stream crossings with a high risk of sediment delivery. Similar to Alternative 2, Alternative 3 would also incorporate effectiveness monitoring and adaptive management practices.

Alternative 4 (Increased Management Flexibility HCP)

This alternative would replace culverts on a project-by-project basis, with no specific commitments to preferentially address culverts on HCP fish species streams and no commitments for the correction of road-stream crossings with a high risk of sediment delivery. Therefore, the results of this alternative are expected to be the same as Alternative 1.

Summary

The overall timeframes and rates for culvert replacement vary between the alternatives. Alternatives 2 and 3 contain specific commitments for replacing known barrier culverts and to correct identified high-risk road-stream crossings, while Alternatives 1 and 4 do not. In addition, Alternatives 2 and 3 contain effectiveness monitoring and adaptive management components, to ensure that desired levels of connectivity are being achieved. Therefore, Alternative 3, which would correct connectivity problems at a faster rate, would benefit fish passage to the greatest degree, especially for the HCP aquatic species. Alternative 2 would also improve connectivity, but at a slightly lower rate than Alternative 3.

Alternatives 1 and 4 would continue to implement existing DNRC policies and procedures with no specific commitments to preferentially address culverts on HCP fish species streams and no commitments for the correction of road-stream crossings with a high risk of sediment delivery. Although it is expected that these alternatives would eventually restore connectivity for the HCP and other fish species, there is considerable uncertainty as to how effective this would be for the recovery or conservation of the HCP fish species because there would be limited prioritization of fish passage barriers and little specific coordination with species recovery plans.

Other Habitat Factors

In addition to the effects on habitat complexity and stream temperature and shading, riparian areas perform a variety of ecological functions, including regulating the exchange of energy, nutrients, and organic matter to streams (Swanson et al. 1982; Gregory et al. 1987). Due to the multiple ecological functions provided by riparian areas, any physical changes to riparian habitat are expected to have a corresponding influence on these functions. Microclimate, particularly solar radiation and air temperature near the ground surface, is very sensitive to changes in canopy cover and is highly variable in time and space (Chen et al. 1999). Anderson et al. (2007) also observed that microclimate gradients were strongest within about 30 feet (10 meters) of the centerline of headwater streams, forming a distinct area of stream influence within the broader riparian corridors. Chen et al. (1999) found that the distance from the edge of a harvest area to where microclimate alterations could be detected varied from tens of feet for a variable such as soil moisture to hundreds of feet for wind velocity. However, this evaluation did not specifically address microclimate changes in riparian habitats.

Establishing or maintaining access roads has the potential to increase recreational fishing pressure, poaching, and introductions of non-native fish species. These activities could adversely affect native fish populations, including the three HCP fish species. Fishing and poaching activities could directly affect these fish populations through the intentional or unintentional removal of fish and incidental hooking or handling mortality. The introduction of non-native species could lead to indirect effects, such as increased competition for resources (e.g., food, rearing habitat, etc.), or more direct effects from increased predation.

A stream and its floodplain comprise a dynamic environment where the floodplain, channel, and bedforms evolve through natural processes that erode, transport, sort, and deposit alluvial materials (Rosgen 1996). Stable streams migrate across the landscape slowly over long periods of time while maintaining their form and function. Naturally stable streams must be able to transport the sediment load supplied by the watershed. Land use changes in the watershed and channelization can alter these processes, leading to large adjustments in channel form (i.e., extreme bank erosion or incision) before a new equilibrium is achieved. Riparian vegetation helps maintain channel form and in-stream habitat through the restriction of sediment input or slowing of sediment moving through the system. The presence of LWD also affects channel forming processes by adding hydraulic roughness (Bilby and Ward 1989).

Alternative 1 (No Action)

As indicated above under the riparian shade discussions, existing laws do not require a no-harvest buffer in riparian areas, except to retain all bank edge trees and enough other trees to ensure adequate levels of shade to maintain natural temperature ranges. Although the existing regulations appear to be adequate to maintain stream temperatures, the modeling results indicate that a substantial initial decrease in stream shading would occur for all channel and stand types under Alternative 1 (Figures 4.8-14 through 4.8-16). These changes suggest that corresponding changes to the ecological functions affected by the integrity and condition of the riparian zone could also occur. This would include effects on microclimate and stream form and function.

It is expected that those habitat factors that are affected directly or indirectly by shade should respond to the gradual changes in shade characteristics estimated over time. However, it is uncertain whether all the factors would respond and recover at the same rate as the shade recovery process, as they can be influenced by a broader area than just the riparian zone. For example, hydrologic characteristics are influenced by the conditions throughout the watershed, with correspondingly less influence from riparian conditions. Changes in flow regime affect a broad range of in-stream habitat conditions, as well as the potential for natural riparian processes to maintain the habitat.

Alternative 1 does not contain monitoring requirements or adaptive management practices as applied to the aquatic habitat components (in-stream LWD, stream temperature, sediment production and delivery, etc.) that support and influence the maintenance of microclimate and channel form and function. Therefore, there is some risk under Alternative 1 that existing policies and procedures are not adequate to support these other important habitat components, but there is no specific mechanism to identify and correct these problems.

Alternative 1 is expected to result in an overall improvement in habitat conditions for HCP aquatic species and other native aquatic and terrestrial species associated with the riparian habitat. The continued implementation of current forest management practices, including road construction practices, would gradually improve the conditions in the HCP project area that resulted from activities conducted prior to enactment of the current regulations. The existing regulations regarding forest management activities are generally effective at maintaining the ecological functions and characteristics of the aquatic habitat, particularly in comparison to historical practices, which have caused substantial degradation of aquatic habitat. As with the other habitat considerations discussed above, Alternative 1 would implement these current forest management practices as specific needs occur. As a result, there would be no overall implementation strategy to prioritize or maximize the benefits to the HCP fish species or their habitat.

Alternative 2 (Proposed HCP)

While secondary functions such as nutrient loading, chemical filtering, and microclimate are not specifically addressed in the overall conservation strategy objectives, they are addressed indirectly through the commitments contained in the riparian timber harvest conservation strategy. As indicated by the shade modeling, maintaining the integrity of SMZs and RMZs is likely to also reduce the effects of timber harvest on other riparian and stream habitat factors, such as microclimate. Most of the results from the shade modeling scenarios suggest that the implementation of the proposed HCP commitments would result in a slight increase in shade over time (Figures 4.8-14 through 4.8-16). The exceptions were for the Swede Creek stand type for the A and B stream channel types, where there is a slight decrease in shade over time. This, along with the LWD modeling results, suggests that the proposed HCP commitments would be likely to maintain healthy and diverse riparian corridor habitat conditions. As a result, the riparian ecosystems adjacent to harvest management areas are expected to be enhanced compared to existing conditions, particularly adjacent to Class 1 streams, which include all fish-bearing streams.

In addition to the no-harvest buffer zones adjacent to Class 1 streams, further impact reductions would also occur through the expansion of RMZs to accommodate stream channel migration (commitment AQ-RM1). As a result, ~~at least 80~~a high percentage of all trees, shrubs, and other ground cover would be retained within the RMZs of Class 1 streams, which is expected to substantially minimize the potential direct or indirect effects on the riparian microclimate. Important microclimate factors include soil moisture and temperature (Heithecker and Halpern 2006; Brosofske et al. 1997; and Davies-Colley et al. 2000).

The allowances included in Alternative 2 for salvage harvest of diseased- or insect-infested trees and fire-killed trees are limited in scope and extent and, therefore, are not expected to substantially affect these riparian functions.

Alternative 2 includes allowances to no-harvest buffers and the 50 percent tree retention requirement for Class 1 streams (including salvage harvest for insects and disease, fire salvage, and harvest design to emulate natural disturbance and intiate early seral forest). However, all allowances are capped at 20 percent of the DNRC Class 1 RMZ acres for any given aquatic analysis unit. This cap includes stands harvested under the allowances, as well as stands subject to natural disturbances that reduce RMZ to non-stocked, seedling/sapling stands, or low-stocked, poletimber size class or sawtimber size class stands (using standard DNRC SLI procedures).

The limited amount of RMZ area managed under these allowances would still be subject to the requirements of the SMZ Law, including the minimum tree retention requirements. Therefore, it is expected to have effects similar to those described under Alternative 1. RMZ harvest conducted under these allowances would also be required to retain all streambank trees (ARM 36.11.425). Because of the proposed limits on these allowances, they are not expected to have a substantial effect on microclimate in HCP project area streams.

An additional allowance to the no-harvest buffer allows some overstory canopy removal to provide clearance for cable yarding systems. Because the total acreage of RMZ affected by this exception would be quite small (clearing would be limited to the minimum amount necessary to provide safe operation and no clearcutting would be allowed), the effect of this allowance on the no-harvest buffer would be minimal, and no measurable changes to aquatic habitat functions would be expected to occur.

Similarly, the proposed HCP commitments are also expected to maintain other riparian functions, such as nutrient loading and chemical and physical filtering processes. The bulk of organic nutrient loading and riparian filtering processes occur within the 100-year site index tree height of a stream (Castelle and Johnson 2000). Therefore, the 50-foot no-harvest buffer requirement around Class 1 streams would be expected to provide greater protection of these functions, compared to the existing regulations, which do not include a no-harvest buffer provision within the RMZ.

The commitments for riparian harvest, including the establishment of CMZs where appropriate, would also generally maintain those processes that contribute to stability in channel form and function. Also, under Alternative 2, the amount of LWD recruitment and associated in-stream woody debris would be sufficient to maintain channel form and function (see Section 4.8.2.2, Habitat Complexity).

Alternative 2 contains monitoring requirements or adaptive management practices as applied to the aquatic habitat components (in-stream LWD, stream temperature, sediment production and delivery, and connectivity) that support and influence the maintenance of microclimate and channel form and function. Therefore, as compared to Alternative 1, there is substantially greater assurance that these habitat components would continue to function at an appropriate level to support the functions necessary to provide quality fish habitat.

As discussed previously for the other habitat parameters, forest management activities adjacent to Tier 2 and 3 streams would follow existing regulations. As such, the effects of these activities on microclimate and other ecological functions, as they relate to fish habitat in these streams, would likely remain similar to Alternative 1.

Alternative 3 (Increased Conservation HCP)

Because the shade and LWD modeling results for Alternative 3 are generally very similar to those for Alternative 2, the effects on those habitat components that maintain microclimate and channel form and function are also expected to be similar. These conditions and functions are expected to be enhanced compared to Alternative 1, and are also likely to be slightly enhanced compared to Alternative 2. Alternative 3 would result in maintaining a larger riparian corridor than Alternative 2, which is expected to further insulate the immediate stream channel corridor from environmental changes occurring within the harvest area, or as a direct or indirect result of such harvests. In addition, Alternative 3 also provides for the establishment of CMZs, which help maintain stability in channel form and function, and monitoring and adaptive feedback mechanisms to ensure relevant habitat components are functioning at a level to support the functions necessary to provide fish habitat.

As with Alternative 2, the effects of Alternative 3 on Class 2 and 3 streams are expected to be similar to Alternative 1 because forest management activities would follow existing regulations.

Alternative 4 (Increased Management Flexibility HCP)

As with Alternatives 2 and 3, Alternative 4 is expected to result in improved conditions in those habitat components that maintain microclimate and channel form and function, compared to Alternative 1. However, it is uncertain whether these factors would be substantially different from Alternatives 2 or 3. If differences were to occur, they would be relatively minor in scale, with Alternative 4 providing slightly less enhancement of these functions than would Alternatives 2 and 3.

Summary

Overall, all of the alternatives would likely provide adequate aquatic habitat conditions, and in the long term, maintain properly functioning channel form and function and microclimate conditions.

However, the three action alternatives would likely provide for better conditions within streams that support HCP fish species. Alternatives 2 through 4 provide more stringent commitments pertaining to riparian harvest, LWD, connectivity, and sediment production in areas that could affect streams that support the HCP fish species. As such, these alternatives would likely provide greater support for these habitat components than Alternative 1. In order, Alternatives 3 and 2 would be most likely to maintain or improve microclimate and channel form and function conditions, followed by Alternative 4, although it is not known if significant differences between the action alternatives would result.

4.8.4.3 Effects of the Transition Lands Strategy and Changed Circumstances Process on HCP Fish Species

The action alternatives all include a transition lands strategy to address the movement of trust lands into and out of the HCP project area, as well as procedures for addressing changed circumstances that can be reasonably anticipated and planned for by DNRC and the USFWS. Potential effects on HCP fish species from actions that would be taken by DNRC as part of the transition lands strategy or changed circumstances process are discussed along with the terrestrial HCP species in Sections 4.9.5 (Wildlife and Wildlife Habitat – Effects of the Transition Lands Strategy (for Both Terrestrial and Fish Species)) and 4.9.6 (Wildlife and Wildlife Habitat – Effects of the Changed Circumstances Process (for Both Terrestrial and Fish Species)).

4.8.4.4 Summary of Effects by Alternative

As discussed in the introduction to this resource section, the potential effects on fish and other aquatic resources in the planning area and HCP project areas are represented by the potential changes in aquatic habitat conditions resulting directly or indirectly from forest management activities. Specifically, the alternative were assessed for potential effects on four primary habitat components, sediment delivery, stream temperature, in-stream habitat complexity, and connectivity among sub-populations of fish species. These components are vital components of a healthy aquatic ecosystem, and provide the physical, biological, and chemical functions necessary to support viable fish populations. The explicit linkages between in-stream and riparian habitat conditions allow comparisons of the various individual and cumulative effects of the alternatives on these primary habitat components. This also allows an assessment of the relative magnitude and type (positive or negative) of influence on fish populations within the planning area, including the HCP aquatic species.

Overall, the alternative analysis indicates that all of the alternatives are generally effective at maintaining the key habitat components at a level that provides for the healthy fish populations, including the HCP aquatic species. However, there are some substantial differences between the alternatives (Table 4.8-23). Most significant is the general differences between the three action alternatives and the no-action alternative. For most instances, Alternative 1 provides the smallest degree of improvement in the individual habitat components during the Permit term. In some cases, such as stream temperature and shading, Alternative 1 could lead to some negative short-term effects on fish populations, although the magnitude of any such effect would be relatively small. In addition, any risk of effects from Alternative 1 would apply equally to all fish species, including HCP aquatic species, because the existing policies, procedures, and corrective actions are not prioritized for any particular species. However, Alternative 1 would still maintain or slightly improve habitat conditions that would support native cold-water and warm-water fish populations.

All of the action alternatives have a greater potential to improve aquatic habitat conditions, based either on overall scale or rate of change. In addition, the action alternatives have some specific mechanisms for monitoring and adaptive management to help to ensure proper implementation and effectiveness of the various conservation strategies. The risk of adverse effects to HCP aquatic species is reduced with the action alternatives, compared to Alternative 1.

TABLE 4.8-23. OVERALL RANKING OF THE ALTERNATIVES BY HABITAT COMPONENT

Habitat Component	Alt. 1	Alt. 2	Alt. 3	Alt. 4
Sedimentation[1]	4	2	1	3
LWD Frequency	4	2	1	3
Shade and Temperature[1]	4	2	1	3
Connectivity[1]	3	2	1	3
Other Habitat Factors	3	2	1	3
Cumulative Effects[2]	3	2	1	3
Overall Ranking	**4**	**2**	**1**	**3**

Ranking values are based on expected positive effects, with 1 = most benefit, 4 = least benefit.
[1] These habitat components show the greatest differences between the no-action and action alternatives.
[2] Cumulative effects, when considered with other past, present, and reasonably foreseeable future actions of other entities, are discussed in detail in Chapter 5 (Cumulative Effects).

As cold-water species, the HCP fish species, especially bull trout, require substantially lower stream temperatures than do many other fish species. Over the landscape of the HCP project area, increased stream temperatures predicted from a changing climate could likely result in a loss of habitat while simultaneously isolating sensitive fish populations, thereby resulting in smaller and less stable populations (Rieman et al. 2007). In general, timber harvest within streamside riparian areas can result in localized stream temperature increases, thus potentially exacerbating the effects of climate change on fish popultations. Compared to Alternative 1, however, the additional protective measures included in the action alternatives, specifically the no-harvest buffers and certain limits on total riparian harvest, would likely reduce the risk of adverse aquatic habitat effects from changes in air temperatures, precipitation, and streamflow patterns anticipated from a changing climate. Because of their commitments, the HCP alternatives are not expected to contribute to habitat fragmentation and genetic isolation of HCP fish species. However, if habitat factors are found to be adversely affected by forest management activities conducted under any of the HCP alternatives, several of the commitments that affect these factors are adaptable if existing conditions change substantially due to climate change. These specific commitments are:

- **Riparian harvest.** Commitment AQ-RM1 would require DNRC to include additional measures for species protection in temperature-sensitive stream reaches.
- **Sedimentation.** If DNRC BMP effectiveness falls below 90 percent, the adaptive management process would be initiated. Through this process, DNRC may adapt its BMPs to changing conditions resulting from climate change.

- **Grazing.** DNRC would evaluate the effectiveness of corrective actions at grazing sites through commitment AQ-GR1. Through this process, corrective actions may be modified over time to address changing conditions resulting from climate change.
- **CWE.** DNRC would set water quality thresholds at levels that ensure compliance with water quality standards and protection of beneficial water uses. As conditions change in response to climate change, meeting these thresholds may require DNRC to adapt several of its timber harvest practices, including BMPs, harvest design, roads, and access.

Although the action alternatives would all benefit aquatic species, including the HCP aquatic species. Alternative 3 would provide the greatest potential benefits, followed by Alternatives 2 and 4. This is generally due to an increased rate of conservation commitment implementation under Alternative 3. In the case of those habitat components affected by riparian buffer width (stream temperature and LWD frequencies), Alternative 3 is roughly equivalent to a "no management" alternative in areas adjacent to HCP aquatic species habitat. This alternative would provide for the maximum levels of LWD recruitment and shade within the riparian zones of the HCP project area, unless LWD frequency was increased through the active placement of LWD through tree falling or manual installation. Although Alternative 3 would provide the greatest potential benefits in the locations where it would be implemented (streams with HCP fish species), many of the riparian harvest commitments under Alternative 2, including those associated with habitat complexity and LWD frequency and shade and temperature, would apply to a greater number of riparian areas. This is because the Alternative 2 no-harvest buffer conditions would apply to streams with any fish species, not just HCP fish species, and would also apply to seasonal non-fish bearing tributaries that connect to fish-bearing waters. For these reasons, the overall benefit of Alternative 2, when considered on a landscape perspective, may be quite similar to that from Alternative 3, although these scalar effects cannot be accurately quantified.

The cumulative effects of DNRC forest management activities on HCP fish species habitat are expected to decrease to some degree for all of the alternatives, over the 50-year Permit term. Based on the expected results of specific commitments, the action alternatives would be slightly more successful at minimizing cumulative effects of DNRC actions on the HCP project area. However, considering all land uses and current actions within the planning area, no significant adverse cumulative effects are anticipated under any of the alternatives.

4.8.4.5 Effects on Bull Trout Critical Habitat

When designating critical habitat, the known physical and biological features (primary constituent elements or PCEs) essential to the conservation of the species are identified. All areas designated as critical habitat for bull trout are occupied, within the species historic range, and contain sufficient PCEs to support at least one life history function.

Based on the current life history, biology, and ecology information of bull trout, the USFWS has identified the bull trout's PCEs (70 FR 56211-56311, September 26, 2005). The following are the PCEs for bull trout: 1) stream temperatures from 32 to 72° F; 2) complex stream channels influenced by large woody debris, pools, and undercut banks that result in various depths, velocities, and instream habitat structures; 3) substrates of sufficient size, amount, and composition for juvenile and egg survival; 4) natural stream flows or artificial flows that are regulated in order to support bull trout; 5) springs, seeps, and groundwater sources, and subsurface flow that contributes to the water quantity and quality as a cold water source; 6) migratory corridors that support unimpeded movement between spawning, rearing, foraging, and over-wintering areas; 7) adequate food base of terrestrial and aquatic insects and forage fish; and 8) permanent water sufficient to provide the quality and quantity for normal reproduction, growth, and survival and 9) few or no predatory, interbreeding, or competitive nonnative species present.

The analysis provided above considers the effects of the proposed action – implementation of the HCP – on the key habitat factors for bull trout. These key habitat factors can be linked to the PCEs for critical habitat. Therefore, adverse effects on PCEs are likely to result where adverse effects are anticipated for key habitat factors. For this analysis, adverse effects are anticipated for sediment and connectivity key habitat factors. Despite implementation of the HCP commitments, increased sediment levels may occur from the surface of existing roads that are within 300 feet of a stream containing HCP fish species as well as sediment produced at road-stream crossings. This in turn, may generate adverse effects on PCEs 2 and 3. Relative to connectivity, adverse effects associated with 106 fish passage culvert barriers have been identified within the HCP project area. While the HCP commitments require replacement of barriers with passable culverts, the timeframe for these replacements may result in adverse effects continuing for a period of 15 years. This in turn, may generate adverse effects on PCEs 6 and 9.

For the other key habitat factors (stream temperature, habitat complexity, and other habitat factors) and associated PCEs (1, 4, 5, 7, and 8), no adverse effects are anticipated.

On January 14, 2010, the USFWS published a proposed rule in the Federal Register (75 CFR Part 9) to revise the critical habitat designation for bull trout in the contiguous United States. In addition to expanding the extent of bull trout critical habitat in Montana, the proposed revised designation also includes an additional PCE. This propsed PCE (#9) designates that bull trout critical habitat should have few or no non-native predator species (e.g., lake trout, walleye, northern pike, smallmouth bass), inbreeding species (e.g., brook trout), or competitive species present. Implementation of the HCP is not expected to have an adverse effect on this proposed PCE.

Subsequent to the revised critical habitat taking effect, DNRC would update its bull trout critical habitat database. The ESA Section 7 consultation process will address potential effects on critical habitat as designated under the final rule.

4.9 Wildlife and Wildlife Habitat

4.9.1 Introduction

The planning area provides a wide variety of habitats, from open grasslands and alpine areas to woodlands and dense forests. Approximately 407 species of wildlife are known or expected to occur in the area, including 91 mammals, 289 birds, 12 amphibians, and 15 reptiles (Table E4-7 in Appendix E, EIS Tables). Following a summary of current management direction for wildlife and wildlife habitat in the EIS planning area and HCP project area (Section 4.9.2 Regulatory Framework), this section examines existing conditions and effects of the alternatives on wildlife resources. These analyses are presented for the two HCP species, transition lands, changed circumstances, and other wildlife species in Section 4.9.3 (Grizzly Bears), Section 4.9.4 (Canada Lynx), Section 4.9.5 (Effects of the Transition Lands Strategy), Section 4.9.6 (Effects of the Changed Circumstance Process), and Section 4.9.7 (Other Wildlife Species). Evaluation criteria are used to assess and compare the effects of the alternatives at the landscape level both in the short term and the long term, focusing on direct and indirect effects.

Data are presented at the planning area scale to provide a landscape-level context from which to assess the relative importance of forested trust lands and the HCP project area to wildlife species and habitats. For the HCP project area, acreage values of various habitat components are generally described using the DNRC land office as a unit of analysis, with more detailed unit office information available in the wildlife tables provided in Appendix E. Where analysis at a finer scale is relevant (e.g., grizzly bear recovery zones and bear management units), data are presented at different analysis units.

Sources of information for analyses in this section include communications with local and regional biologists, GIS data from DNRC and other sources, hunting and trapping data from MFWP, and literature review. Numerous analyses were performed to evaluate existing wildlife habitat in the HCP project area, on DNRC lands in the planning area not included in the HCP, and in some instances, other ownerships in the planning area. The analyses conducted include assessments of linkage areas, lynx habitat mapping, road densities in the future, the amount of grizzly bear hiding cover, the availability of bald eagle habitat, and wolf pack activity. Information on methodologies used for GIS analyses and tables providing additional information on existing wildlife and habitat conditions are included in the *Supporting Documentation for the HCP Wildlife Analysis* (DNRC 2008i), which is available on the project website at: http://www.dnrc.mt.gov/HCP/.

Lastly, during development of the HCP, species accounts were prepared for the covered species. The accounts are a review and compilation of all relevant and current scientific information in a synthesis document for each species. Applicable information for this EIS was drawn from those species accounts, which are available on DNRC's HCP website (http://dnrc.mt.gov/HCP/).

4.9.2 Regulatory Framework

Management of trust lands in the planning area is accomplished in compliance with various wildlife-related federal and state regulations (Table 4.9-1). While some of these regulations (e.g., ESA) may provide protections specific to individual species, others provide more general direction on the protection of wildlife habitat. In addition, numerous other regulations govern other types of environmental factors that can directly and indirectly affect wildlife and wildlife habitat, such as road building, water quality, riparian areas, and wetlands. Those regulations are described in more detail in Sections 4.4 (Transportation), 4.5 (Geology and Soils), 4.6 (Water Resources), and 4.7.3 (Wetlands), and 4.10 (Recreation) of this EIS.

TABLE 4.9-1. SUMMARY OF APPLICABLE FEDERAL AND STATE WILDLIFE-RELATED REGULATIONS

Regulation	Overseeing Agency	Purpose
Federal		
Endangered Species Act (16 USC 1531 et seq.)	USFWS	Protect and recover threatened and endangered plant and animal species.
Fish and Wildlife Coordination Act (16 USC 661 through 667)	USFWS and MFWP	To provide assistance to and cooperate with federal and state agencies to protect, rear, stock, and increase the supply of game and fur-bearing animals, as well as to study the effects of domestic sewage, trade wastes, and other polluting substances on wildlife.
Migratory Bird Treaty Act and Executive Order 13186 (Responsibilities of Federal Agencies to Protect Migratory Birds)	U.S. Department of Interior and all federal agencies	Prohibits illegal hunting, capture, possession, or sale of migratory birds, for the protection of migratory birds or any part, nest, or egg of any such bird.
Bald Eagle and Golden Eagle Protection Act	USFWS	Prohibits take of bald or golden eagles.
State		
ARMs 36.11.401 through 450[1]	DNRC	Provide regulatory guidance in timber sale planning for threatened and endangered species, DNRC sensitive species, game species, wildlife habitat.
MEPA (MCA 75-1-101 through 324)[2] DNRC implementing regulations (ARMs 36.2.521 through 543)	DNRC	To provide a public process that assures Montana's citizens that a deliberate effort is made to identify impacts before the state government decides to permit or implement an activity that could have significant impacts on the environment.
Montana Nongame and Endangered Species Conservation Act (MCA 87-5-101)	MFWP	To provide adequate remedies for the protection of the environmental life support system from degradation and provide adequate remedies to prevent unreasonable depletion and degradation of natural resources.

[1] For a complete citation of the Forest Management ARMs pertaining to the covered species, go to: http://www.mtrules.org/.
[2] For a complete citation of the Montana Code Annotated, go to: http://data.opi.mt.gov/bills/mca_toc/index.htm.

The most applicable regulations governing wildlife and wildlife habitat on forested trust lands are the Forest Management ARMs. These rules were adopted to conserve wildlife and wildlife habitat and other resources of concern. Several ARMs apply to specific wildlife groups or state land management practices. These include rules governing threatened and endangered species, game species, biodiversity, old-growth forest, and road management (Table E4-8 in Appendix E, EIS Tables). The primary function of these rules is to provide land managers with tools to conserve species and habitat in a manner consistent with trust obligations. The forest management ARMs for threatened and endangered species are DNRC's interpretation of and commitment to complying with ESA to avoid take as defined by that legislation. For most projects proposed on forested trust lands, DNRC wildlife biologists conduct site visits and identify mitigation measures to be implemented to avoid or minimize impacts on wildlife and wildlife habitat, based on the policies contained in the ARMs (Table E4-8 in Appendix E, EIS Tables).

In addition to the wildlife-specific ARMs, those that address the management of streams, wetlands, and other waterbodies also influence wildlife and wildlife habitat. The Montana SMZ Law (MCA 77-5-301 through 307) and rules (ARM 36.11.301 through 313) regulate commercial timber harvest conducted immediately adjacent to all streams, specific lakes, and other bodies of water in Montana. While this law's primary goal is to restrict the scope and range of activities that may pose a threat to aquatic habitat and species, these restrictions also affect the availability and quality of wildlife habitat in these areas. Refer to Section 1.5.2 for further details on these regulations and DNRC's commitments under them.

In addition to abiding by the Forest Management ARMs, DNRC participates in regional agreements and committees aimed at protecting wildlife and wildlife habitat. These include the Swan Agreement and the NCDE Subcommittee of the Interagency Grizzly Bear Committee. DNRC also recognizes the management direction provided in other state plans, such as the *Montana Gray Wolf Conservation and Management Plan* (MFWP 2003a) and the *Grizzly Bear Management Plan for Western Montana* (MFWP 2006).

4.9.3 Grizzly Bears

This section describes the status, distribution, life history, habitat requirements, and risk factors for grizzly bears. In addition, this section includes an analysis of the effects of the HCP Transition Lands Strategy and the changed circumstances process on all HCP species (including fish), as well as other fish and wildlife species.

4.9.3.1 Affected Environment

Status

In 1975, the USFWS listed the grizzly bear as a threatened species in the contiguous United States (40 FR 31734-31736, July 28, 1975). Subsequent to listing, the USFWS developed a grizzly bear recovery plan in 1982 (revised in 1993), with the objective of sufficiently restoring populations so that the grizzly bear could be delisted (i.e., no longer classified by the USFWS as threatened or endangered) (USFWS 1993). The recovery plan established six grizzly bear recovery zones, defined as areas within which the population and habitat criteria for achievement of recovery will be measured (USFWS 1993). Recovery zones, named for the ecosystems in which they occur, are areas large enough and of sufficient habitat quality to support a recovered bear population. Four of these recovery zones, the Greater Yellowstone Ecosystem (GYE), the NCDE, the CYE, and the BE, occur wholly or partially in Montana. Portions of these four recovery zones occur in the planning area, but no HCP project area lands occur in the GYE (Table 4.9-2; Figure D-17 in Appendix D, EIS Figures). With the exception of the BE, grizzlies occur both within the formally designated recovery zones and in associated NROH, which was documented by Wittinger (2002).

TABLE 4.9-2 ACREAGES OF GRIZZLY BEAR RECOVERY ZONES AND ASSOCIATED NON-RECOVERY OCCUPIED HABITAT WITHIN THE PLANNING AREA AND HCP PROJECT AREA

Recovery Zone	Recovery Zones All Ownerships	Non-recovery Occupied Habitat in Montana[1]	Recovery Zone Lands in Planning Area[2] (% of Recovery Zone)		Non-recovery Occupied Habitat in Planning Area[1,2] (% of Non-recovery Occupied Habitat)		Recovery Zone on DNRC Lands in Planning Area[2] (% of Recovery Zone)		Non-recovery Occupied Habitat on DNRC Lands in Planning Area[1,2] (% of Non-recovery Occupied Habitat)		HCP Project Area in Recovery Zone (% of Recovery Zone)		HCP Project Area in Non-recovery Occupied Habitat[1,3] (% of Non-recovery Occupied Habitat)	
NCDE	5,711,299	2,459,088	5,711,299	(100.0)	2,459,088	(100.0)	204,139	(3.6)	160,640	(6.5)	147,845	(2.6)	72,875	(3.0)
BE[4]	3,021,200[5]	0	405,272	(13.4)	0	(0.0)	341	(< 0.1)	0	(0.0)	182	(< 0.1)	0	(0.0)
CYE	1,655,886[5]	873,230	1,338,763	(80.8)	873,230	(100.0)	6,855	(0.5)	12,246	(1.4)	6,174	(0.5)	12,122	(1.4)
GYE	5,899,789[5]	2,406,568	1,110,365	(18.8)	1,896,458	(78.8)	40	(< 0.1)	81,588	(4.3)	0	(0.0)	27,714	(1.5)
Total	**16,288,174[e]**	**5,738,886**	**8,565,699**	**(52.6)**	**5,228,776**	**(91.1)**	**211,374**	**(2.5)**	**254,475**	**(4.9)**	**154,201**	**(1.8)**	**112,711**	**(2.2)**

Note: Totals may not add up due to rounding.
1 NROH designation from Wittinger (2002).
2 Planning area includes all of the NWLO, SWLO, and CLO. Total acreage of lands in the planning area (all ownerships) = 39,412,232.
3 HCP project area includes all DNRC HCP-covered lands within the planning area.
4 The BE is currently not considered occupied by grizzly bears.
5 Includes some acreage outside of Montana and the planning area: 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.
Source: DNRC (2008a).

Distribution

The current distribution of grizzly bears in Montana is restricted to the western portion of the state in and around Glacier National Park, Yellowstone National Park, the Bob Marshall Wilderness, the Mission Mountains, Swan Valley, the Swan Mountains, and the Cabinet Mountains (Foresman 2001). On March 29, 2007, the USFWS published the final rule for the designation and delisting of the DPS of the Yellowstone population of grizzly bears (72 FR 14865-14938, March 29, 2007); in 2005 it was estimated that 546 bears occupied that ecosystem (72 FR 14865-14938, March 29, 2007, p. 14881).

In response to apparent increases in the NCDE population, an interagency project was undertaken recently to obtain a population estimate of grizzly bears in that ecosystem. This study, led by the USGS, is called the Northern Divide Grizzly Bear Project. Preliminary analysis of deoxyribonucleic acid (DNA) obtained from hair samples in 2007 identified 545 individual grizzly bears in the NCDE. A final population estimate of 765 grizzly bears for that ecosystem was presented by USGS biologists on September 16, 2008 (Kendall et al. 2009). The study also found that the occupied range of the grizzly bears now extends 2.6 million acres beyond the 1993 NCDE recovery zone boundary set by the USFWS in the Grizzly Bear Recovery Plan. The Recovery Plan recognized that grizzly bears would move and permanently reside in areas outside recovery zones (USFWS 1993). In April 2010, the first population trend estimate was announced for the NCDE, which indicated that the grizzly bear population grew at about 3 percent per year from 2004 to 2009 (Mace 2010, personal communication).

The CYE, with an apparently stable or decreasing population of 30 to 40 bears, is below the recovery goal of 70 bears (MFWP 2002a; Wakkinen and Kasworm 2004; U.S. District Court, District of Montana, Missoula Division Order No. CV 01-152-M-DWM; Kasworm et al. 2005; 70 FR 69853-69884, November 17, 2005; 72 FR 14865-14938, March 29, 2007). Some recent grizzly bear mortality in the CYE is higher than the population can sustain and is largely the result of human-caused mortality (U.S. District Court, District of Montana, Missoula Division Order No. CV 01-152-M-DWM).

The BE recovery zone is not currently occupied by bears (72 FR 14865-14938, March 29, 2007 p.14869).

Relationship of DNRC Trust Lands to Grizzly Bear Distribution

The relationship of DNRC trust lands to grizzly bear recovery zones and NROH is provided in Table 4.9-2. Trust lands make up ~~no more~~less than 3.6 percent of any recovery zone in Montana and ~~no more~~less than 6.5 percent of the NROH associated with any ecosystem. Of 154,201 acres of HCP project area lands that fall within recovery zones, 96 percent are in the NCDE recovery zone, and ~~only~~ 182 acres of HCP project area lands occur within the BE recovery zone. HCP project area lands make up 2.6 percent of the NCDE recovery zone and 0.5 percent of the CYE recovery zone. Lands within the Stillwater Block and Swan River State Forest make up most (130,372 acres) of the recovery zone lands within the HCP project area. For NROH, the planning area includes approximately 5.2 million acres (91 percent of the NROH in Montana), 254,475 acres of which are located on trust lands, and 112,711 acres of which are located in the HCP project area.

Risk Factors

Two major factors affecting grizzly bear recovery include (1) habitat loss and degradation and (2) bear-human conflicts, especially those resulting in grizzly bear mortality. Human presence in, and use of, grizzly bear habitat occurs in many forms.

In the Rocky Mountains, the overwhelming majority of adult grizzly bear deaths are caused by humans (Mace and Waller 1998; McLellan et al. 1999; Benn and Herrero 2002; Wakkinen and Kasworm 2004). Human-caused mortality can be classified into six major categories: (1) direct bear-human confrontations, (2) attraction of grizzly bears to improperly stored food and garbage, (3) careless livestock husbandry practices including failure to dispose of dead carcasses properly, (4) direct killing for the purpose of protecting livestock, (5) erosion of grizzly bear habitat, and (6) hunting (both lawful and illegal) (USFWS 1993).

Of 172 human-caused grizzly bear mortalities documented for the NCDE from 1999 to 2008, 34 percent were associated with management actions primarily related to human foods and livestock, 26 percent resulted from illegal killing (i.e., poaching/vandal killing) or mistaken identification by black bear hunters, 26 percent resulted from train or automobile collisions, 9 percent were from self defense, 3 percent were due to management trapping, and 2 percent were associated with a human mortality (USFWS 2009).

Forest management practices are not a detectible source of grizzly bear mortality but have consequences to habitat effectiveness. Furthermore, roads used for forest management are also used by the public and sometimes indirectly contribute to grizzly bear mortality.

Relationship of Covered Activities to Grizzly Bear Risk Factors

The analysis for this EIS focuses on risk factors that DNRC has the opportunity to affect and that are addressed directly or indirectly in the HCP as part of conservation commitments. These include (1) forest roads and associated human activity (including helicopter use), (2) physical alteration of habitat through timber harvest and other means, (3) livestock grazing, and (4) possibility of direct encounter by humans working in bear habitat.

Roads

The most pervasive and chronic effects on grizzly bears related to covered activities arise from the presence of roads and human activity associated with roads. Bears generally respond to roads and human presence in three ways: (1) they may be disturbed by human presence, suggesting a relatively short term – short distance response; (2) they may be displaced from roaded areas, suggesting an avoidance response and movement to another area; or (3) they may become habituated to human activities and roads but then expose themselves to a greater probability of encounter with humans.

Throughout most of their range in Canada and the contiguous United States, grizzly bears have been found to use areas near open roads significantly less than expected (Jonkel 1982; Hamer and Herrero 1983; McLellan and Shackleton 1988, 1989a; Nagy et al. 1989; Heinrich et al. 1995). The federal *Grizzly Bear Recovery Plan* (USFWS 1993) devotes considerable attention to the harmful effects of roads on grizzly bears, concluding that increased human access on open roads and continued human use of closed roads have overall detrimental effects on grizzly bear populations.

In the *Biological Opinion on the Swan Valley Grizzly Bear Conservation Agreement,* the USFWS (1995), stated that roads and excessive road densities have been among the most serious adverse impacts of timber harvest on grizzly bears. The USFS (1982) indicated that a viable road and access management plan is "the most important factor influencing the long-term impacts on grizzly bears in habitat influenced by timber harvesting."

Many researchers have documented avoidance of roads and roaded areas by grizzly bears, as well as other negative impacts to grizzly bears caused by roads in Montana. Aune and Kasworm (1989), for example, found 63 percent of all known human-caused grizzly bear mortalities occurred within 0.6 mile of a road, including 10 to 11 known female mortalities. While the roads did not directly cause the mortality, they increased the probability and frequency of bear-human encounters, which sometimes resulted in the death of grizzly bears. Mattson (1993) documented that grizzly bears consistently under-used habitat within 300 to 1,600 feet of roads in the Yellowstone area, regardless of the road class (paved versus unpaved) and even at low levels of traffic (0.5 to 1.9 vehicles per hour). In the Swan Mountains, Mace et al. (1996 and 1999) found grizzly habitat use decreased as total road density increased. In this study, it was difficult to attribute direct effects on survival to roads; only 1 of 12 documented deaths of grizzly bears occurred in multiple-use areas (public land used for forestry, recreation, etc.), and annual mortality rate (accounting for variable exposure time) for bears using private lands in addition to multiple use lands was almost 20 times higher than for bears using only multiple-use lands (Mace and Waller 1998). Kasworm and Manley (1998) and Mace et al. (1999) also documented significant grizzly bear avoidance of habitats in proximity to roads in the Cabinet Mountains and NCDE, respectively. When bears avoid roads, they forgo the resources near the roads, or may be displaced into competition with other bears, or conflicts with humans.

Helicopter Use

On an infrequent basis, 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 harvested in this manner are typically material of high value because helicopter yarding is more expensive to accomplish than traditional ground yarding methods. On rarer occasions, DNRC may use helicopters to accomplish various other short-duration 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 one to three projects per year statewide) (Baty 2010, personal communication) and are of short duration (i.e., 1 to 2 days of operating time). While helicopter use for forest management overall is infrequent on DNRC lands, associated disturbance can have adverse effects on grizzly bears. Use of helicopters can also be beneficial for land managers because their use can serve to lessen the amount of roads needed on the landscape (particularly in sensitive, rugged areas), they can accomplish timely broadcast applications that minimize the duration of the disturbance, and they can lessen risk associated with ground crews (e.g., seeding, weed spraying) operating in grizzly bear habitat for days or weeks at a time, thereby reducing risk of bear-human encounters. Due to safety considerations, helicopter use occurs only during daylight hours.

However, similar to other motorized ground activities, helicopter flights have the potential to disturb grizzly bears. Situations involving effects on grizzly bears caused by aerial flights have not been extensively studied (USFS and USFWS 2009); however, there is general agreement that helicopters create audible temporary disturbance that can influence bears, but without the longer lasting effects associated with roads. Thus, disturbance to grizzly bears caused by helicopters does not typically result in the same degree of effect as permanent roads or other developments (USFS and USFWS 2009). Research findings regarding helicopter disturbance related to grizzly bears have been variable (USFS and USFWS 2009), and the magnitude of the response exhibited by observed bears can be influenced by a number of factors, including differences in individual bear behavior, the degree of habituation of individual bears, and the amount of cover in the landscape being evaluated (McLellan and Shackleton 1989b). Depending upon the cover present, degree of human use in an area, and their individual behavior, bears may respond by (1) fleeing a great distance (1 kilometer [0.6 mile] or more), (2) running to nearby cover, (3) walking away, or (4) standing still.

McLellan and Shackleton (1989b) noted that, in general, their study bears responded more strongly to disturbance when in open habitat than did bears in areas with greater cover. They also observed that the presence of cover could bias the observability of individual bears, creating uncertainty in actual detection responses. Consistent with the findings of Jope (1985), McLellan and Shackleton (1989b) also observed elevated disturbance responses by bears in areas with inherently low human use than for those areas where human activity was common, suggesting that habituation may have lessened observed reactions in some bears. They also noted that in a similar northern research project (Harding and Nagy 1980), study bears had been chased and captured using helicopters, which may have elicited greater observed hiding or fleeing responses in those individuals with past experiences with humans. Similarly, observed responses of bears to foot traffic suggest that greater reactions by bears may often be more common in areas rarely visited by people than in areas where human use is inherently higher (Jope 1985; McLellan and Shackleton 1989b). McLellan and Shackleton (1989b) further noted that humans on foot elicited the greatest reaction from bears than any other disturbance type they studied, particularly when it occurred in areas rarely frequented by humans.

Grizzly bears have demonstrated sensitivity to both fixed-wing aircraft and helicopter flights, but they may be more sensitive to helicopter disturbance (IGBC 1987). Harding and Nagy (1980) observed greater responses by bears to helicopters and documented the potential for abandonment of dens where flights were low and nearby. Reynolds et al. (1986) found that fixed-wing flights over dens at more than 500 meters (1,640 feet) above ground level had little measurable effect on the heart rates of bears in dens; however, when flights were 100 to 150 meters (330 to 500 feet) above the dens, notable increases in heart rates occurred, particularly near the period of den emergence. Schoen et al. (1987) also noted that their sample of denning bears with motion sensing transmitters increased their activity while in the den following small fixed-wing flights occurring 150 meters (500 feet) above the dens.

Vegetation Changes

Forest management physically changes vegetation through timber harvest or prescribed burning. The response of grizzly bears to the physical changes of logging (including salvage harvest and pre-commercial thinning) is mixed and complex (Zager et al. 1983; Waller and Mace 1997a,b; McLellan and Hovey 2001) because treatments, post-treatments, cover types, and habitat types vary, and because logging is inevitably associated with roads and increased human activity, which tends to disturb or displace grizzly bears. A review by Moss and Lefranc (1987) found that, while many studies documented reduced grizzly bear use of logged areas (e.g., Mace and Jonkel 1980; Zager et al. 1983; McLellan 1990a), others reported no evidence that vegetation changes resulting from timber harvest significantly impacts grizzly bears (e.g., Meehan 1974; Zager 1980). Alterations in timber cover can affect the quality of grizzly food and cover (Blanchard 1983; USFS 1985), causing bears to change their use of an area. East of the Continental Divide in the GYE, Anderson (1994) found that production of two species of huckleberries was lower in clearcuts than in similar uncut stands.

The manner in which logging slash is controlled or disposed may physically hinder bear use in an area or may limit the establishment of bear forage (Bratkovich 1986). Zager et al. (1983) found that 15- to 35-year-old clearcuts with slash piled by a bulldozer had lower canopy coverage of preferred summer grizzly bear plant foods than those with no slash or those that had been burned. Broadcast burns can encourage the growth of fruiting shrubs that are preferred forage for grizzly bears in the fall (Martin 1983; Zager et al. 1983; Bratkovich 1986; Moss and Lefranc 1987; Hamilton 2000). Results from Martin (1983) suggested that light-intensity, post-harvest burning could stimulate production of blue huckleberry (*Vaccinium globulare)*, an important summertime fruit producer for grizzly bears on certain sites.

Livestock Grazing

The impacts to grizzly bears from agriculture and livestock were summarized by Harting (1987) into five classes:

- **Direct loss.** Mortality or loss of grizzly bears through control actions, relocations, or illegal kills associated with livestock allotments, ranching, or farming operations
- **Indirect loss.** Habituation of grizzly bears to human activity following attraction to livestock, livestock carrion, crops, etc., pre-disposing them to nuisance behavior elsewhere
- **Habitat loss.** Loss or modification due to grazing or other agricultural activity
- **Displacement.** Temporal or spatial displacement away from agricultural activity
- **Direct competition.** Competition with livestock for preferred forage species.

Grizzly bears are known to kill domestic sheep easily (Knight and Judd 1983), and specific individual bears learn to kill cattle calves as well (Anderson et al. 2002). Bears that kill livestock have a high rate of mortality caused by people.

DNRC has very few grazing licenses on very limited ownership in grizzly bear recovery zones (Table 4.9-3).

Humans Working in Bear Habitat

Generally, DNRC activities such as timber sale cruising and layout, site preparation, road maintenance include timber sale cruising and layout, site preparation, and road maintenance would not adversely impact grizzly bears. The effects of these non-motorized activities would most likely 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 short term disturbance or displacement due to creation of new roads or use of existing roads and adjacent management areas.

TABLE 4.9-3 ACREAGE OF GRAZING LICENSES AND LEASES ON TRUST LANDS WITHIN GRIZZLY BEAR RECOVERY ZONES AND NON-RECOVERY OCCUPIED HABITAT IN THE PLANNING AREA AND HCP PROJECT AREA, BY LAND OFFICE AND ADMINISTRATIVE UNIT FOR BLOCKED LANDS AND SCATTERED PARCELS

Land Offices and Unit Offices by Recovery Zone[2] (Scattered or Blocked Status)	Licenses on Trust Lands in the Planning Area[1]		Licenses in the HCP Project Area[1]		Leases on Trust Lands in the Planning Area[1]		Leases in the HCP Project Area[1]	
	Recovery Zone	Non-recovery Occupied Habitat[3]	Recovery Zone	Non-recovery Occupied Habitat[3]	Recovery Zone	Non-recovery Occupied Habitat[3]	Recovery Zone	Non-recovery Occupied Habitat[3]
NWLO	**4,928**	**9,395**	**4,198**	**7,879**	**0**	**613**	**0**	**273**
Kalispell Unit NCDE (Scattered)	2,454	632	2,137	584	0	117	0	117
Libby Unit CYE (Scattered)	0	3,346	0	3,346	0	0	0	0
Plains Unit CYE (Scattered)	1	651	1	651	0	0	0	0
Plains Unit NCDE (Scattered)[6]	N/A	786	N/A	786	N/A	210	N/A	156
Stillwater Unit NCDE (Blocked)[4]	2,139	N/A	2,061	N/A	0	N/A	0	N/A
Stillwater Unit NCDE (Scattered)	335	3,972	0	2,509	0	0	0	0
Swan Unit NCDE (Blocked)[6]	0	N/A	0	N/A	0	N/A	0	N/A
Swan Unit NCDE (Scattered)[6]	0	N/A	N/A	N/A	0	N/A	N/A	N/A
SWLO	**5,663**	**29,598**	**4,142**	**25,033**	**0**	**5,250**	**0**	**1,718**
Anaconda Unit NCDE (Scattered)[6]	N/A	4,070	N/A	4,070	N/A	638	N/A	0
Clearwater Unit NCDE (Scattered)	5,663	25,528	4,142	20,963	0	4,613	0	1,718
Hamilton Unit BE (Scattered)[5,6]	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A
Missoula Unit BE (Scattered)[5,6]	0	N/A	0	N/A	0	N/A	0	N/A
Missoula Unit NCDE (Scattered)	0	0	0	0	0	0	0	0
CLO	**639**	**7,102**	**639**	**5,605**	**49,642**	**136,804**	**0**	**21,729**
Bozeman Unit GYE (Scattered)[6]	0	3,465	N/A	3,166	0	14,320	N/A	2,781
Conrad Unit NCDE (Scattered)[6]	0	0	N/A	N/A	30,539	45,293	N/A	N/A
Dillon Unit GYE (Scattered)[6]	N/A	1,838	N/A	640	N/A	57,559	N/A	18,868
Helena Unit NCDE (Scattered)	639	1,799	639	1,799	19,104	19,631	0	80
Total	**11,231**	**46,094**	**8,979**	**38,517**	**49,642**	**142,667**	**0**	**23,721**

[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 lease area.
[2] NCDE = Northern Continental Divide Ecosystem, CYE = Cabinet-Yaak Ecosystem, BE = Bitterroot Ecosystem, GYE = Greater Yellowstone Ecosystem.
[3] Non-recovery occupied habitat designation from Wittinger (2002).
[4] Includes the Coal Creek State Forest and majority of the Stillwater State Forest.
[5] The BE recovery zone is currently not considered occupied by grizzly bears.
[6] N/A = not applicable. Where N/A is listed in the table, there is no such land area in the given unit.
Source: DNRC (2008a).

There has not been a case of a DNRC employee or its contractor, having a direct conflict with a grizzly bear.

Life History

Generally solitary, grizzly bears avoid one another, except during the mating season when male and female 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 bears. 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 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 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, bears increase their food intake dramatically and may gain as much as 3.64 pounds per day (Schwartz et al. 2003).

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). 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 bears have one of the lowest reproductive rates among terrestrial mammals. Grizzly bear females cease breeding successfully some time in their mid to late 20s (Schwartz et al. 2003).

Grizzly bears are opportunistic omnivores and will eat fish, berries, grasses, leaves, insects, roots, carrion, small mammals, fungi, nuts, and ungulates. The 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 1997a; McLellan and Hovey 2001).

Habitat Requirements

Grizzly bears are habitat generalists. Key habitat requirements include the availability of food, security (from humans and other bears), and den sites (Archibald et al. 1987; Harting 1987; Heinrich et al. 1995; Mace et al. 1996, 1999; Linnell et al. 2000) (Table 4.9-4). 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 bears would prefer to feed under cover.

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 (2004 Grizzly Bear Species Account 2004 available at http://dnrc.mt.gov/HCP/). 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 bears (USFWS 1993:2).

TABLE 4.9-4. 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 (1997a).
[2] Archibald et al. (1987); Kasworm and Manley (1990); Mace et al. (1996); Mace et al. (1999); Mattson et al. (1987); McLellan and Shackleton (1988,1989a); 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).

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 bears include avalanche chutes (Zager et al. 1980; Mace et al. 1996; Waller and Mace 1997a; 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 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 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. Grizzly bear foraging habitat associated with riparian areas and shrub fields is scattered throughout the planning area and the HCP project area.

When 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 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. For this analysis, therefore, spring habitat is defined as all areas below 4,900 feet elevation, except in the Swan River State Forest. In that area, spring habitat is defined as all areas below 5,200 feet elevation.

Waller and Mace (1997a) defined the spring period as the period from den exit to July 15 based on apparent changes in food habitats and behavior. For the proposed grizzly bear conservation strategy, the spring period is defined for the Stillwater Block as April 1 through June 15 for non-spring habitat and April 1 through June 30 for areas within spring habitat. For lands within the Swan River State Forest and DNRC scattered parcels, the spring period is defined as April 1 through June 15. These dates were selected to balance DNRC operational needs with the security needs of bears. The June 15 date is consistent with current management 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 Technical 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 15 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 elevation by bears after mid-June.

Spring habitat is available on blocked lands and scattered parcels throughout the planning area and the HCP project area. Spring habitat on HCP project area lands accounts for approximately 3 percent of the spring habitat in the recovery zones and NROH in the planning area. More than 80 percent of the spring habitat in the HCP project area occurs in the NWLO (Table 4.9-5).

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, 1989a; Kasworm and Manley 1990; Mace et al. 1996, 1999).

Human activities can result in direct mortality of bears, as well as indirect negative effects by displacing 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). The most effective way to minimize the risk of adverse interactions between humans and bears is to provide spatial separation between areas of human activity and areas of bear activity. In areas where such separation is not possible, providing large areas of secure habitat that include seasonal habitats may reduce the potential for contact and minimize risk of disturbance and illegal mortality (Mace and Waller 1998).

While security cover is necessary primarily to allow grizzly bears to avoid contact with humans, the cover is sometimes necessary for bears to avoid contact with other bears. Strict territoriality among grizzly bears is not documented, and intra-specific (grizzly-to-grizzly) defense behavior generally tends to result from defense of limited food concentrations, defense of young, and surprise encounters (USFWS 1993:2). Adult male bears are known to kill juveniles, and adults also occasionally kill other adults. ~~Specifically, f~~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 bears by adult 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 landscape features, are commonly used as security from humans or other bears (McLellan and Hovey 2001; Wielgus et al. 2002), and dispersing subadult bears may be forced to choose poor home ranges that may be equally dangerous to their survival (USFWS 1993:5).

TABLE 4.9-5. ACREAGE OF GRIZZLY BEAR SPRING HABITAT IN THE PLANNING AREA AND HCP PROJECT AREA, FOR RECOVERY ZONES AND NON-RECOVERY OCCUPIED HABITAT, BY LAND OFFICE AND ADMINISTRATIVE UNIT FOR BLOCKED LANDS AND SCATTERED PARCELS

	Spring Habitat in the Planning Area (all ownerships)[1]		Spring Habitat on Trust Lands in the Planning Area[1]		Spring Habitat in the HCP Project Area	
Land Offices and Unit Offices by Recovery Zone[2] (Scattered or Blocked Status)	Recovery Zone	Non-recovery Occupied Habitat[3]	Recovery Zone	Non-recovery Occupied Habitat[3]	Recovery Zone	Non-recovery Occupied Habitat[3]
NWLO	**1,978,549**	**1,271,156**	**97,478**	**46,953**	**95,198**	**35,225**
Kalispell Unit NCDE (Scattered)	107,640	207,760	7,106	6,375	6,580	4,512
Libby Unit CYE (Scattered)	566,262	449,752	2,832	9,904	2,832	9,779
Plains Unit CYE (Scattered)	250,149	249,584	3,193	2,311	3,011	2,257
Plains Unit NCDE (Scattered)[4]	N/A	25,191	N/A	1,807	N/A	N/A
Stillwater Unit NCDE (Blocked)[4,5]	48,649	53	48,649	53	48,571	48
Stillwater Unit NCDE (Scattered)	467,628	338,817	3,493	26,502	2,467	16,822
Swan Unit NCDE (Blocked)[4]	31,871	N/A	31,871	N/A	31,738	N/A
Swan Unit NCDE (Scattered)[4]	506,351	N/A	335	N/A	N/A	N/A
SWLO	**67,945**	**372,734**	**2,756**	**37,796**	**2,094**	**28,455**
Anaconda Unit NCDE (Scattered)[4]	N/A	8,126	0	0	0	0
Clearwater Unit NCDE (Scattered)	32,205	363,038	2,324	36,088	1,821	28,306
Hamilton Unit BE (Scattered)[4,6]	5,344	N/A	N/A	N/A	N/A	N/A
Missoula Unit BE (Scattered)[4,6]	25,833	N/A	340	N/A	181	N/A
Missoula Unit NCDE (Scattered)	4,564	1,569	92	1,708	92	149
CLO	**381,517**	**786,427**	**30,604**	**66,556**	**4**	**91**
Bozeman Unit GYE (Scattered)	N/A	29,857	0	0	N/A	0
Conrad Unit NCDE (Scattered)[4]	310,793	596,481	20,164	46,841	N/A	N/A
Dillon Unit GYE (Scattered)[4]	N/A	0	N/A	0	N/A	0
Helena Unit NCDE (Scattered)	70,723	160,089	10,439	19,715	4	91
Total	**2,428,010**	**2,430,316**	**130,838**	**151,305**	**97,296**	**63,772**

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 and the row identifier as scattered vs. blocked should be ignored. "Spring habitat" is defined as all areas below 5,200 feet elevation for the Swan Unit and all areas below 4,900 feet elevation for other lands.
2 NCDE = Northern Continental Divide Ecosystem, CYE = Cabinet-Yaak Ecosystem, BE = Bitterroot Ecosystem, GYE = Greater Yellowstone Ecosystem.
3 NROH designation from Wittinger (2002).
4 N/A = not applicable. Where N/A is listed in the table, there is no such land area in the given unit.
5 Includes the Coal Creek State Forest and majority of the Stillwater State Forest.
6 The BE recovery zone is currently not considered occupied by grizzly bears.
Source: DNRC (2008a).

There are no broadly accepted USFWS or IGBC standards related to grizzly bear 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. For this analysis, security cover adequate to reduce visual detection by humans has been defined as vegetation or topography that hides 90 percent of a grizzly bear from view at the distance of 200 feet (DNRC 2008i).

Table 4.9-6 shows existing forested hiding cover on DNRC lands in the planning area and the HCP project area for recovery zones and NROH. Cover amounts provided by geographic features were not included in this analysis. Most of the forested cover on DNRC lands in the planning area occurs within the HCP project area, specifically the NWLO. Within the NWLO, most of the cover is located on blocked lands within the Stillwater Block and Swan River State Forest.

Another key habitat requirement for grizzly bears is the presence of suitable denning habitat. 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).

The literature on disturbance and impacts to 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. 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.

For this analysis, post-denning habitat is defined as all areas that occur on sites with slopes greater than 45 percent at elevations greater than 6,300 feet (Mace and Waller 1997:41). Methods for this analysis are described in DNRC (2008i). Of 1.8 million acres of post-denning habitat in recovery zones and NROH in the planning area, less than 11,000 acres (0.6 percent) occur on trust lands (Table 4.9-7). The HCP project area contains 5,863 acres of post-denning habitat within recovery zones (mostly on blocked lands in the NWLO) and 2,989 acres in NROH (mostly within the CLO).

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

TABLE 4.9-6. ACREAGE OF FORESTED GRIZZLY BEAR HIDING COVER AND ACREAGE OF NON-HIDING COVER ON TRUST LANDS WITHIN THE PLANNING AREA

	Trust Lands in the Planning Area				HCP Project Area			
	Recovery Zone		Non-recovery Occupied Habitat[3]		Recovery Zone		Non-recovery Occupied Habitat[3]	
Land Offices and Unit Offices by Recovery Zone[2] (Scattered or Blocked Status)	**Acres of Hiding Cover[1]**	**% of Total Recovery Zone in Hiding Cover**	**Acres of Hiding Cover**	**% of Total Recovery Zone in Hiding Cover**	**Acres of Hiding Cover**	**% of Total Recovery Zone in Hiding Cover**	**Acres of Hiding Cover**	**% of Total Recovery Zone in Hiding Cover**
NWLO	**104,688**	**(70.3)**	**31,727**	**(64.1)**	**103,248**	**(70.7)**	**24,966**	**(66.1)**
Kalispell Unit NCDE (Scattered)	6,230	(82.0)	6,131	(78.3)	5,989	(84.6)	4,467	(74.9)
Libby Unit CYE (Scattered)	1,763	(61.6)	5,905	(59.1)	1,763	(61.6)	5,831	(59.1)
Plains Unit CYE (Scattered)	3,248	(81.3)	1,342	(59.5)	2,629	(79.3)	1,342	(59.5)
Plains Unit NCDE (Scattered)[4]	N/A	N/A	2,313	(80.9)	N/A	N/A	2,313	(82.4)
Stillwater Unit NCDE (Blocked)[4]	60,020	(66.1)	N/A	N/A	59,956	(66.1)	N/A	N/A
Stillwater Unit NCDE (Scattered)	2,047	(58.2)	16,036	(60.4)	1,789	(71.7)	11,013	(65.3)
Swan Unit NCDE (Blocked)[4]	31,150	(78.2)	N/A	(0.0)	31,121	(78.4)	N/A	(0.0)
Swan Unit NCDE (Scattered)[4]	230	(68.9)	N/A	(0.0)	N/A	N/A	N/A	(0.0)
SWLO	**4,876**	**(53.0)**	**23,739**	**(46.7)**	**4,000**	**(53.8)**	**20,527**	**(49.6)**
Anaconda Unit NCDE (Scattered)[4]	N/A	N/A	3,376	(63.1)	N/A	N/A	3,114	(66.1)
Clearwater Unit NCDE (Scattered)	3,179	(49.8)	20,342	(45.4)	2,397	(50.1)	17,393	(48.3)
Hamilton Unit BE (Scattered)[4,5]	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A
Missoula Unit BE (Scattered)[4,5]	145	(42.6)	N/A	N/A	52	(28.5)	N/A	N/A
Missoula Unit NCDE (Scattered)	1,552	(62.6)	20	(03.2)	1,552	(62.6)	20	(03.2)
CLO	**5,311**	**(10.0)**	**12,614**	**(8.2)**	**231**	**(36.1)**	**10,320**	**(30.7)**
Bozeman Unit GYE (Scattered)[4]	0	(0.0)	5,242	(24.5)	N/A	N/A	4,711	(57.9)
Conrad Unit NCDE (Scattered)[4,6]	4,480	(13.4)	0	(0.0)	N/A	N/A	N/A	N/A
Dillon Unit GYE (Scattered)	N/A	N/A	3,932	(06.5)	N/A	N/A	2,214	(11.3)
Helena Unit NCDE (Scattered)	831	(04.2)	3,440	(13.3)	231	(36.1)	3,394	(57.2)

[1] See DNRC (2008i) for methods used to calculate grizzly bear hiding cover.
[2] NCDE= Northern Continental Divide Ecosystem, CYE = Cabinet-Yaak Ecosystem, BE = Bitterroot Ecosystem, GYE = Greater Yellowstone Ecosystem.
[3] NROH designation from Wittinger (2002).
[4] N/A = not applicable. Where N/A is listed in the table, there is no such land area in the given unit.
[5] The BE recovery zone is currently not considered occupied by grizzly bears.
[6] All lands on this unit occur outside of the HCP project area.
Source: DNRC (2008a).

TABLE 4.9-7. ACREAGE OF GRIZZLY BEAR POST-DENNING HABITAT ON DNRC BLOCKED LANDS AND SCATTERED PARCELS WITHIN THE PLANNING AREA AND HCP PROJECT AREA, FOR RECOVERY ZONES AND NON-RECOVERY OCCUPIED HABITAT, BY LAND OFFICE

	Post-denning Habitat in the Planning Area (all ownerships)[1]		Post-denning Habitat on Trust Lands in the Planning Area		Post-denning Habitat in the HCP Project Area	
Land Office and Unit Office by Recovery Zone[2] (Scattered or Blocked Status)	**Recovery Zone**	**Non-recovery Occupied Habitat[3]**	**Recovery Zone**	**Non-recovery Occupied Habitat[3]**	**Recovery Zone**	**Non-recovery Occupied Habitat[3]**
NWLO	**536,696**	**2,895**	**5,764**	**52**	**5,764**	**52**
Stillwater Unit NCDE (Blocked)[4,5]	4,498	N/A	4,498	N/A	4,498	N/A
Swan Unit NCDE (Blocked)[4]	1,266	N/A	1,266	N/A	1,266	N/A
Scattered parcels (NCDE and CYE)	530,932	2,895	0	52	0	52
SWLO (NCDE and BE)[6,7]	**260,346**	**22,979**	**99**	**421**	**99**	**333**
CLO (NCDE and GYE)[7]	**589,744**	**435,856**	**623**	**3,945**	**0**	**2,604**
Total	**1,386,786**	**461,730**	**6,487**	**4,418**	**5,863**	**2,989**

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 and the row identifier as scattered vs. blocked should be ignored.
[2] NCDE= Northern Continental Divide Ecosystem, CYE = Cabinet-Yaak Ecosystem, BE = Bitterroot Ecosystem, GYE = Greater Yellowstone Ecosystem.
[3] NROH designation from Wittinger (2002).
[4] N/A = not applicable. Where N/A is listed in the table, there is no such land area in the given unit.
[5] Includes the Coal Creek State Forest and the blocked portion of the Stillwater State Forest that occurs within the NCDE.
[6] The BE recovery zone is currently not considered occupied by grizzly bears.
[7] Only scattered parcels, no blocked lands, are included in this land office.
Source: DNRC (2008a).

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 (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 federal *Grizzly Bear Recovery Plan* (USFWS 1993) called for the evaluation of linkage potential between grizzly bear recovery zones.

For this analysis, linkage in the planning area is qualitatively and quantitatively evaluated by considering three identified subsets of defined linkage zones or linkage areas: (1) those described by Servheen et al. (2001, 2003), (2) those identified in the Swan Agreement for the Swan River State Forest, and (3) additional potential zones within the planning area that were identified using methods developed by DNRC (2008i) that are similar to those used by Servheen et al. (2001) (Table 4.9-8; Figures D-18A through D-18C in Appendix D, EIS Figures). The DNRC 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. To compare the alternatives, the combination of the three methods identified above was deemed satisfactory for descriptive purposes.

The mapped zones in Figures D-18A through D-18C (Appendix D, EIS Figures) provide two important features: (1) they disclose the relationship of the HCP project area lands and non-project area lands in the planning area to areas estimated to have importance for linkage, and within those areas where the efforts of others have identified areas of importance for linkage; and (2) they provide a basis for understanding how impacts may or may not vary between the alternative management policy approaches being considered. No particular commitment to this map is being contemplated as part of this project or analysis.

More than 6 million acres of potential linkage are estimated to occur in the planning area (Table 4.9-9). Approximately 318,141 acres (5 percent) are on trust lands, of which 123,513 acres (2 percent) lie within the HCP project area (Table 4.9-9). Within the HCP project area, the majority of the potential linkage habitat occurs in the NWLO (Tables 4.9-8 and 4.9-9).

Effects of and Trends in Climate Change

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. To a large extent, the types of potential effects of climate change on grizzly bears are expected to be similar to those for wildlife species in general (see Section 4.9.7.3, Other Wildlife Species – Effects of and Trends in Climate Change, below). At this time, the scope and scale of such changes are unknown, and the effects (positive or negative) on bears would likely be variable across the landscape.

TABLE 4.9-8. ACREAGE OF POTENTIAL HABITAT LINKAGE ON TRUST LANDS WITHIN THE PLANNING AREA AND HCP PROJECT AREA, BY LAND OFFICE AND ADMINISTRATIVE UNIT

	Acreage of Habitat Linkage Identified by Servheen et al. (2003)		Acreage of Habitat Linkage Identified in the Swan Agreement		Acreage of Habitat Linkage using DNRC Methodology in Remainder of the Planning Area		Total Acreage of Habitat Linkage on Trust Lands in the Planning Area and HCP Project Area	
Land Office and Administrative Unit Office	**Servheen et al. portion of Trust Lands in Planning Area**	**Servheen et al. portion of HCP Project Area**	**Swan Agreement portion of Trust Lands in Planning Area**	**Swan Agreement portion of HCP Project Area**	**Remainder of Trust Lands in Planning Area**	**Remainder of HCP Project Area**	**Trust Lands in Planning Area**	**HCP Project Area**
NWLO	**32,655**	**31,862**	**19,821**	**19,817**	**24,876**	**19,970**	**77,352**	**71,650**
Kalispell Unit	0	0	0	0	7,665	5,387	7,665	5,387
Libby Unit	0	0	0	0	0	0	0	0
Plains Unit	643	643	0	0	2,243	557	2,886	1,200
Stillwater Unit	32,012	31,219	0	0	9,841	8,899	41,853	40,118
Swan Unit	0	0	19,821	19,817	5,127	5,127	24,948	24,944
SWLO	**6,778**	**4,882**	**0**	**0**	**54,901**	**38,977**	**61,679**	**43,859**
Anaconda Unit	0	0	0	0	21,453	10,651	21,453	10,651
Clearwater	0	0	0	0	19,517	15,480	19,517	15,480
Hamilton Unit	0	0	0	0	8,337	7,697	8,337	7,697
Missoula Unit	6,778	4,882	0	0	5,595	5,149	12,373	10,031
CLO	**0**	**0**	**0**	**0**	**179,110**	**8,004**	**179,110**	**8,004**
Bozeman Unit	0	0	0	0	36,615	4,043	36,615	4,043
Conrad Unit[1]	0	N/A	0	N/A	39,207	N/A	39,207	N/A
Dillon Unit	0	0	0	0	41,114	952	41,114	952
Helena Unit	0	0	0	0	62,174	3,010	62,174	3,010
Total	**39,433**	**36,744**	**19,821**	**19,817**	**258,887**	**66,951**	**318,141**	**123,513**

[1] All lands in this unit occur outside to the HCP Project Area.
Source: DNRC (2008a). See DNRC (2008i) for methodology.

TABLE 4.9-9. ACREAGE OF POTENTIAL HABITAT LINKAGE (DNRC MODEL) WITHIN THE PLANNING AREA, BY LAND OWNERSHIP

	Habitat Linkage within the Planning Area	
Ownership[1]	**Acres**	**Percent of Total[2,3]**
USFS	1,746,661	27.7
BLM	153,578	2.4
NPS	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[4]	1.1
SWLO	43,859[4]	0.7
CLO	8,004[4]	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] USFS = U.S. Forest Service, BLM = Bureau of Land Management, NPS = National Park Service.
[2] Numbers may not sum to total due to rounding.
[3] 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).
[4] These values add up to the total in "HCP Project Area" row. These three land offices total all HCP project area lands in planning area with potential linkage.
Source: DNRC (2008a). See DNRC (2008i) for methodology.

As discussed in Section 4.1, Climate, research is underway in many regions, including the planning area, to document the effects on wildlife and wildlife habitat from a changing climate. Some specific observations concerning how this species may respond to potential climatic changes are provided below.

- Decreased winter mortality of large ungulates such as elk could reduce the availability of carrion, reducing the availability of this food source during later winter and early spring (Wilmers and Getz 2005).

- An important food for grizzly bears in the GYE is seeds from the whitebark pine, which is in decline (Logan and Powell 2001; Saunders et al. 2008; also see the discussion in Section 4.9.7.3, Other Wildlife Species – Effects of and Trends in Climate Change, below). In years of poor whitebark pine cone production, bear-human conflicts and bear deaths in the GYE increase (Mattson et al. 1992; IGBST 2010). In addition, death rates of mature grizzly bears in the GYE nearly double during years when pine seed crops are small compared to years when they are large (Pease and Mattson 1999). Compared to females that consume few pine seeds, females in the GYE that use whitebark pine seeds extensively reproduce at an earlier age, produce litters more frequently, and produce more three-cub litters (Mattson 2000).

4.9.3.2 Environmental Consequences

As described above, bears can be affected in a number of ways by the forest management activities considered for coverage under the HCP. Broadly, these effects fall into the categories of (1) effects caused by roads, (2) risk of bear-human conflicts, and (3) habitat modification. The following subsections discuss these potential effects and describe the following for each: (1) the criteria by which the effects of the alternatives are evaluated, (2) the rationale for those criteria, and (3) the relative effects of the alternatives. 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.

The aquatic conservation strategies and the lynx conservation strategy are discussed in these sections as appropriate when commitments overlap those of the grizzly bear.

Road-related Effects

A key indicator of security and isolation from humans is the presence and use of roads. Roads, along with the activities associated with road construction, gravel pits, off-road vehicle access, snowmobile access, and other motorized and non-motorized recreation, can affect grizzly bears both directly and indirectly in terms of disturbance, displacement, habituation, and increased risk of mortality as described above. Road amounts on DNRC ownership have largely resulted from past projects and activities necessary to generate revenue for trust beneficiaries. Also, some existing roads on trust lands today were acquired through purchase or exchange with other landowners. Actions resulting in access development have included (but are not limited to) timber harvesting, cabin or home site access, utility easements, easements to access private property, and agriculture and grazing management. Roads developed to access timberlands decades ago were occasionally built in very high densities. Current Forest Management ARMs provide guidelines to minimize road construction and road access (Table E4-8 in Appendix E, EIS Tables).

Increasing numbers of people are using trust lands for non-motorized and motorized recreation, such as snowmobiling, hiking, camping, and swimming in creeks, rivers, and lakes, as well as hunting and fishing. All uses of forestlands, including DNRC staff use of roads closed to public access, can reduce the amount of area available to grizzly bears (as well as other species sensitive to human disturbance), depending on location of these activities, season of use, and other factors. Animals disturbed by human presence may flee from areas that provide vital habitat (e.g., den sites, key foraging areas during critical times of the year), interfering with activities essential to survival and possibly putting themselves or their young at an increased risk of predation (Claar et al. 2003; Ruediger et al. 2000).

Road density is a measure commonly used to assess the effects of roads on grizzly bears. Accounting for road density allows managers to monitor changes in the amount of roads in critical bear habitat, such as spring foraging habitat. However, the effects of roads on bears vary by location and management activities (MFWP 2002a).

For this analysis, two distinct methods for calculating road density were used to evaluate the impacts of the alternatives on grizzly bears. In areas of blocked lands, where DNRC manages large, contiguous blocks of land and can control the types of activities that occur on those lands (Stillwater Block and Swan River State Forest), a "moving windows" analysis was used to calculate road density (USFS 1995c). Elsewhere, where trust lands occur as scattered parcels, road density was calculated as miles of road per square mile of land area (i.e., the simple linear road density calculation, mi/mi^2). Of 154,201 acres of HCP project area lands in the recovery zones, about 85 percent occur on blocked lands (Table 4.9-10).

The preferred method of road density calculation, recommended by the IGBC where applicable, is a GIS-based moving windows analysis (USFS 1995c). This method considers the spatial location of roads in relation to one another, and is commonly used to assess impacts associated with road density on species such as grizzly bears. For wide-ranging species, this method is preferred for assessing impacts at large scales (USFS 1995c), and for grizzly bears, the scale of assessment is approximately 50 square miles, the minimum size of a female grizzly bear home range. This methodology also provides land managers with the ability to create density contour maps for visually assessing effects and understanding where the greatest road density occurs. In this way, moving windows analysis provides more than just a simple density estimate over a given area (USFS 1995c). Results are summarized as the proportion of an analysis area in variously defined density classes (e.g., less than 1 mi/mi^2, between 1 and 2 mi/mi^2, more than 2 mi/mi^2). Moving windows analysis requires input of an adequate road layer, an adequate trail layer, and a defined analysis area.

In the Stillwater and Swan Units, road density is analyzed at the level of BMU subunits, which is the analysis unit ~~preferred~~used by the USFWS. A BMU is an area in which the yearlong habitat needs of both male and female grizzly bears can be met. BMUs in the NCDE (which encompasses the Stillwater and Swan Units) are about 400 square miles in size. A BMU subunit represents the approximate size of an average annual female home range (about 50 square miles), generally delineated from ridge top to valley bottom and encompassing all seasonal habitats (USFS 1995a). For this programmatic analysis, analyzing potential effects at the scale of the affected grizzly bear subunits provides a consistent approach for quantifying and comparing effects of the alternatives at an appropriate scale that accounts for home range-sized areas potentially usable by female grizzly bears. Using analysis units of considerably greater size than grizzly bear subunits can result in an observed "dilution" of potential effects to individual bears that may occupy such areas.

An alternative method of assessing road density is simple linear calculation, which is used for scattered parcels for this analysis because road data for trust lands and adjacent lands is limited. Many scattered parcels are less than or equal to one square mile in size (640 acres) surrounded by a matrix of other ownerships, often national forest lands. Using this method, the total miles of road in the analysis area is divided by the total size of an analysis area (in square miles). This method does not allow a spatial assessment of the amount and distribution of different density classes in an analysis area, but it does provide suitable surrogate estimates of density useful for comparison. Results calculated through this method are not directly comparable to those calculated through moving windows analysis. Anticipated changes in linear road density under the alternatives, however, can serve as an indicator of potential road-related effects on grizzly bears in scattered parcels. These estimates can be used to evaluate the likely broad-scale effects of the various conservation strategy approaches. An important consideration using the linear method is the size of the analysis area. As the size of a particular analysis area grows smaller, the road density for that area may be skewed toward larger values. For example, a 1-mile length of road crossing a 1-square-mile parcel (1 mile on each side) produces a road density of 1 mi/mi^2. If each side of that parcel is

TABLE 4.9-10. ACREAGES OF LANDS IN GRIZZLY BEAR RECOVERY ZONES AND ASSOCIATED NON-RECOVERY OCCUPIED HABITAT IN THE PLANNING AREA AND HCP PROJECT AREA BY LAND OFFICE AND ADMINISTRATIVE UNIT FOR BLOCKED LANDS AND SCATTERED PARCELS, BY RECOVERY ZONE

Land Office and Recovery Zone[1] (Scattered or Blocked Status)	Recovery Zone in the Planning Area (All Ownerships)[2]	Non-recovery Occupied Habitat in the Planning Area (All Ownerships)[2,3,4]	Recovery Zone on Trust Lands in the Planning Area[2]	Non-recovery Occupied Habitat on Trust Lands in the Planning Area[4]	Recovery Zone in the HCP Project Area	Non-recovery Occupied Habitat in the HCP Project Area[4]
NWLO Subtotal	**4,626,501**	**1,615,487**	**148,895**	**49,436**	**146,120**	**37,718**
Kalispell Unit NCDE (Scattered)	216,467	300,781	7,603	7,828	7,079	5,965
Libby Unit CYE (Scattered)	914,265	587,602	2,861	9,989	2,861	9,865
Plains Unit CYE (Scattered)	424,498	285,628	3,994	2,257	3,313	2,257
Plains Unit NCDE (Scattered)	0	45,992	0	2,860	0	2,806
Stillwater Unit NCDE (Blocked)[7]	1,193,803	0	90,751	0	90,673	0
Stillwater Unit NCDE (Scattered)		395,449	3,519	26,502	2,494	16,826
Swan Unit NCDE (Blocked)	1,877,468	0	39,833	0	39,699	0
Swan Unit NCDE (Scattered)		34	334	0	0	0
SWLO Subtotal	**961,438**	**821,552**	**9,199**	**50,816**	**7,442**	**41,348**
Anaconda Unit NCDE (Scattered)	0	141,430	0	5,347	0	4,709
Clearwater Unit NCDE (Scattered)	475,615	655,416	6,379	44,821	4,781	35,990
Hamilton Unit BE (Scattered)[5]	299,700	0	0	0	0	0
Missoula Unit BE (Scattered)[5]	105,572	0	341	0	182	0
Missoula Unit NCDE (Scattered)	80,551	24,707	2,478	648	2,478	648
CLO Subtotal	**2,977,759**	**2,791,737**	**53,281**	**154,222**	**639**	**33,645**
Bozeman Unit GYE (Scattered)	1,110,366	1,116,446	40	21,365	0	8,132
Conrad Unit NCDE (Scattered)[6]	1,316,679	636,838	33,417	46,837	0	0
Dillon Unit GYE (Scattered)	0	780,013	0	60,224	0	19,582
Helena Unit NCDE (Scattered)	550,714	258,440	19,824	25,797	639	5,931
Total	**8,565,699**	**5,228,776**	**211,374**	**254,475**	**154,201**	**112,711**

Note: Totals may not add up due to rounding.
1 NCDE = Northern Continental Divide Ecosystem, CYE = Cabinet-Yaak Ecosystem, BE = Bitterroot Ecosystem, GYE = Greater Yellowstone Ecosystem.
2 For columns where acreages portrayed are for "all ownerships," the designation of scattered parcels vs. blocked lands is not applicable and the row identifier as scattered vs. blocked should be ignored.
3 The scattered vs. blocked status is not relevant to the acres portrayed "all ownerships."
4 Non-recovery occupied habitat designation from Wittinger (2002).
5 The BE recovery zone is currently not considered occupied by grizzly bears.
6 Lands on this unit occur outside of the HCP project area.
7 Includes the Coal Creek State Forest and majority of the Stillwater State Forest.
Source: DNRC (2008a).

reduced to 0.5 mile, the parcel area becomes 0.25 square mile (0.5 mile times 0.5 mile); a straight road crossing that parcel would be 0.5 mile long, producing a road density of 2 mi/mi^2 (0.5 mile divided by 0.25 mile).

For this analysis, DNRC developed estimates for the future miles of road in different road management classes (open, restricted, and total) based on several sources. These included historical data on miles of roads constructed and project area acreages from personal communications with project leaders, foresters, or unit managers, as well as environmental documents and contracts that were available for timber sale contracts sold between fiscal years 1998 and 2006. Information from the Stillwater and Swan Transportation Plans developed for the proposed HCP (Appendix A, HCP, Tables 2-2 and 2-3, respectively) was used to determine road mile values in those areas under Alternatives 2, 3, and 4. Increases in Alternative 1 (No Action) were developed using the calculated constants for restricted roads in the Stillwater Block. The "Swan Agreement Future" column in Appendix A, HCP, Table 2-3 was used to determine road increases for the Swan River State Forest under Alternative 1. Note that the transportation plan for the Swan River State Forest would be implemented only if the Swan Agreement is terminated. If this happens, the actual amount of additional road open to motorized public access at any time in the future would depend on the status of access agreements between DNRC and adjacent landowners, as well as the timing of individual landowners' decisions to pursue access across parcels of trust lands. 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.

The effects of roads on grizzly bears are described in terms of total road density and open road density. For this analysis, open roads include those classified as open, private, or seasonally open, and exclude restricted, highway, and county roads. Total roads include those classified as restricted, along with open, private, or seasonally open roads. 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. Due to the likelihood of longer-term risks to grizzly bears, permanent open and permanent restricted roads pose a greater potential risk for grizzly bears than temporary roads. Thus, the quantified analysis of permanent open and total road densities was considered the most relevant analysis approach for comparing the alternatives in the context of risk to grizzly bears at the landscape scale. At the programmatic scale, additional effects on grizzly bears associated with the construction and use of temporary roads were considered minimal when considered in conjunction with effects from permanent roads.

The following two subsections address these topics in greater detail and compare the effects of the alternatives.

Total Road Density

Potential Effects

- The presence of road prisms on the landscape may cause bears to avoid areas they might otherwise use for feeding, breeding, and sheltering.

Indicators and Rationale

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 those 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 and types of human access.

For this analysis, total road density is used as an indicator of the relative amounts of road prisms on the landscape predicted under the various alternatives to assess risk of grizzly bear displacement from habitat important for feeding, breeding, and sheltering. In Montana, the USFWS generally evaluates the effects of road presence on grizzly bears expressed as a percent of a given BMU subunit with a total road density greater than 2 mi/mi^2. Generally, a female in the NCDE can effectively use the home range to successfully raise cubs if about 20 percent or less of the BMU subunit exhibits a total road density greater than 2 mi/mi^2 (as well as other habitat measures) (IGBC 1998). Above these levels, a female with cubs may begin to experience significant loss of resources and increased risk of mortality.

In no case does DNRC ownership encompass an entire BMU subunit (a surrogate female home range) (Table 4.9-11). DNRC blocked lands occur in 13 grizzly bear subunits and account for 0.7 to 84 percent of any one subunit. DNRC controls 20 percent or more of the lands within seven BMU subunits.

The following subsection discusses the rules and commitments that would influence total road density under the alternatives. Resulting differences in total road density under the alternatives are illustrated using modeled estimates of future road densities. Moving windows analysis was used for the blocked lands in the Stillwater Block and Swan River State Forest, while linear road densities were calculated for scattered parcels elsewhere in the recovery zones and NROH.

Comparison of Alternatives

The primary factor driving any differences in total road density under the alternatives is the anticipated amount of new road construction. The alternatives do not differ in the amount of roads that would be abandoned or reclaimed (see Table 4.4-6), so any differences in the miles of open, restricted seasonally, or restricted year-round roads would derive from differences in new road construction or changes in road classes. In addition to those constructed for forest management activities on trust lands, roads may be built as a result of easement requests from adjacent landowners. The following analysis, therefore, also addresses variations in provisions for granting easements under the alternatives.

Under Alternative 1, new road construction commitments would continue to consider the needs of public access, wildlife habitat, and adjacent landowners. The only areas where road construction would be specifically limited would be SMZs. New road construction in avalanche chutes would not specifically be constrained under this alternative and could reduce grizzly bear use of these important foraging areas. There would be no policy setting precise limits on permanent or temporary road construction, thereby potentially allowing more roads to be constructed under general constraints. ARM 36.11.421 requires that forest managers plan transportation systems for the minimum number of road miles needed; however, the degree to which transportation planning would be scrutinized would be less under Alternative 1 than any of the action alternatives. Under Alternative 1, the environmental impacts (including those on grizzly bears) from easements must be considered through DNRC's Access Road Easement Policy. Under Alternatives 2, 3, and 4**,**

TABLE 4.9-11. MOVING WINDOWS ESTIMATES OF THE PERCENTAGE OF TRUST LANDS WITH TOTAL ROAD DENSITIES EXCEEDING 2 MI/MI^2 UNDER EACH ALTERNATIVE, BY BMU AND BMU SUBUNIT FOR BLOCKED LANDS WITHIN THE HCP PROJECT AREA, AT 50 YEARS FOLLOWING PERMIT ISSUANCE

		Percent of HCP Lands within Subunit Exceeding 2 mi/mi^2				
			Alternative			
Administrative Unit, BMU, and BMU Subunit	**Percent of BMU Subunit within the HCP Project Area**	**Existing Conditions**	**1 No Action**	**2**	**3**	**4**
Stillwater Block		**53.2**	**56.5**	**57.2**	**56.5**	**57.2**
Lower North Fork Flathead BMU		**5.0**	**5.0**	**5.0**	**5.0**	**5.0**
Werner Creek	1.3	5.0	5.0	5.0	5.0	5.0
Murphy Lake BMU		**0.1**	**0.1**	**0.1**	**0.1**	**0.1**
Krinklehorn	0.7	0.1	0.1	0.1	0.1	0.1
Stillwater River BMU		**55.5**	**58.4**	**58.4**	**58.4**	**58.4**
Lazy Creek	41.6	79.7	79.7	79.6	79.7	79.6
Stryker	80.6	37.9	42.1	42.1	42.1	42.1
Upper Whitefish	84.0	64.1	67.0	67.0	67.0	67.0
Upper North Fork Flathead BMU		**44.8**	**50.1**	**54.1**	**50.1**	**54.1**
Coal and South Coal	1.6	0.1	0.1	0.1	0.1	0.1
Hay Creek	5.4	55.0	55.6	57.0	55.6	57.0
State Coal Cyclone	42.8	44.5	50.8	55.2	50.8	55.2
Swan River State Forest		**76.8**	**90.2**	**90.2**	**90.2**	**90.2**
Bunker Creek BMU		**71.6**	**86.6**	**86.5**	**86.6**	**86.5**
Goat Creek	21.4	92.0	97.6	97.6	97.6	97.6
Lion Creek	10.6	97.8	100.0	100.0	100.0	100.0
South Fork Lost Soup	61.3	60.4	80.6	80.6	80.6	80.6
Mission Range BMU		**88.2**	**98.3**	**98.3**	**98.3**	**98.3**
Piper Creek	0.6	23.4	66.5	66.5	66.5	66.5
Porcupine Woodward	32.5	89.2	98.7	98.7	98.7	98.7

Source: DNRC (2008a).

commitment GB-PR4 would require more specifically that new construction of open roads be minimized in ~~riparian areas~~RMZs, WMZs, and avalanche chutes throughout the HCP project area. In addition, the development of transportation plans in the Stillwater Block and Swan River State Forest that specifically control how much and where new roads can be constructed over the 50-year Permit term would reduce the risk of direct and indirect effects on grizzly bears associated with displacement from important habitat.

The transportation plan for the Stillwater Block under Alternatives 2 and 4 would prohibit the construction of new permanent roads on Class A lands, and would designate where new road construction would be allowed on Class B lands. The prohibition of new permanent roads on Class A lands would minimize long-term displacement and mortality risk to bears using these areas. A total of 19.3 miles of new road construction would be allowed in the Stillwater Block (Appendix A, HCP, Table 2-2). 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 the Swan

River State Forest lands would be subject to rest requirements. In the event that the Swan Agreement is terminated, new road construction would be limited to approximately 70.3 miles identified in the Swan River State Forest Transportation Plan map (Appendix A, HCP, Table 2-3). The Stillwater transportation plan under Alternative 3 would not identify Class A or Class B lands, but would maintain the existing prohibition on road density increases in the Stillwater Core. Given past access needs on the forest, it was predicted that an additional 17.6 miles of new road (restricted year-round) would be added over the course of the 50-year Permit term under Alternative 1. However, the specific locations of those roads were not predicted due to a high degree of uncertainty regarding long-term access needs under this alternative. For scattered parcels in recovery zones, Alternatives 2 and 4 include no conservation commitments that specifically limit total road density. In contrast, under Alternative 3, commitment GB-SC1 would prohibit any net increases in baseline total road densities for forest management projects at the DNRC administrative unit level.

Regarding easements, the implementation of commitment GB-NR2 under Alternatives 2, 3, and 4 would discourage granting 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. In contrast to Alternative 1, all three action alternatives would provide increased protection and specific consideration for grizzly bears when access easements are considered. This increased consideration and subsequent protections may reduce the amount of roads and other human activities and access in bear habitat, thereby reducing impacts of displacement to grizzly bears. Because DNRC is legally obligated to consider all reasonable easement requests, the additional commitments under the action alternatives would likely not substantially reduce the amount of new road construction across trust lands.

Under all four alternatives, in the Stillwater Block and Swan River State Forest, in all BMU subunits where HCP project area lands make up at least 5 percent of the total area, the proportion of trust lands where total road densities exceed 2 mi/mi^2 would increase (Table 4.9-11). As a result, grizzly bears might proportionally avoid suitable feeding, breeding, or sheltering habitat in these subunits. Under all alternatives, the greatest increases would occur in the Piper Creek and South Fork Lost Soup subunits in the Swan River State Forest. Throughout the Swan River State Forest, increases in total road density would be identical (or nearly so) under all alternatives, including Alternative 1. In the Stillwater Block, anticipated increases in total road density under Alternatives 2 and 4 would exceed those for Alternatives 1 and 3 in the Hay Creek and State Coal Cyclone subunits. The differences, however (1.4 percentage points in Hay Creek and 4.4 percentage points in State Coal Cyclone), do not represent substantial increases over current values, and would not be expected to result in any discernible differences in effects on grizzly bears in these areas.

Based on the linear density calculation method, total road densities on scattered parcels in all land offices would increase under all alternatives by year 50 (Table 4.9-12). Under current conditions and all alternatives at year 50, road densities in NROH are higher than in the recovery zones. The exception to the pattern of increasing road densities is Alternative 3, under which road densities on scattered parcels in the recovery zones would remain at existing levels. This reflects the additional provision under commitment GB-SC1, which would not allow increases in baseline total road densities. Thus, on scattered parcels under Alternative 3, displacement risk to grizzly bears due to the density of roads on the landscape would likely not increase appreciably from existing levels.

TABLE 4.9-12. TOTAL ROAD DENSITY USING LINEAR CALCULATION OF MI/MI^2 ON SCATTERED PARCELS FOR RECOVERY ZONES AND NON-RECOVERY OCCUPIED HABITAT IN THE HCP PROJECT AREA, BY ALTERNATIVE, AT 50 YEARS FOLLOWING PERMIT ISSUANCE

	Existing Conditions		Alternative 1		Alternative 2		Alternative 3		Alternative 4	
Land Office	Recovery Zones	NROH	Recovery Zones	NROH	Recovery Zones	NROH	Recovery Zones	NROH	Recovery Zones	NROH
NWLO	2.8	3.8	3.4	4.5	3.4	4.5	2.8	4.5	3.4	4.5
SWLO	2.3	2.9	3.5	4.2	3.5	4.2	2.3	4.2	3.5	4.2
CLO	0.2	1.5	0.6	1.9	0.6	1.9	0.2	1.9	0.6	1.9

Source: DNRC (2008a).

The implications of these road density predictions to grizzly bear conservation vary. In some cases, where DNRC ownership represents a small percentage of a BMU subunit embedded in a matrix of national forest lands (e.g., Hay Creek subunit of the Upper North Fork Flathead BMU, where DNRC owns 5.4 percent of the lands) and the increase in total road density is minor (no more than 2 percent), a female with cubs can effectively use the subunit, including such 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 female grizzly bear's potential home range. High road densities could cause reduced habitat effectiveness on significant amounts of habitat, resulting in either displacement of bears from important habitats or increased risk of bear-human encounters for bears that select these habitats anyway. Some, more tolerant bears, may habituate to roads and human activity and continue to use the affected lands, but they would be at greater risk due to greater potential for contact with humans. The potential for increased contact with humans would be minimized through the implementation of the HCP conservation commitments, including seasonal restrictions, the establishment of quiet areas, project-by-project consideration of important habitat features, and retention of cover. The effects of implementing these commitments are analyzed below under the respective issue statements.

Open Road Density

Potential Effects

- Use of roads in 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. 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.

Indicators and Rationale

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 potentially suitable habitat for bears, substantially increasing the risk of their displacement from desirable areas in important seasons, such as spring. Thus, open road density is used as an indicator of relative human use on the landscape predicted under the various alternatives to assess risk of 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 were considered open for density calculations (excluding non-DNRC county roads, highways, and private roads) (DNRC 2008i).

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.). In Montana, the USFWS generally evaluates the effects of road use on grizzly bears expressed as a percent of a given BMU subunit with an open road density of greater than 1 mi/mi^2. Generally, a female with cubs in the NCDE can effectively use her home range to successfully raise her cubs if about 20 percent or less of the BMU subunit exhibits an open road density greater than 1 mi/mi^2 (as well as other habitat measures) (IGBC 1998). Above these levels, a female with cubs may begin to experience significant loss of resources and increased risk of mortality.

In no case does DNRC ownership encompass an entire BMU subunit (surrogate female home range) (Table 4.9-11). DNRC blocked lands occur in 13 grizzly bear subunits and account for 0.7 to 84 percent of any one; with less than 20 percent ownership in seven BMU subunits.

It is important to note that the effects of open road density on grizzly bears are difficult to predict for several reasons. The utility of open road density as an indicator of the potential effects on grizzly bears is limited by uncertainty about (1) the amount of use that actually occurs on restricted road systems, (2) differences in the effects of seasonally restricted roads compared to those with year-round use restrictions (and also how varying amounts of one class may offset or exacerbate impacts of another), (3) locations where bears may occur at any given time, and (4) variations in how individual bears may respond to roads and their use by humans.

The following subsection discusses the ARMs and commitments under the action alternatives that would influence open road density. Among these are provisions that would restrict increases in open road density, as well as requirements for inspecting and maintaining road closure structures (e.g., gates, berms) used to discourage motorized public use of restricted roads. Similar to the preceding analysis, resulting differences in open road density under the alternatives are illustrated using predicted estimates of future road densities. Moving windows analysis (USFS 1995c) was used for the blocked lands in the Stillwater Block and Swan River State Forest, while linear road densities were calculated for scattered parcels elsewhere in the recovery zones and NROH.

Comparison of Alternatives

None of the alternatives include program-wide commitments that would explicitly limit open road densities to a prescribed level. Under all alternatives, restrictions are applied within certain portions of the HCP project area, such as NROH or the blocked lands of the Stillwater Block and Swan River State Forest. In addition, commitments for monitoring and repairing road closures would influence the amount of road that is designated as closed to motorized public access but is accessible to motor vehicles.

As described earlier, the implications to grizzly bear conservation of the various road density indices vary. In some cases, where DNRC ownership represents a small percentage of a BMU subunit, a female with cubs can continue to effectively use the subunit, including such DNRC lands during portions of the year and throughout her lifespan. In other cases, DNRC controls a significant percent of a potential female grizzly bear home range. High road densities in this scenario could reduce habitat effectiveness on large acreages of habitat. Therefore, the HCP includes conservation commitments to avoid or minimize the potential adverse effects of disturbance and/or displacement, including seasonal restrictions, the establishment of quiet areas, project-by-project consideration of important habitat features, and retention of cover. The effects of these commitments are analyzed below.

Stillwater Block

Under Alternative 1, existing ARMs would not allow increases from the 1996 baseline in the proportion of BMUs that exceed an open road density of 1 mi/mi^2. Under special circumstances, minor increases could occur with approval from the FMB Chief. Road management decisions would be made on a project-by-project basis, and would be constrained by requirements to avoid take under Section 9 of the ESA. In most situations, any increase in miles of road open for motorized public access would be offset by closing an equal or greater amount of open road elsewhere in the Stillwater Block. Although the overall open road density would not increase, there would be no requirement to consider the location or timing of road closures or allowance of low-intensity forest management activities in spring relative to the needs of grizzly bears.

Under Alternatives 2 and 4, a 50-year transportation plan would be adopted for the Stillwater Block. The plan would identify the locations and miles of road that would be constructed and identify how the roads would be used (i.e., restricted year-round, restricted seasonally, open to low-intensity forest management activities only, etc.). Use restrictions would emphasize the protection of key habitat areas (e.g., spring habitat) during key periods. Unlike Alternatives 1 and 3, some roads in the Stillwater Core would be open seasonally to motorized public access under Alternatives 2 and 4. As a result, functional open road densities in the Stillwater Block would be expected to increase for these two alternatives.

Under the Stillwater transportation plan, the amount of existing roads open year-round for all motorized public access would decrease by 18.3 miles (15 percent) from current amounts (Appendix A, HCP, Table 2-2). In contrast, the amount of existing roads available for motorized public access with seasonal restrictions would increase nearly tenfold, from 6.4 miles to 54 miles. Most of this increase would occur in the Stillwater Core, where roads currently closed year-round to motorized public access would be open with seasonal restrictions. Of the seasonally restricted roads in the Stillwater Block, 29.8 miles would be closed in spring (April 1 to June 30), and 24.2 miles would be closed in spring and fall (April 1 to June 30 and September 16 to November 30). Although these use restrictions were developed through consideration of grizzly bear seasonal habitat use and availability, it is possible that bears could be present in areas where roads are seasonally open. Compared to Alternative 1, implementation of the Stillwater transportation plan under Alternatives 2 and 4 would be expected to reduce, but not eliminate, the risk that bears may be displaced from habitat they would otherwise use for feeding, breeding, or shelter. In areas currently managed as part of the Stillwater Core, the risk attributable to functionally open roads would increase.

Under Alternative 3, road management in the Stillwater Block would be the same as under Alternative 1, with additional provisions for grizzly bears. None of the closed roads in the Stillwater Core would be opened to public access. Also, any changes in use restrictions that would cause the amount of designated security core in a BMU subunit to decrease would require the approval of the USFWS. DNRC would adopt the existing road network with the use restrictions currently in place, adding 17.6 miles of road with year-round restrictions during the 50-year Permit term. Overall, under Alternative 3, similar to Alternative 1, there would be 18.3 more miles of road open year-round to motorized public access in the Stillwater Block at Year 50, compared to Alternatives 2 and 4. However, the miles of road open with seasonal restrictions would be 47.6 miles less than under the other action alternatives. In areas outside the Stillwater Core, Alternative 3 would be expected to result in a slightly greater risk that bears may be displaced from habitat they would otherwise use for feeding, breeding, or sheltering, compared to Alternatives 2 and 4. Within the areas currently managed as security core, the risk would be the same as under Alternative 1, and lower than under Alternatives 2 and 4. Note that transportation plan provisions for areas of minimal human activity (i.e., security core areas and rest periods) in the Stillwater Block are addressed in subsection Risk of Bear-Human Conflicts, below.

Swan River State Forest

Under all alternatives, the road system in the Swan River State Forest would continue to be managed in accordance with the terms of the Swan Agreement, unless the agreement is terminated by another cooperator. Similar to the Stillwater Block, any increases in open road miles above minimum thresholds required by the agreement would have to be offset by decreases elsewhere on the forest to remain in compliance. If the Swan Agreement is terminated, transportation management decisions would be made on a case-by-case basis, and would be constrained by requirements to avoid take under Section 9 of the ESA. DNRC would likely undergo revision of existing ARMs to identify ways of ensuring ESA compliance. It is likely that the mileage of open roads in the Swan River State Forest on trust lands would not change substantially if the Swan Agreement is terminated under Alternative 1.

The transportation plan for the Swan River State Forest would be implemented only if the Swan Agreement is terminated. Under the Swan Agreement in its current form, no changes are anticipated in the miles of road open to motorized public access. If the agreement is terminated and replaced by the HCP Swan River State Forest Transportation Plan, the amount of open or seasonally restricted road could increase from the current 43.4 miles to as much as 66.5 miles under Alternatives 2, 3, and 4 (Table 4.4-6). The estimated total of 66.5 miles of open road under the proposed HCP strategy reflects the worst-case scenario. Included in this total are roads currently restricted that could be opened to motorized public access due to circumstances beyond the control of DNRC. On these roads, DNRC has established all lawful purpose reciprocal access agreements with adjacent landowners. Under current ownership, these roads would remain restricted through time under the Swan Agreement. If the Swan Agreement is terminated or neighboring lands change ownership within the 50-year Permit term, subsequent grantees of reciprocal access agreements could petition DNRC to change the status of these roads from restricted to open. Although cooperation from these grantees is not guaranteed under the proposed HCP, DNRC would work with appropriate parties in an effort to maintain these roads as restricted and to avoid or mitigate impacts to grizzly bears that would result from a status change on these roads. As a result of potential termination of the Swan Agreement and a worst-case open road assessment, the risk of displacement from otherwise suitable habitat would also likely increase proportionally. No new restrictions would be placed on any roads that are currently open to public motorized access.

Ultimately, the actual amount of additional road that would be open to motorized public access at any time in the future would depend on the management objectives of neighboring landowners and their willingness to be cooperators in the Swan Agreement. Regardless of the status of the Swan Agreement, commitment GB-SW1, which describes the transportation plan, would apply under all action alternatives and limit DNRC administrative and commercial use of roads closed to the public.

In summary, all four alternatives would be similar in their effect to grizzly bear displacement while the Swan Agreement is in place. Whereas, under Alternative 1, if the Swan Agreement were to be terminated, a backup strategy would have to be developed and adopted by DNRC. Under Alternatives 2, 3, and 4 the Swan River State Forest Transportation Plan would immediately be implemented by DNRC if the Swan Agreement is terminated. This plan would require that very similar commitments be met on trust lands as those required under the current Swan Agreement. Impacts to grizzly bears would likely be similar under any alternative, with more certainty and up-front planning provided in Alternatives 2, 3, and 4.

Scattered Parcels

On scattered parcels in the recovery zones (including the CYE), Alternative 1 would allow no permanent increases in open road density for parcels exceeding 1 mi/mi^2. However, temporary increases would be allowed on scattered parcels. Alternative 1 contains no specific provisions for minimizing the construction of new open roads in NROH. Throughout the project area, Alternative 1 offers no specific measures requiring consideration of the location of open roads in relation to important berry fields, wetlands, unique congregation areas, ~~riparian zones~~RMZs, WMZs, and avalanche chutes, or limitations on their construction during important times of the year, such as the spring period. Rather, Alternative 1 provides a set of more general measures that would be applied on a case-by-case basis at the project level by DNRC biologists and foresters to minimize risk to grizzly bears.

Alternatives 2, 3, and 4 would take a more rigorous approach to limiting open road density on scattered parcels in the recovery zones, prohibiting any increases in baseline open road amounts at the administrative unit level for conducting forest management activities. Any decisions not to restrict access to open roads would need to be documented and a rationale provided. This would likely have the effect of minimizing increases in open road densities on scattered parcels, and could encourage decisions to restrict access in areas of potentially suitable grizzly bear habitat. Alternative 3 would go further, prohibiting any net increases in baseline total road densities for forest management projects at the DNRC administrative unit level as well. This would likely place even greater limits on the potential for increases in open road density on scattered parcels in the recovery zones.

In contrast to Alternative 1, the action alternatives would require DNRC to minimize construction of new open roads in NROH. In addition, within the CYE, DNRC would expedite the process of addressing open road densities, rather than addressing them on a project-by-project basis, to more promptly identify and minimize any existing potential risk to grizzly bears in that ecosystem. Collectively, these commitments would reduce the likelihood of open roads being located in key grizzly bear habitat during key times of the year.

Road Closures

Under Alternative 1, DNRC would continue its commitment to inspect all road closures within the Stillwater Block and Swan River State Forest annually (ARMs 36.11.431 and 432), and elsewhere inside recovery zones, as well as outside, at least every 5 years (ARM 36.11.421(14)). Repairs to ineffective road closures would be assigned a high priority when allocating time and budget. If any roads that are managed as closed to motorized public access have ineffective closure structures, they could in fact be accessible for up to 5 years, or possibly longer, depending on how long it takes to identify the problem, allocate funding, and complete the repairs. Based on this consideration, it is possible that in some areas, the density of actual (*de facto*) open roads could be higher than the calculated values for those areas. This could result in unanticipated adverse effects on grizzly bears, particularly in portions of recovery zones and NROH where closure devices are not currently checked annually. In addition, it is possible that new open road construction could occur in areas where calculated open road densities are less than 1 mi/mi^2 but *de facto* open road densities exceed that limit, increasing the risk of adverse effects in areas of high open road density.

Under Alternative 2, 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. Compared to Alternative 1, this would be expected to lead to a decline in the miles of road on which unauthorized motorized public use could occur. The risk of unanticipated adverse effects on grizzly bears due to elevated densities of *de facto* open roads would be lower than under Alternative 1. Outside recovery zones, DNRC would continue its commitment to inspect all road closures at least every 5 years.

Under Alternative 3, DNRC would commit to repairing all ineffective closures in recovery zones during the same operating season in which they are identified to the extent that time, workforce, and contracting funds are available. Any repairs not completed during the same season would be completed within 1 year of being identified. Compared to Alternative 1, these measures would also be expected to lead to a decline in the miles of road where unauthorized motorized public use could occur. Also, fewer miles would be open for *de facto* motorized public access than under Alternative 2, because fewer road miles would be constructed and closures would be inspected and repaired more frequently. The risk, therefore, of unanticipated adverse effects on grizzly bears due to elevated densities of functionally open roads would be lower than under Alternatives 1, 2, or 4.

Under Alternative 4, DNRC would commit to inspecting road closures on scattered parcels in recovery zones every 2 years and repairing ineffective closures within 1 year of identifying the problem. Compared to Alternative 1, this would be expected to lead to a decline in the miles of road where unauthorized motorized public use could occur, even though the management goal of those roads includes use restrictions. The mileage of *de facto* open roads that functionally would allow unauthorized motorized public access, and their associated risk to bears, would be greater than under Alternative 2, however, because inspections and repairs would occur less often.

Future Open Road Densities

Moving windows analysis of the anticipated changes in road densities in the Stillwater Block and Swan River State Forest indicates that open road densities would increase throughout both areas under all four alternatives (Table 4.9-13). In the Stillwater Block, the greatest increases would occur under Alternatives 2 and 4, with the adoption of the transportation plan resulting in currently closed roads in the Stillwater Core being opened to motorized public access on a seasonal basis. In

TABLE 4.9-13. MOVING WINDOWS ESTIMATES OF THE PERCENTAGE OF TRUST LANDS WITH OPEN ROAD DENSITIES EXCEEDING 1 MI/MI^2 UNDER EACH ALTERNATIVE, BY BMU AND BMU SUBUNIT FOR BLOCKED LANDS WITHIN THE HCP PROJECT AREA, AT 50 YEARS FOLLOWING PERMIT ISSUANCE

Administrative Unit, BMU, and BMU Subunit	Percent of BMU Subunit within HCP Project Area	Percent of HCP Lands with Open Road Densities Exceeding 1 mi/mi^2: Existing Conditions	Alternative 1 No Action	Alternative 2	Alternative 3	Alternative 4
Stillwater Block		**41.5**	**41.5**	**50.4**	**41.5**	**50.4**
Lower North Fork Flathead BMU		**6.1**	**6.1**	**11.0**	**6.1**	**11.0**
Werner Creek	1.3	6.1	6.1	11.0	6.1	11.0
Murphy Lake BMU		**3.6**	**3.6**	**3.6**	**3.6**	**3.6**
Krinklehorn	0.7	3.6	3.6	3.6	3.6	3.6
Stillwater River BMU		**43.4**	**43.4**	**52.4**	**43.4**	**52.4**
Lazy Creek	41.6	72.3	72.3	72.2	72.3	72.2
Stryker	80.6	37.5	37.5	43.6	37.5	43.6
Upper Whitefish	84.0	35.1	35.1	52.7	35.1	52.7
Upper North Fork Flathead BMU		**34.3**	**34.3**	**43.0**	**34.3**	**43.0**
Coal and South Coal	1.6	0.0	0.0	0.0	0.0	0.0
Hay Creek	5.4	3.2	3.2	12.1	3.2	12.1
State Coal Cyclone	42.8	40.3	40.3	49.1	40.3	49.1
Swan River State Forest[1]		**36.1**	**36.2**	**60.6**	**60.6**	**60.6**
Bunker Creek BMU		**36.0**	**36.2**	**50.8**	**50.8**	**50.8**
Goat Creek	21.4	46.3	46.1	87.8	87.8	87.8
Lion Creek	10.6	46.0	45.8	85.9	85.9	85.9
South Fork Lost Soup	61.3	30.8	31.3	32.6	32.6	32.6
Mission Range BMU		**36.5**	**36.4**	**82.1**	**82.1**	**82.1**
Piper Creek	0.6	2.0	2.0	35.0	35.0	35.0
Porcupine Woodward	32.5	37.0	36.9	82.8	82.8	82.8

[1] Increases in future open road densities depicted under Alternatives 2, 3, and 4 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: DNRC (2008a).

the Swan River State Forest, modeled increases in open road density for the action alternatives reflect the worst-case scenario under which the Swan Agreement is terminated and all functionally open roads are added due to easement agreements held by adjacent landowners, and for which DNRC would not control access to these roads. Increases in the amount of trust lands with open road densities exceeding 1 mi/mi^2 represent an 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 that modeled changes in open road density do not account for additional roads that may be open to motorized public access due to damaged or ineffective closure structures. However, under the current ARMs, closure devices are checked annually on blocked lands. The percentage of effective closure devices on trust lands in the Swan River State Forest reported for years 2000 to 2007 averaged 93 percent and ranged from 88 percent to 99 percent. Thus, the density estimates in Table 4.9-13 may represent slight underestimates of *de facto* open road densities on trust lands.

The no-action alternative and the three action alternatives all include restrictions on increasing open road densities on scattered parcels in recovery zones. As modeled for this analysis, these differences would not be expected to result in marked differences in open road densities on these lands (Table 4.9-14). In both recovery zones and NROH in all three land offices, modeled increases under all four alternatives would range from 0 to 0.1 mi/mi^2. Slight variations in management policies between the no-action alternative and action alternatives would not likely result in noticeable differences in effects on grizzly bears at the landscape scale within the HCP project area.

TABLE 4.9-14. OPEN ROAD DENSITY USING LINEAR CALCULATION OF MI/MI^2 ON SCATTERED PARCELS FOR RECOVERY ZONES AND NON-RECOVERY OCCUPIED HABITAT IN THE HCP PROJECT AREA, BY ALTERNATIVE, AT 50 YEARS FOLLOWING PERMIT ISSUANCE

	Existing Conditions		Alternative 1		Alternative 2		Alternative 3		Alternative 4	
Land Office	Recovery Zones	NROH	Recovery Zones	NROH	Recovery Zones	NROH	Recovery Zones	NROH	Recovery Zones	NROH
NWLO	1.4	2.1	1.5	2.1	1.4	2.1	1.4	2.1	1.4	2.1
SWLO	1.8	0.8	1.9	0.9	1.8	0.9	1.8	0.9	1.8	0.9
CLO	0.2	1.4	0.2	1.4	0.2	1.4	0.2	1.4	0.2	1.4

Source: DNRC (2008a).

Helicopter-related Effects

Potential Effects

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

Indicators and Rationale

Research findings regarding helicopter disturbance have been mixed (USFS and USFWS 2009). However, trends in research findings suggest that the more intense the disturbance and greater the duration of the disturbance, the more likely subsequent effects on the species are to occur. More specifically, the magnitude of the associated effects can be influenced by a number of factors, including the (1) proximity of the action to the species, (2) distribution of the activity on the landscape, (3) timing of the activity, (4) nature of the effect, (5) duration of the disturbance, (6) frequency of the disturbance, (7) intensity of the disturbance, and (8) severity of the disturbance. Evaluation of the frequency, altitude, and duration of helicopter trips are key considerations for evaluating potential effects on grizzly bears.

According to a 2009 guide developed by the USFS and USFWS (2009) to address activities involving helicopter use on federal lands, the following levels of effects are likely based on altitude, frequency, and duration:

- Flights more than 500 meters (1,640 feet) 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 (1,640 feet) above ground level are likely to elicit a response by 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 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 bears. These effects may be greatest when logging or flights occur in secure habitat for bears or otherwise undisturbed bear habitat.

Comparison of Alternatives

On an infrequent basis, DNRC contractors use helicopters to access harvested timber in otherwise inaccessible terrain and/or areas in which road construction and maintenance are not feasible. 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. Only a portion of these units would have occurred on HCP project area lands within grizzly bear recovery zones. Disturbance zones for helicopter yarding a logging unit requiring flights less than 500 meters (1,640 feet) 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.

Over the past two years (2008 to July 2010), no DNRC timber sales included helicopter logging units. On rare occasions, DNRC has used helicopters to accomplish other various other short-duration forest management activities, such as weed control, prescribed burning ignition and control efforts, aerial seeding, and moving large pieces of equipment or materials to remote and/or rugged locations. Short-duration activities are typically those requiring 1 to 2 days of operating time. While helicopter use for forest management is infrequent, associated disturbance can have adverse effects on grizzly bears.

Under Alternative 1, and pursuant to ARM 36.11.432(1)(f) in the Stillwater Block, DNRC is required to minimize the duration of air- and ground-based harvest to the extent practicable when conducting project activities in or near security core and areas of seasonal importance for bears. Additionally, ARM 36.11.432 directs DNRC to make efforts to design flight routes to avoid or minimize flight time across security core or areas of seasonal importance for bears and, when feasible, to design flight paths greater than 1 mile from these areas. Implementation of this commitment in the Stillwater Block helps maintain the integrity of the security core and minimize disturbance of bears. However, under Alternative 1, recovery zones and NROH outside the Stillwater Block are not subject to the same restrictions, which may result in disturbance of bears in security core and seasonally important areas.

Under the action alternatives, 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 designated 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 designated security core areas. With implementation of GB-CY5 in the CYE, potential disturbance to 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 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.

In some instances, DNRC may find that flight paths designed to avoid seasonally important areas or rested subzones are not economically feasible. Depending on the timing and circumstances of the activity, adverse effects on grizzly bears may result, and these would primarily be attributable to disturbing bears from important foraging areas. Disturbance in the fall may have a greater effect on bears than during the summer because bears are feeding and building up fat stores for the approaching denning season. Effects on grizzly bears attributable to DNRC's helicopter activities would likely be minor across all alternatives considered because (1) the nature of helicopter disturbance in areas important for grizzly bears is infrequent on a program basis (each year very few projects contain helicopter harvest units applied across the broad 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.

Under Alternative 1, there are no minimization measures for short-duration activities requiring helicopter use, although the Stillwater Block would be subject to the requirements of ARM 36.11.432(1)(f). Under the action alternatives, short-duration activities would be subject to the requirements of commitment GB-PR8, requiring 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. Short-duration activities that use helicopters may result in some disturbance to 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 bears are anticipated because the effect would be minor in intensity and would not persist for a long period of time. 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 on bears using secure habitats and seasonally important areas would be avoided.

Risk of Bear-human Conflicts

Secure Habitat and Quiet Areas

Potential Effects

- 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 and Rationale

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 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 bears to be more vulnerable to human-caused mortality.

Therefore, measures that restrict activities either over a period of time (several years) or during important seasons (within a year) can avoid or minimize effects on bears. Two terms, secure habitat and quiet areas, are used in this analysis to describe approaches to managing HCP project area lands to reduce or minimize risk of displacement of bears and bear-human conflicts. Secure habitat for grizzly bears (or security core area) 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. Quiet areas are defined 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.

The following subsection analyzes the effects on bears under these two management approaches.

Comparison of Alternatives

Currently, the only area DNRC has designated as secure habitat under the ARMs is in the Stillwater and Coal Creek State Forests (Stillwater Core), where trust lands occur in large blocks within the NCDE grizzly bear recovery zone. Under Alternative 1**,** DNRC would commit to keeping the Stillwater Core (approximately 36,800 acres) in the Stillwater Block intact for at least 10 years, as practicable. Any net decreases from the 1996 baseline in the proportion of trust lands in a BMU subunit designated as security core areas would require approval from the FMB Chief. The potential for disturbance would be further minimized by the requirement that any management activities be conducted only during the denning period (November 16 to March 31) in security core areas. Under Alternative 1, the Swan River State Forest would continue to be managed using quiet areas (i.e., rotating BMU subunits), where 3 years of active management would be followed by

6 years of rest. Seasonal restrictions would be given consideration on a project-level basis for management activities on scattered parcels.

Under Alternatives 2 and 4, DNRC would no longer manage for secure habitat in the Stillwater Block using the traditional "security core area" approach. Instead, the transportation plan for that unit would identify 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 4 years of management and 8 years of rest. 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 fixed transportation system, along with seasonal restrictions and management of large blocks of quiet areas, would represent a departure from the existing ARMs (Alternative 1). Under Alternatives 2 and 4, the concept of establishing areas managed to reduce the risk of bear-human conflicts in the Stillwater Block would shift from secure habitat to quiet areas. Instead of making long-term commitments (i.e., approximately 10 years) to keeping fixed areas free from motorized administrative, commercial, and public access during the non-denning period, DNRC would focus on minimizing the potential for disturbance in key habitats during key periods and limiting the frequency with which large-scale disturbance (e.g., commercial forestry) may occur. 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 such that potential adverse effects on bears would be sufficiently minimized to allow bears to successfully meet their habitat requirements.

On the Stillwater Block, resting subzones could receive up to 30 days per year for small projects, including salvage. The potential effects of these short disturbances during critical time periods for bears would be avoided 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. If these allowable annual days in total are exceeded, an 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 8-year rest period. A full uninterrupted 8-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 8-year rest period to mitigate disturbance-related impacts to grizzly bears. Nonetheless, commitments that allow human access beyond that which currently is allowed in larger security core areas could increase the risk above present levels of disturbance or displacement of bears from areas they would otherwise use for feeding, breeding, and sheltering.

In the Stillwater Block under Alternative 3**,** DNRC would maintain its commitment to keeping the security core area intact for at least 10 years, similar to Alternative 1. In addition, approval from the USFWS would be required for any net decreases in secure habitat. To conduct salvage in the Stillwater Core under Alternatives 1 and 3, activities would have to be conducted in winter or an equal or greater amount of core area would have to be created through additional access restriction. Under Alternative 3, activities also could not occur in winter above 6,300 feet elevation.

As long as the Swan Agreement remains in effect, management of the Swan River State Forest under all action alternatives would also be the same as under Alternative 1. If the Swan Agreement is terminated, the forest would be managed under Alternatives 2, 3, and 4 as five independent subzones, with each subzone scheduled for 4 years of active management and 8 years of rest and allowances for salvage harvest as described above for the Stillwater Block. Similar to the Stillwater Block, low-intensity forest management activities would be allowed within rested areas, except as restricted during the spring period. Additionally, one salvage project exceeding 30 days would be allowed as described 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. When this occurs, DNRC would mitigate the potential effects on bears by (1) minimizing the distance of the pit from the open road, 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 bears.

A similar rest-rotation schedule (4 years of activity followed by 8 years of rest) would be implemented on all scattered parcels in recovery zones and NROH associated with the CYE under Alternatives 2, 3, and 4; this would also represent a departure from the existing ARMs (Alternative 1). The rest commitment for scattered parcels would increase rest and provide quiet areas on approximately 35,770 acres of scattered parcels not currently provided for under Alternative 1. 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 8-year rest period per parcel for this purpose. Under Alternative 3 within the CYE recovery zone, DNRC would impose additional restrictions on the number of vehicle trips per parcel during the non-denning period, further restricting use of roads for administrative purposes and lessening disturbance potential for grizzly bears.

Compared to Alternative 1, the total amount of land area managed to reduce the risk of bear-human conflicts would increase under all of the action alternatives, from approximately 76,300 acres under Alternative 1, to almost 95,000 acres under Alternatives 2 and 4, and to more than 112,000 acres under Alternative 3.

The degree to which activities are restricted in these areas would differ under the alternatives, however. Specifically, for the Stillwater Block, under Alternatives 1 and 3, approximately 39,600 acres in the Stillwater Unit would be managed as secure habitat for at least 10 years (Stillwater Core). In contrast, about 19,400 acres (most of which is a subset of the Stillwater Core) would be managed as quiet areas under Alternatives 2 and 4, with a maximum entry period of 4 years of activity followed by 8 years of rest from commercial logging activities. Management to reduce the risk of bear-human conflicts in the Swan River State Forest under all action alternatives would remain the same as under Alternative 1, although the management-rest schedule would be extended from 3 and 6 years to 4 and 8 years. Lastly, under all action alternatives, an additional 35,770 acres would be managed to reduce the risk of bear-human conflicts through a schedule of 4 years management followed by 8 years rest.

Analysis of the anticipated changes in secure habitat over 50 years in the Stillwater Block and Swan River State Forest indicates that the availability of secure habitat would decrease in both areas under all four alternatives (Table 4.9-15). In the Stillwater Block, the greatest decreases would occur in the Upper North Fork Flathead BMU under Alternatives 2 and 4, with the adoption of the transportation plan resulting in currently closed roads in the Stillwater Core being opened to motorized public access on a seasonal basis. Decreases in secure habitat in the Swan River State Forest, would be almost identical under all alternatives. Decreases in the availability of secure habitat on trust lands represent an 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 areas that would be managed as quiet areas in the Stillwater Block and scattered parcels, which would likely offset much of this risk, but to an uncertain degree.

TABLE 4.9-15. ESTIMATES OF THE PERCENTAGE OF HCP LANDS IN SECURE HABITAT UNDER EACH ALTERNATIVE, BY BMU AND BMU SUBUNIT FOR BLOCKED LANDS, AT 50 YEARS FOLLOWING PERMIT ISSUANCE

Administrative Unit, BMU, and BMU Subunit	Percent of BMU Subunit within HCP Project Area	Percent of HCP Lands in Secure Habitat[1]				
			Alternative			
		Existing Conditions	1 No Action	2	3	4
Stillwater Block		**42.8**	**37.4**	**30.6**	**37.4**	**30.6**
Lower North Fork Flathead BMU		**79.6**	**79.6**	**79.6**	**79.6**	**79.6**
Werner Creek	1.3	79.6	79.6	79.6	79.6	79.6
Murphy Lake BMU		**92.5**	**92.5**	**92.5**	**92.5**	**92.5**
Krinklehorn	0.7	92.5	92.5	92.5	92.5	92.5
Stillwater River BMU		**42.3**	**39.0**	**30.7**	**39.0**	**30.7**
Lazy Creek	41.6	15.7	15.7	16.3	15.7	16.3
Stryker	80.6	49.1	46.0	39.7	46.0	39.7
Upper Whitefish	84.0	48.1	42.8	27.5	42.8	27.5
Upper North Fork Flathead BMU		**43.0**	**27.8**	**27.5**	**27.8**	**27.5**
Coal and South Coal	1.6	99.1	99.1	99.1	99.1	99.1
Hay Creek	5.4	29.3	29.3	29.9	29.3	29.9
State Coal Cyclone	42.8	43.4	25.5	24.9	25.5	24.9
Swan River State Forest[2]		**20.7**	**10.3**	**9.7**	**9.7**	**9.7**
Bunker Creek BMU		**22.8**	**12.8**	**12.5**	**12.5**	**12.5**
Goat Creek	21.4	9.9	4.7	2.6	2.6	2.6
Lion Creek	10.6	4.5	2.8	2.8	2.8	2.8
South Fork Lost Soup	61.3	30.2	17.2	17.4	17.4	17.4
Mission Range BMU		**16.1**	**4.7**	**3.4**	**3.4**	**3.4**
Piper Creek	0.6	65.5	0.0	0.0	0.0	0.0
Porcupine Woodward	32.5	15.3	4.8	3.5	3.5	3.5

[1] Secure habitat is defined as the area 0.3 mile from an open or restricted road.
[2] Decreases in secure habitat in the Swan River State Forest depicted under Alternatives 2, 3, and 4 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: DNRC (2008a).

Spring Habitat

Potential Effects

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

Indicators and Rationale

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 bears from spring foraging habitat may adversely affect their ability to consume adequate amounts of food in a short amount of time. Restricting DNRC activities in these areas during critical seasons would minimize and potentially avoid adverse effects on bears. Activity restrictions, duration of restrictions, and the amount of area over which these activities would be restricted are compared.

Comparison of Alternatives

In most of the project area under Alternative 1, no commitments would be in place to limit forest management activities (including road use) in spring habitat. Wildlife biologists would have opportunities to provide input during project planning and implementation, but there would be no explicit direction for which activities would be limited or how. On the Swan River State Forest, seasonal restrictions identified in the Swan Agreement would continue to limit most activities in spring habitat within linkage zones. Under this alternative, therefore, the risk of disturbing or displacing bears from spring foraging habitat would continue at current levels.

In contrast, under Alternatives 2, 3, and 4, specific restrictions would be implemented during the spring period in spring habitat in recovery zones and NROH. These restrictions would prohibit commercial forest management activities, pre-commercial thinning, and heavy equipment slash treatment. Other low-intensity activities would be allowed, and commercial forest management activities would be allowed within 100 feet of open roads. Allowing low-intensity activities presents limited risk to bears because of the low likelihood that bear use and DNRC activities would overlap in a given location at any give time. Additionally, the effect on bears is likely to be similar to a bear encountering a hiker on a trail (brief and limited) versus a 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 bears beyond those attributed to the open road. Alternative 3 would implement additional restrictions eliminating all motorized activities in spring habitat, except for seasonally necessary and potentially beneficial activities, such as tree planting, spring burning, weed control, and emergency road maintenance. Alternative 4 is similar to Alternative 2 but would provide more management flexibility by eliminating limitations on site preparation, road maintenance, and bridge replacement.

Additional spring restrictions would be implemented under all three action alternatives in the Stillwater Block by restricting DNRC administrative activities on a group of roads in spring habitat during the spring period. In the Swan River State Forest, spring habitat restrictions 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. In the CYE recovery zone and associated NROH, additional limits would be placed on the amount and location of motorized low-intensity activities under all three action alternatives, with slightly more stringent restrictions under Alternative 3 (see Table E3-1 in Appendix E, EIS Tables).

Spring habitat restrictions would be implemented on 161,068 acres 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 would be in the CYE (Table 4.9-5). The greatest reduction of risk would occur under Alternative 3, which includes the most stringent restrictions, with slightly smaller risk reductions under Alternative 2, followed by Alternative 4. By limiting the types of allowable activities during the spring period in areas where bears are more likely to be present, all three action alternatives would reduce the risk (compared to Alternative 1) of displacement from crucial habitat during this important season for bears. Minimizing this risk would be accomplished by allowing only those activities that are typically of short duration that must occur during narrow spring windows, or that provide indirect benefits to bears.

Denning and Post-denning Habitat

Potential Effects

- 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 and Rationale

As described under Habitat Requirements, above, human activity near grizzly bear dens can cause physiological stress or, in some cases, den abandonment. Post-denning habitat, defined as areas with slopes greater than 45 percent at elevations greater than 6,300 feet, identifies areas with the greatest risk of disturbance to females with young cubs who have recently emerged from den sites. The risk of disturbance to bears in dens during the winter period is avoided by measures that restrict activities in denning habitat, defined as areas at elevations greater than 6,300 feet. The following subsection identifies and compares the rules, policies, and commitments that address forest management activities near denning habitat, den sites, and post-denning habitat under the alternatives. The amount of area over which activities would be restricted is also compared.

Comparison of Alternatives

Under Alternative 1**,** DNRC would provide den site protection on a case-by-case basis program-wide. In the Stillwater Core, the requirement to conduct management activities during the denning period (November 16 to March 31) would reduce the potential for disturbance to bears as they prepare to enter dens and after they emerge. On the Swan River State Forest, salvaging is not allowed in linkage zones during the spring period, and salvage harvest is only allowed in inactive subunits for 30 days each between June 15 and September 1 each year, which would have a similar result. The rest-rotation schedule identified under the Swan Agreement would indirectly reduce the potential for disturbance, but not specifically in areas of denning or post-denning habitat.

Under Alternatives 2, 3, and 4**,** commitment GB-PR5 would prohibit mechanized operations within 0.6 mile of known active, occupied den sites. Where specific information is available, (e.g., for bears that are subjects of radio-tracking studies, etc.), this measure would avoid the risk of physiological stress to denning 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 it is not feasible to conduct 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 all action alternatives, 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 bears on or nearby trust lands.

Under all action alternatives in recovery zones, commitment GB-RZ5 would implement additional restrictions in post-denning habitat. 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. Compared to Alternative 1, this would reduce the risk of disturbance to grizzly bears emerging from dens, particularly females with young cubs. Alternative 3 would extend the area in which this restriction would be implemented, prohibiting motorized activities within 0.6 mile of mapped post-denning habitat within both recovery zones and NROH, greatly expanding the area that would be protected. Implementation of the rest-rotation schedule in the Stillwater Block, Swan River State Forest, and scattered parcels in recovery zones under all three action alternatives may provide for additional reduction of the risk of disturbance, but not specifically in areas of post-denning habitat. By prohibiting commercial forest management activities above 6,300 feet between November 16 and March 31, the rest-rotation commitments would provide additional protection of denning habitat under the action alternatives.

For the 8,852 acres of mapped post-denning habitat in recovery zones and NROH within the HCP project area (Table 4.9-7), Alternative 1 would not provide any site-specific restrictions (Table 4.9-16). Alternatives 2 and 4 would restrict forest management activities in 5,863 of these acres (all in recovery zones). Alternative 3 would restrict activities on all 8,852 acres, plus a 0.6-mile buffer, for a total of 66,376 acres in which activities would be restricted to reduce the risk of disturbance to bears emerging from dens (Table 4.9-16).

Risk of Direct Conflict

Potential Effects

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

Indicators and Rationale

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. The risk of direct conflict can be managed by informing the public and DNRC staff of ways to avoid encounters with bears. Stringent requirements for food storage and sanitation can minimize the risk of habituation of bears to human foods and waste. 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. 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.

TABLE 4.9-16. ACREAGE BY ALTERNATIVE OF GRIZZLY BEAR POST-DENNING HABITAT IN THE HCP PROJECT AREA WHERE CONSERVATION COMMITMENTS WOULD APPLY WITHIN RECOVERY ZONES AND NON-RECOVERY OCCUPIED HABITAT, BY LAND OFFICE AND ADMINISTRATIVE UNIT FOR BLOCKED LANDS AND SCATTERED PARCELS

Land Offices and Unit Offices by Recovery Zone[1] (Scattered or Blocked Status)	Alternative 1		Alternative 2		Alternative 3		Alternative 4	
	Recovery Zone	Non-recovery Occupied Habitat[2]	Recovery Zone	Non-recovery Occupied Habitat[2]	Recovery Zone	Non-recovery Occupied Habitat[2]	Recovery Zone	Non-recovery Occupied Habitat[2]
NWLO	0	0	**5,764**	**0**	**41,062**	**534**	**5,764**	**0**
Kalispell Unit NCDE (Scattered)	0	0	0	0	43	0	0	0
Libby Unit CYE (Scattered)	0	0	0	0	0	0	0	0
Plains Unit CYE (Scattered)	0	0	0	0	0	0	0	0
Plains Unit NCDE (Scattered)[)3]	N/A	0	N/A	0	N/A	534	N/A	0
Stillwater Unit NCDE (Blocked)[3,4]	0	N/A	4,498	N/A	33,708	N/A	4,498	N/A
Stillwater Unit NCDE (Scattered)	0	0	0	0	0	0	0	0
Swan Unit NCDE (Blocked)[3]	0	N/A	1,266	N/A	7,311	N/A	1,266	N/A
Swan Unit NCDE (Scattered)[3]	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A
SWLO	0	0	**99**	**0**	**1,729**	**2,675**	**99**	**0**
Anaconda Unit NCDE (Scattered)[3]	N/A	0	N/A	0	N/A	1,968	N/A	0
Clearwater Unit NCDE (Scattered)	0	0	28	0	496	59	28	0
Hamilton Unit BE (Scattered)[3,5]	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A
Missoula Unit BE (Scattered)[3.5]	0	N/A	0	N/A	0	N/A	0	N/A
Missoula Unit NCDE (Scattered)	0	0	71	0	1,233	648	71	0
CLO	0	0	**0**	**0**	**0**	**20,376**	**0**	**0**
Bozeman Unit GYE (Scattered)[3]	N/A	0	N/A	0	N/A	6,990	N/A	0
Conrad Unit NCDE (Scattered)[3]	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A
Dillon Unit GYE (Scattered)[3]	N/A	0	N/A	0	N/A	12,462	N/A	0
Helena Unit NCDE (Scattered)	0	0	0	0	0	924	0	0
Total	**0**	**0**	**5,863**	**0**	**42,792**	**23,584**	**5,863**	**0**

1 NCDE = Northern Continental Divide Ecosystem, CYE = Cabinet-Yaak Ecosystem, BE = Bitterroot Ecosystem, GYE = Greater Yellowstone Ecosystem.
2 Non-recovery occupied habitat designation from Wittinger (2002).
3 N/A = not applicable. Where N/A is listed in the table, there is no such land area in the given unit.
4 Includes the Coal Creek State Forest and majority of the Stillwater State Forest.
5 The BE recovery zone is currently not considered occupied by grizzly bears.
Source: DNRC (2008a).

Livestock grazing (including the use of domestic sheep and goats for integrated noxious weed management) can also increase the risk of bear-human conflicts. Bears may be attracted to sheep grazing operations and facilities and to the carcasses of dead livestock. Grizzly bear predation of sheep can result in risks to human life, property damage, death of individual bears, or indirect mortality through habituation. 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.

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 would not be a covered activity under the HCP, and trends in the use of such sites would not be expected to change from current trends under any of the alternatives. Therefore, public use of recreation facilities is not addressed further in this analysis.

The following subsection identifies and compares the rules, policies, and commitments under the alternatives that address risk management through public education, food storage and sanitation, limitations on firearms possession, and restrictions on livestock grazing.

Comparison of Alternatives

Information and Education

Alternative 1 provides for informal training as needed. In contrast, under all three action alternatives, DNRC would provide grizzly bear awareness information to all contractors and their employees, as well as training to DNRC employees in the same manner. Under the action alternatives, the long-term information and education program would help ensure that the risk of bear-human conflicts from DNRC activities remains low.

Food Storage

Under Alternative 1, food storage and sanitation requirements would continue to be included in contracts, and DNRC staff would be informally briefed. Alternatives 2 and 4, 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 bears. Alternative 3 would go further, requiring a DNRC agency-wide food storage and sanitation order for all activities, not just forest management activities. This order would be based on IGBC task force recommendations, and would be required to be implemented within 2 years of Permit issuance. All action alternatives would increase awareness of agency personnel and contractors, and would reduce the potential for food and sanitation-related risks to grizzly bears when compared with Alternative 1. Alternative 3 would provide a greater number of measures and considerably expand the scope of application, potentially even to where bears are not present. 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. While all of the action alternatives provide additional measures intended to reduce risk to grizzly bears beyond Alternative 1, the actual degree that such measures would differentially reduce risk to bears in relation to DNRC's forest management program is uncertain.

Firearms

Under Alternative 1, firearms would continue to be prohibited for contractors and employees, except in the case of employees who are specifically authorized to carry a firearm under special circumstances. All three action alternatives 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. Thus, there are no appreciable differences among the no-action or action alternatives regarding risk to grizzly bears.

Livestock Grazing

Under Alternative 1, DNRC would determine restrictions on a case-by-case basis regarding grazing concerns on lands in recovery zones or NROH. In situations where there is a high risk of 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.

Under Alternatives 2, 3, and 4 in NROH**,** 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 bears (e.g., through the use of human shepherds, fencing/bedding areas, guard dogs). Additionally, prompt removal of all livestock carcasses identified as creating the potential for bear-human encounters would also minimize risk of bear-livestock conflicts. None of the action alternatives would differ in how livestock grazing concerns would be addressed. 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. Compared to Alternative 1, like measures contained in the action alternatives would help reduce the risk of bear-human conflicts associated with livestock on trust lands.

Gravel Operations

<u>Potential Effects</u>

- Increased levels of human activity associated with gravel operations may displace bears from otherwise suitable habitat.

<u>Indicators and Rationale</u>

Limitations on the number, location, and size of active gravel pits is the primary means for avoiding or minimizing their potential effect on 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 open road density above. Therefore, this analysis primarily addresses provisions for gravel pits that would occur greater than 0.25 mile from open roads.

<u>Comparison of Alternatives</u>

Gravel pits are restricted in number, location, and timing, and have specific definitions regarding size: borrow-size (up to 1 acre), medium (1 to 4.9 acres), and large (5 to 40 acres). In Alternative 1, gravel pits only have to be located as close to planned roads as possible and must adhere to the requirements of Opencut Mining Permits for large gravel pits in all areas. Therefore, gravel pits could displace bears from suitable habitat because relatively few restrictions are in place under this alternative regarding the allowable numbers, sizes, timing of operations, and specific locations of pits.

Under all action alternatives, five active pits would be allowed on the Stillwater Block in any calendar year, with no more than three of these considered large, while the Swan River State Forest could operate four, with only three considered large. On scattered parcels, three pits would be allowed per administrative unit, with only two of these considered large. Gravel pits are only counted in this total if they are more than 0.25 mile from an open road, but include federal and state highway pits. Effects on 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. Pits within 0.25 mile would not be subject to restrictions on season or duration of use because they are considered close enough to open roads to be part of the disturbance associated with those roads. Thus, DNRC managers would be encouraged through these commitments to place pits adjacent to open roads to minimize disturbance risk in more remote locations.

The effects of gravel pits operated greater than 0.25 mile from an open road are 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 (see Table E3-1 in Appendix E, EIS Tables).

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

During the 4-year window for forest management within active subzones on blocked lands or on scattered parcels, gravel pits more than 0.25 mile from an open road may be operated outside the spring rest period without restriction on amount and duration of use while commercial activities are also taking place. Specific commitments in the Stillwater Block (Class A and B lands), Swan River State Forest, and scattered parcels restricting the number and size of gravel pits in operation farther than 0.25 mile from an open road would be in place as well.

Gravel pits do remove suitable habitat from potential use by bears; however, for the period the pits are operating, bears are likely to avoid these areas due to the high disturbance and noise associated with this activity. However, assuming that all units would develop all allowable pits to the largest size possible, a maximum of 1,105 acres could be converted to a non-vegetated condition, and most of this acreage would lie close to existing open roads. This represents 0.4 percent of the 266,900 acres of HCP project area lands within all recovery zones and NROH. Some additional acreage could be affected that would be associated with state and federal highway construction projects; however, actual acreages are uncertain, and effects on federally protected species from those actions would be addressed under project-specific permitting processes with federal oversight outside the scope of this analysis.

With these gravel pit commitments in place under all action alternatives, risk of adverse effects to grizzly bears is low, and the commitments under all action alternatives would provide considerable additional protections for grizzly bears as compared to Alternative 1.

Habitat Modification

Visual Screening

Potential Effects

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

Indicators and Rationale

Activities that reduce the potential for vegetation to conceal a grizzly bear can lower effective bear use of habitat and render bears more vulnerable to human-caused mortality (Servheen et al. 1999). Visual screening along roads and in areas that provide foraging habitat for 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.

For this analysis, modeled cover projections are used for comparison of the differences in how hiding cover would be affected under each of the alternatives. The model used to derive the DNRC sustainable yield estimate (DNRC 2004b) was also used to estimate forest cover at structural densities that would screen from view large mammals such as grizzly bears. The model was constrained differentially based on the varying characteristics and requirements of each of the alternatives. Outputs were projected for years 0 and 50 after Permit issuance (Table 4.9-17). 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. 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 and comparing the alternatives at a landscape scale. The following subsection also identifies and compares the rules, policies, and commitments under the alternatives that address the provision of visual screening in RMZs and WMZs in timber harvest units and along open roads.

Comparison of Alternatives

Under Alternative 1, DNRC would be required to maintain 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 would be provided, where available, along all ~~riparian zones~~RMZs and WMZs. DNRC would also be required to provide visual screening adjacent to open roads to the extent practicable. Within the Swan River State Forest and the Stillwater Block, DNRC would be required to retain no less than 40 percent of the trust lands in any BMU subunit in hiding cover.

TABLE 4.9-17. PROJECTED ACRES OF GRIZZLY BEAR HIDING COVER FOR EACH ALTERNATIVE ON THE HCP PROJECT AREA BY LAND OFFICE, AND STILLWATER BLOCK AND SWAN RIVER STATE FOREST THAT ARE SITUATED WITHIN GRIZZLY BEAR RECOVERY ZONES AND ALL OTHER PROJECT AREA LANDS OUTSIDE OF RECOVERY ZONES AT YEARS 0 AND 50

	Acres of Grizzly Bear Hiding Cover in the HCP Project Area				
	Year 0	50 years			
DNRC Land Office and Status in or out of Recovery Zones	All Alternatives	No Action	Alternative 2	Alternative 3	Alternative 4
CLO Total	30,409	35,320	35,320	35,219	35,320
CLO in Recovery Zones	231	252	252	252	252
CLO outside Recovery Zones	30,178	35,068	35,068	34,967	35,068
NWLO Total	186,464	186,519	185,553	186,197	185,640
NWLO Total in Recovery Zones	103,247	105,583	104,043	105,993	104,363
NWLO Total outside Recovery Zones	83,217	80,937	81,510	80,203	81,277
Stillwater Block in Recovery Zones (includes blocked and scattered parcels)	61,745	63,656	61,605	63,685	61,642
Stillwater Block outside Recovery Zones (includes scattered parcels)	11,015	11,183	11,065	10,963	11,140
Swan River State Forest in Recovery Zones (blocked lands)	31,121	31,644	32,371	31,944	32,311
Other NWLO Units in Recovery Zones (KU, LIB, PLNS)	10,381	10,282	10,067	10,365	10,409
Other NWLO Units outside Recovery Zones (KU, LIB, PLNS)	72,202	69,754	70,445	69,240	70,137
SWLO Total	61,695	60,656	60,677	60,641	60,677
SWLO in Recovery Zones	4,000	3,873	3,917	3,873	3,917
SWLO outside Recovery Zones	57,695	56,783	56,760	56,768	56,761
TOTAL in Recovery Zones (% of recovery zone acres)	107,478 (69.7)	109,708 (71.2)	108,211 (70.2)	110,119 (71.4)	108,531 (70.4)
TOTAL outside Recovery Zones	171,090	172,788	173,338	171,938	173,106
GRAND TOTAL	**278,568**	**282,496**	**281,549**	**282,057**	**281,637**
Total Percent Cover Estimates for 446,095 acres of Forested Trust Lands in the Project Area[1]	62.4	63.3	63.1	63.2	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.

Source: DNRC (2008a).

Alternatives 2, 3, and 4 include GB-PR6, a program-wide commitment that would require DNRC to provide visual screening in ~~riparian areas and in wetlands~~RMZs and WMZs. In recovery zones and NROH, 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 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. This commitment to provide visual screening along open roads would be implemented under

Alternatives 2 and 3, but not Alternative 4. Alternative 4 would only incorporate these measures as in Alternative 1 for the Stillwater Block and Swan River State Forest. The requirement to retain target amounts of hiding cover in BMU subunits in the Stillwater Block would cease under Alternatives 2, 3, and 4. Under all three action alternatives, the similar requirement for the Swan River State Forest would cease if the Swan Agreement is terminated. Collectively, the three measures described above (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 direct bear mortality and potentially increasing habitat effectiveness, compared to Alternative 1. However, Alternative 4 would require less screening along open roads than Alternatives 2 and 3, thus resulting in a slightly elevated risk to grizzly bears than those two alternatives.

Modeled cover projections at year 50 varied little between alternatives (Table 4.9-17). Estimates by alternative at year 50 were very similar for each individual land office and the two blocked units, indicating no severe differential harvesting on one land office versus another over the Permit term. Compared to the current condition, total estimates of forest vegetation that would provide visual screening in recovery zones increased slightly under all alternatives at year 50, and the estimate for Alternative 3 was greatest at 110,119 acres. The percentage of cover in recovery zones of all of the HCP project area lands ranged from 70.2 (Alternative 2) to 71.4 (Alternative 3), well above the 40 percent threshold requirements required by the ARMs and Swan Agreement under Alternative 1. Similarly for all forested HCP project area lands, the percentages of acres possessing cover under all action alternatives varied from 63.1 to 63.3 percent (Table 4.9-17). In recovery zones, Alternative 2 showed the greatest decrease at year 50 from Alternative 1 with about 1.4 percent fewer acres in cover. Localized risks to grizzly bears associated with management of forest cover could occur at smaller scales; however, this analysis indicates that anticipated levels would be relatively high across HCP project area lands over the 50-year Permit term. Thus, the greatest differences among the alternatives in how they address cover-associated risks to grizzly bears is likely through differences in how they address distance to cover and visual screening along open roads, as described above.

Habitat Elements

Potential Effects

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

Indicators and Rationale

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. Management activities that reduce the effectiveness of such areas to provide forage, or reduce use of these important places during important seasons, could adversely impact the nutritional condition of bears. The following discussion identifies and compares the rules, policies, and commitments that address impacts to these habitat elements under the alternatives.

Comparison of Alternatives

Under Alternative 1, impacts to habitat elements would be addressed as identified for individual projects through the MEPA interdisciplinary process. No rules are currently in place to identify or mitigate the impacts of timber management activities on specific habitat elements. In contrast, Alternatives 2, 3, and 4 contain specific provisions for assessing impacts to specific grizzly bear habitat elements for projects in recovery zones. DNRC would develop mitigations that minimize impacts to these specific habitat elements. Mitigations would typically involve scheduling activities to occur while 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 compared to Alternative 1, which would provide no specific direction or assurances. As described earlier in this analysis, ~~riparian areas~~RMZs, WMZs, and avalanche chutes would be similarly protected through the program-wide commitment that restricts road construction in these important areas. There may be instances when it is impracticable to incorporate habitat elements into project designs. In these situations, DNRC would document the circumstances in the MEPA environmental analysis. Such a situation is not expected to preclude the project from addressing at least some habitat element measures in the project design. Additionally, the USFWS would monitor these situations as described in HCP Chapter 4 (Monitoring and Adaptive Management) in Appendix A (HCP). Therefore, potential effects on habitat elements are expected to be minor.

Habitat Linkage

Potential Effects

- 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 and Rationale

The effects of the alternatives are evaluated in two ways: (1) a comparison of standards for maintaining cover and other vegetative conditions and road densities conducive to promoting bear security and habitat linkage, and (2) an assessment of the likelihood that portions of linkage areas in the HCP project area would be converted to residential or other development.

Comparison of Alternatives

No boundary changes or land additions to any formally identified linkage zones would occur under any of the alternatives. 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 the project area (approximately 2 percent) and distribution of lands in western Montana (Tables 4.9-8 and 4.9-9, and Figures D-18A through D-18C in Appendix D, EIS Figures). 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). With the exception of spring restriction commitments for specific linkage zones in the Swan River State Forest that apply under the Swan Agreement, the commitments under all alternatives 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, or similar commitments associated with all action alternatives for supporting effective linkage in that area. All of the alternatives are similar and vary slightly in how they contribute to, or may impact, habitat linkage for grizzly bears and other species on project area lands in western Montana.

Under Alternative 1 for all DNRC forest management projects, forest patch size, shape, connectivity, and habitat fragmentation would be considered at the project level under ARM 36.11.415. In the Stillwater Block, commitments to security core would remain in place, the 40 percent hiding cover in BMU subunits measure would remain, gates would be checked and repaired annually, and open road densities would be managed under the approach of no net increase from the 1996 baseline. Visual screening would continue to be required along open roads in the Stillwater Block. Similarly, on the Swan River State Forest, activities would be avoided in the spring period in defined linkage zones below 5,200 feet elevation, harvest unit design would require the 600-feet-to-cover measure, and a minimum of 40 percent hiding cover would be maintained per BMU subunit, as long as the Swan Agreement is in place. Open road density limits would also remain in place in the Swan River State Forest, gates would be checked and repaired annually, and visual screening would continue to be required along open roads~~ and riparian areas~~, RMZs, and WMZs. On scattered parcels in grizzly bear recovery zones, open roads would be restricted to no net increase on lands with greater than 1 mi/mi^2. Retention of cover associated with ~~riparian zones~~RMZs and WMZs and visual screening along open roads would continue to be required. These measures would continue to contribute to linkage in areas that are important for grizzly bears.

Under Alternatives 2, 3, and 4, forest patch size, shape, connectivity, and habitat fragmentation would continue to be considered in a similar manner at the project level under ARM 36.11.415. Under all action alternatives, access management would be addressed on blocked lands through the incorporation of relatively static transportation plans. The approaches under all action alternatives incorporate seasonal restrictions on roads; limits on amounts of open and restricted roads; and maintenance of large, relatively secure areas that would facilitate their use by grizzly bears during important seasons. Under all action alternatives, a program-wide commitment for all HCP project area lands would ensure that visual screening associated with RMZs and WMZs is retained, and that limited road construction would occur within these areas and avalanche chutes. Also, authorization of access easements with other parties would be subject to greater scrutiny and oversight by the FMB within both recovery zones and NROH, placing additional controls on access within areas potentially important for linkage. Similarly, in NROH and recovery zone lands (on both blocked lands and scattered parcels), additional restrictions on allowable activities in spring habitat would reduce risk for bears during this important season, including areas with high linkage value. In particular, these improved spring commitments expand restrictions from those contained in Alternative 1 to include a much greater area associated with scattered parcels, the Swan River State Forest (if the Swan Agreement is terminated), and lands within the CYE. Checking and repairing gates and road closure devices would also be expanded under all action alternatives to include all scattered parcels in recovery zones. Repair time for ineffective closures could not extend beyond 2 years under any action alternative. Under all action alternatives, there would be no specific requirement to maintain a specific hiding cover percentage; however, the application of a requirement to restrict harvest unit size to ensure cover is available within 600 feet from any point within a clearing would be expanded to include all of the Stillwater Block and all scattered parcels within recovery zones and NROH. Under Alternative 1, this measure is only applicable on the Swan River State Forest. Given the results contained in Table 4.9-17 and DNRC's commitment by statute to a sustainable harvest volume (MCA 77-5-222), hiding cover amounts are not expected to vary appreciably under Alternative 1 or any of the action alternatives.

Under Alternative 3, maintenance of security core areas on the Stillwater Block at the DNRC 1996 baseline levels would continue. Under Alternatives 1 and 3, approximately 39,600 acres in the Stillwater Unit would be managed as secure habitat for at least 10 years (Stillwater Core). In contrast, about 19,400 acres (53 percent of the 36,800 acres) would be managed as quiet areas under Alternatives 2 and 4**,** with a maximum entry period of 4 years of activity followed by 8 years of rest from commercial logging activities. On the Stillwater Block, Alternative 3 would likely provide the greatest degree of habitat quality associated with the formally identified linkage zone along Highway 93 because it requires that the largest amount of blocked secure acreage that possesses the least allowable disturbance be maintained. In NROH and recovery zones, Alternative 3 would provide greater levels of restriction on low-intensity motorized activities in seasonally important areas, such as spring habitat, and greater motorized activity restrictions in recovery zones in post-denning habitat found at high elevations. Where such areas occur within lands important for linkage, bears may be better able to live and move through such places undisturbed. In contrast to Alternatives 1, 2, and 4, Alternative 3 provides a cap on the level of restricted roads on scattered parcels in recovery zones, allows less motorized use for low-intensity activities in the CYE in spring habitat, and provides for greater oversight and approval by the USFWS for activities associated with salvage harvest and interrupting parcels or subzones in rest.

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. However, all action alternatives provide for restrictions on access, quiet areas, cover maintenance, and control of development in similar ways. Alternatives 2, 3, and 4 would increase the amount and quality of linkage zones when compared to current conditions, especially within the Stillwater Block and Swan River State Forest, due to the variety of mitigation measures incorporated within these areas. There is likely little measurable difference between Alternatives 2 and 4 in how habitat linkage would be influenced for grizzly bears. However, Alternative 3 provides tighter controls on public and administrative motorized access, greater acreage of secure/quiet areas, and more rigid oversight and approval by the USFWS for activities associated with salvage harvest and interrupting parcels or subzones in rest. Collectively, these additional measures may result in somewhat greater potential to maintain important linkage areas of higher quality than Alternatives 1, 2, or 4. All three action alternatives provide greater certainty of maintaining linkage in important areas over the 50-year Permit term than Alternative 1.

Summary

Compared to Alternative 1, all three action alternatives would impose greater restrictions on the location of new road construction and the granting of access easements, potentially reducing the risk of effects on bears due to the presence of roads in key habitat areas. Alternative 3 would include additional commitments, prohibiting any net increase in total road densities at the administrative unit level.

Within the Stillwater Block, implementation of the transportation plan under Alternatives 2 and 4 would be expected to reduce, but not eliminate, the risk that bears may be displaced from habitat they would otherwise use for feeding, breeding, or shelter, compared to Alternative 1. In areas that are currently managed as security core (Stillwater Core), however, the risk would increase because some roads that are currently closed year-round to motorized public access would be open with seasonal restrictions. This risk would be offset in part by the implementation of more rigorous requirements for monitoring and maintaining road closures. Under Alternative 3, DNRC would maintain existing road closures in the Stillwater Core, with additional provisions for grizzly bears.

Open road densities in the Swan River State Forest would be expected to remain at or near existing levels under Alternative 1. Under the action alternatives, if the Swan Agreement is terminated, open road densities could increase dramatically, depending on the status of access agreements with neighboring landowners. On scattered parcels in recovery zones and NROH, transportation commitments under the action alternatives would reduce the likelihood (compared to Alternative 1) of open roads being located in key grizzly bear habitat during key times of the year.

Effects on grizzly bears attributable to DNRC's helicopter activities would likely be minor for all alternatives since helicopter logging occurs infrequently within DNRC's forest management program, relatively small areas are typically affected by helicopter use (less than 320 acres annually statewide), and disturbance is brief (usually initiated and completed within one 3- to 6-month operating season). While short-term helicopter disturbance can be intense for local bears using an area, the effect of the activity provides less long-term risk than similar ground-based yarding methods requiring new road construction or existing road systems. While Alternative 1 includes measures to minimize disturbance associated with helicopter use, these measures would only apply in the Stillwater Block. All of the HCP alternatives would require measures to minimize disturbance effects from helicopter use across a broader geographic area, which would further minimize potential disturbance effects on bears.

Compared to Alternative 1, the total amount of land area managed to reduce the risk of bear-human conflicts would increase under all of the action alternatives, from approximately 76,300 acres under Alternative 1 to almost 95,000 acres under Alternatives 2 and 4**,** and more than 112,000 acres under Alternative 3. The management emphasis in these areas would differ under the alternatives, however. Under Alternatives 2 and 4, areas in the Stillwater Core would instead be managed as quiet areas, with reduced restrictions on where and when management activities may occur. These changes could increase the risk of such activities occurring at locations that would displace bears. However, these increased risks would be offset by restrictions on commercial activities in spring habitat in the spring period and no net increases in open road densities in rested subzones. In contrast, under Alternative 3, DNRC would maintain its commitment to keeping the Stillwater Core area intact for periods of at least 10 years, which is similar to Alternative 1.

All three action alternatives would impose greater restrictions on activities in spring habitat, post-denning habitat, and near den sites, compared to Alternative 1. These restrictions would reduce the risk of displacement from important habitat during these crucial periods. The greatest reduction of risk would occur under Alternative 3, which would implement the most stringent restrictions, with slightly smaller risk reductions under Alternative 2, followed by Alternative 4. Additional provisions for public education, food storage and sanitation, limitations on firearms possession, restrictions on livestock grazing, and the location of gravel operations under the action alternatives would further reduce the risk of habituation to human presence and foods, as well as bear-human encounters.

Compared to Alternative 1, commitments under the action alternatives to provide additional visual screening in important foraging areas, near harvest openings, and along open roads, would reduce the risk the of direct bear mortality and potentially increase habitat effectiveness and maintenance of effective linkage. In addition, the action alternatives would include commitments to identify and mitigate the impacts of timber management activities on habitat features that provide key foraging opportunities, thereby reducing the risk of displacement from these sites.

The different commitments under the alternatives would provide a range of protection for grizzly bears and their habitat, and these measures are expected to reduce the effects of other stressors that may compound the anticipated effects of climate change over the Permit term. Under Alternative 1, ongoing changes and related scientific research would be factored into project-level designs and analyses as they occur, and additional mitigation measures may be required for individual projects to further protect grizzly bears. In contrast, the action alternatives include additional commitments to protect bears and bear habitat that would be in effect for the entire Permit term. Through annual and 5-year reviews, the monitoring and adaptive management process, and the changed circumstances process, the action alternatives would also provide continuing opportunities to address ongoing changes and incorporate current scientific research.

Overall, Alternative 3 is expected to result in the lowest potential for forest management activities on trust lands contributing to any adverse effects from climate change, followed by Alternatives 2, 4, and then 1. On a local level, more active forest management in the Stillwater Core under Alternatives 2 and 4 may increase stress on bears responding to climate change in that area. For example, bears facing stress due to geographic and temporal shifts in the availability of food and other resources may be further stressed by increased levels of disturbance due to management activities, leading to their possible displacement from preferred habitats for feeding, breeding and sheltering.

4.9.4 Canada Lynx

4.9.4.1 Affected Environment

Status and Distribution

The DPS of Canada lynx in the contiguous United States was listed as threatened by the USFWS on March 24, 2000 (65 FR 16051 -16086). A status review by the USFWS in 2003 concluded that listing the lynx as endangered was not warranted and that the contiguous United States DPS was correctly classified as threatened (68 FR 40076-40101, July 3, 2003).

Canada lynx are found in boreal forest habitat throughout northern Canada and Alaska; they extend south into the contiguous United States in the Northeast (northern Maine and New Hampshire), Great Lakes region, and Northern Rocky Mountains and Cascade Mountains (USFWS 2005c). Lynx population densities are highest in the northern parts of their range (northern Canada and Alaska), and densities of the contiguous United States populations are lower and likely dependent on immigration from the northern populations (Ruediger et al. 2000; USFWS 2005c). The Northern Rocky Mountains in the United States (i.e., within Idaho, Montana, Wyoming, and Utah represents one of the southern limits of their North American distribution (USFS and BLM 2004). In Montana, lynx are currently found in the Rocky Mountains from the Canadian border south to the Yellowstone area (Butts 1992; McKelvey et al. 1999; Ruediger et al. 2000) and east to the Big Belt, Little Belt, and Crazy Mountains (Butts 1992; Ruediger et al. 2000). Trapping records indicate historical presence in the Big Snowy, Little Snowy, and Highwood Mountains. Lynx distribution in Montana is shown on Figure D-19 (Appendix D, EIS Figures).

The current status of the lynx population in isolated Montana mountain ranges, including the Big Snowy and Judith Mountains, has not been determined (Ruediger et al. 2000). The current lynx population in Montana is unknown, although limited population data indicate that Montana likely has more lynx than any other western state (Foresman 2001). Foresman (2001) reported estimates for the Montana population at between 800 and 1,000 lynx, and MFWP (2005a) considered the Montana lynx population to be well-distributed and stable. However, more recent observations, particularly in light of observed climatic warming trends, have raised questions about numbers and stability of local populations (Squires 2007, personal communication; McKelvey et al. 2008). Lynx are capable of traveling long distances, and there are occasional records for Montana of lynx sightings in habitat unsuited to sustaining a lynx population (Foresman 2001).

In the planning area, lynx distribution encompasses the administrative boundaries of the CLO, NWLO, and SWLO (Figure D-19 in Appendix D, EIS Figures). DNRC does not monitor lynx populations, but does report sightings of lynx and other special status species to the MNHP (DNRC 2005b). Between 2001 and July 2005, DNRC biologists reported two lynx sightings to MNHP (DNRC 2005b).

As a result of the federal listing of lynx, DNRC developed ARMs for forest management activities to address lynx habitat issues and ESA requirements. The proposed lynx conservation strategy incorporates many of the existing Forest Management ARMs and contains additional commitments based on recent information and studies. The action alternatives minimize impacts of forest management activities on lynx, while allowing varying degrees of management flexibility for DNRC to meet its fiduciary and stewardship trust responsibilities. See Appendix A (HCP) for further details concerning the proposed HCP lynx conservation strategy (Alternative 2).

In 2000, the LCAS was developed by the USFS, BLM, NPS, and USFWS to provide a consistent and effective approach to conserve lynx on federal lands in the contiguous United States (Ruediger et al. 2000). The guiding principles of this document are: (1) to use the best scientific information available about lynx; (2) retain future options until more conclusive information concerning lynx management is developed; (3) integrate a consideration of natural ecological processes and landscape patterns, and explicitly consider multiple spatial scales; (4) consider the habitat requirements of other wildlife species, including other forest carnivores; and (5) develop a useful, proactive plan to conserve lynx on federal lands. The principles of the LCAS were used to guide development of the lynx conservation strategy for the proposed HCP.

The LCAS identified 17 risk factors affecting lynx productivity, mortality, and dispersal. These 17 risk factors can be grouped into four broad categories: (1) sources of direct mortality (e.g., from predation, trapping, shooting, and vehicle collisions); (2) habitat loss (e.g., from forest management and non-native plant species); (3) habitat fragmentation (e.g., from highways and human development); and (4) disturbance, particularly near den sites (e.g., from forest management and recreation). This EIS (and the proposed HCP) addresses the last three categories of risk factors, because these are most likely to be affected by DNRC forest management activities. In earlier conservation efforts, it was assumed that packed snowmobile routes provide unnatural trails into areas with deep snow, providing a competitive advantage to species such as coyotes. However, a recent, local study designed to examine this concern found little evidence for that hypothesis (Kolbe et al. 2007). Therefore, this issue is not analyzed further in this EIS.

In 2005, the USFWS developed a recovery outline for lynx in the contiguous United States (USFWS 2005c). The purpose of the outline is to serve as an interim strategy for the USFWS to guide recovery efforts until a final recovery plan is completed. The outline introduces 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. The HCP project area lies within core and secondary areas. The recovery outline provides four preliminary recovery objectives, and the HCP conservation strategies are consistent with these objectives.

Life History

Canada lynx are wide-ranging carnivores with relatively large home ranges (up to 50 square miles [USFWS 2005c]) that requires various habitat features for foraging and denning. The distribution of lynx is closely associated with boreal forest and distribution of their principal prey, snowshoe hares (Koehler and Aubry 1994; Hodges 1999; Ruediger et al. 2000). Throughout their range, lynx rely on hares for anywhere from 35 to 97 percent of their diet; therefore, it is generally accepted that lynx select habitats with abundant snowshoe hare populations (Brand and Keith 1979; Koehler and Aubrey 1994; Murray et al. 1994). From 1998 to 2002, a study in northwestern Montana found that snowshoe hares made up 96 percent of the prey biomass found in winter diets of lynx (Squires and Ruggiero 2007). Lynx have large feet and long legs and are well-adapted to moving in moderately deep to deep soft snow, which may provide an advantage over competing predators (coyote and bobcat) when hunting in these conditions (Ruediger et al. 2000). In the western United States, most lynx habitat is found in coniferous forests of the Rocky Mountains (Kuchler 1964 *in* McKelvey et al. 1999) at elevations from 4,900 to 6,500 feet (McKelvey et al. 1999). Lynx are solitary animals, except for young of the year that remain with their mothers. Mating occurs in March and April, and dens are used by lynx for birthing and rearing kittens until the kittens are approximately 10 weeks of age (WADNR 1996; MFWP 2005a). While rearing kittens, lynx may be highly sensitive to disturbance and, if disturbed, have been known to abandon den sites (Claar et al. 1999; Ruediger et al. 2000).

Analysis Units

The LCAS required identification of lynx habitat and establishment of "lynx analysis units" (LAUs) throughout the lynx's range on federal lands. 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. Table 4.9-18 summarizes the number and acreage of LAUs in Montana, and acreage of federal lands and trust lands within LAUs. Further details regarding lynx analysis and methodology can be found in Document B-3 – DNRC Canada Lynx Habitat Mapping Protocols for Implementation of the HCP in Appendix B (HCP Documents). Within the planning area, there are 830 LAUs containing about 8.4 million acres of lynx habitat on federal lands and ~~86,000~~112,200 acres of habitat on trust lands. Thus, habitat on trust lands makes up about ~~1~~1.3 percent of that identified on federal lands. ~~In comparison to the amount of suitable habitat in LAUs found on federal lands in western Montana, DNRC's contribution is considerably smaller.~~

TABLE 4.9-18. LYNX HABITAT WITHIN FEDERALLY DEFINED (USFS AND BLM) LYNX ANALYSIS UNITS WITHIN THE PLANNING AREA

Subject Description	Amount	
Number of LAUs ~~Containing Federal Land~~ with Federally Identified Lynx Habitat	830	
Total Acreage within ~~of~~ LAUs ~~Containing Federal Land with Some Amount of Federally Identified Lynx Habitat~~	19,388,255	
Acreage of Federally Identified Lynx Habitat within LAUs	8,409,506	
Acreage of Trust Land ~~that Occurs~~ within ~~Federal~~ LAUs	612,755	
Acreage (and Percent)[1] of DNRC Total Potential Lynx Habitat ~~that Occurs~~ within LAUs That Also Contain Federally Identified Lynx Habitat	112,221	(1.3)

[1] The percentage of DNRC total potential lynx habitat acres of the federal lynx habitat acres occurring in LAUs.
Source: DNRC (2008a).

For this analysis, and for implementation of the proposed HCP, DNRC delineated LMAs in areas ~~believed to be~~ of elevated importance for lynx conservation. LMAs represent DNRC's effort to develop management areas that reflect the complexity of DNRC ownership patterns and identify lynx habitat on trust lands in a manner similar to that used for delineating federal lands within LAUs in western Montana. DNRC developed LMAs based on available literature, correspondence with John Squires (USFS research biologist), the LCAS (Ruediger et al. 2000), and habitat definitions for several national forests in Montana. Six LMAs were delineated in the HCP project area, and these encompass approximately 151,000 acres of trust lands in the NWLO and SWLO. These are the Stillwater East, Stillwater West, Coal Creek, and Swan LMAs in the NWLO and the Garnet and Seeley Lake LMAs in the SWLO (Figure C-17 in Appendix C, HCP Figures).

Habitat Requirements

Forest cover types preferred by lynx in the western United States include lodgepole pine, subalpine fir, Engelmann spruce, and the cedar-hemlock cover type in northwestern Montana (Aubry et al. 1999). Lynx will also use cool, moist Douglas-fir, grand fir, western larch, and aspen cover types where they occur in or near subalpine forests (Ruediger et al. 2000).

Lynx use a variety of forest structural stages to meet their foraging, denning, and cover habitat needs. 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). Optimal foraging habitat includes forested stands in the seedling or sapling age class with high stem densities and a dense overhead canopy or shrub layer between 3 and 10 feet in height. Lynx also use late-seral forests for foraging, as snowshoe hares also use these forest types (Griffin 2004). Denning habitat generally consists of late-seral forests with high horizontal cover, although younger forests with adequate woody debris are also used (Mowat et al. 1999; Squires 2008). The important component for all lynx den sites appears to be the amount of woody debris present, not the age of the forest (Mowat et al. 1999).

For this analysis, potential lynx habitat was defined and modeled throughout the EIS planning area. Potential lynx habitat includes both suitable habitat and temporary non-suitable habitat, and represents any stands with the potential to support vegetation types preferred by lynx, regardless of a stand's current structural condition. For units west of the Continental Divide, preferred habitat types were used as the primary indicators of potential lynx habitat regardless of elevation or average snow depths. For units east of the Continental Divide, elevation and other attributes from photo interpretation data were integrated into habitat identification due to SLI data limitations. For more details regarding ~~mapping and modeling protocol~~classification of lynx habitat, refer to Document B-3 – DNRC Canada Lynx Habitat Mapping Protocols for Implementation of the HCP in Appendix B (HCP Documents).

Suitable habitat consists of forest stands within habitat types considered to be preferred by lynx, where crown closure is at least 40 percent. Suitable lynx habitat also includes stands that contain at least 180 stems per acre that are greater than or equal to 6 feet tall. Suitable habitat is subdivided into winter foraging habitat, ~~young~~summer foraging habitat, and other foraging habitat classes. Winter foraging habitat includes sawtimber stands that possess multi-layering of moderate- or well-stocked coniferous vegetation and horizontal cover. ~~Young~~Summer foraging habitat includes ~~conifer seedling and sapling stands with an average height greater than or equal to 6 feet and a density greater than 2,000 stems per acre~~dense sapling stands and moderate to densely stocked poletimber stands within suitable lynx habitat that possess horizontal cover. Other suitable habitat is a subset of suitable lynx habitat that does not contain the necessary attributes to classify as winter foraging habitat or ~~young~~summer foraging habitat. Winter foraging habitat is most likely to be influenced by commercial timber harvesting activities, while ~~young~~summer foraging habitat is primarily influenced by pre-commercial thinning.

Temporary non-suitable habitat includes recently harvested or naturally disturbed (e.g., burned) areas that have fewer than 180 saplings per acre that are at least 6 feet tall, or less than 40 percent total stand canopy cover, but have the potential to be forested suitable lynx habitat over time. Non-habitat areas include permanent non-forested areas, such as dry forest types, rock, lakes, and meadows.

It should be noted that the definitions of suitable and temporary non-suitable habitat used for the proposed HCP and for this analysis differ slightly from those currently found in the Forest Management ARMs (ARM 36.11.403). Under ~~both~~the Forest Management ARMs definition~~s~~, the amount of total potential lynx habitat on trust lands in the planning area is approximately ~~218,727~~218,700 acres (Table 4.9-19). Under the HCP action alternatives, the mapping criteria for lynx potential habitat was expanded to include lynx habitat in areas mapped as big game winter range. As a result, total potential lynx habitat under the HCP definition is approximately 298,900 acres in the planning area (Table 4.9-19). Of this, approximately ~~182,500~~248,500 acres (using the HCP definition) or 186,600 acres (using the Forest Management ARMs definition) are considered suitable habitat. These values compare to approximately 8.5 million acres of suitable lynx habitat on federal lands in the planning area (Table 4.9-19). Additional information on lynx habitat by land office and administrative unit is provided in the tables contained in the *Supporting Documentation for the HCP Wildlife Analysis* (DNRC 2008i). Further details regarding lynx analysis and methodology can be found in Document B-3 – DNRC Canada Lynx Habitat Mapping Protocols for Implementation of the HCP in Appendix B (HCP Documents).

Based on the HCP definition of lynx habitat, there are approximately 257,300 acres of total potential lynx habitat within the HCP project area (Table 4.9-19). Of this, approximately 214,600 acres are considered suitable habitat (Table 4.9-19). Approximately ~~93,000~~107, 300 acres of suitable lynx habitat currently occur on trust lands within ~~DNRC~~ LMAs, which is 83 percent of the total potential habitat (129,300 acres) in those areas (Table 4.9-20). On scattered parcels, suitable habitat makes up approximately ~~75,000 acres (85 percent) out of 88,000 acres~~ 107,300 acres out of 128,000 acres of total potential lynx habitat (Table 4.9-21).~~ Together, these values add up to approximately~~

TABLE 4.9-19. COMPARISON OF ACREAGES OF LYNX HABITAT ON FEDERAL VS. DNRC LANDS IN THE PLANNING AREA AND HCP PROJECT AREA

Habitat Type	Lynx Habitat on Federal Lands in the Planning Area	Lynx Habitat[1] on DNRC Lands in the Planning Area		Lynx Habitat[1] on DNRC Lands in the HCP Project Area	
		HCP Definition	Forest Management ARMs Definition	HCP Definition	Forest Management ARMs Definition
Suitable Lynx Habitat[2]	8,456,017	248,529	186,610	214,605	169,997
Temporary Non-suitable Habitat[3]	—	50,415	32,117	42,728	29,166
Total Potential Lynx Habitat	**8,456,017**	**298,944**	**218,727**	**257,333**	**199,163**

[1] Subtle differences in vegetative parameters exist between the action alternatives and Alternative 1 (Forest Management ARMs definitions). See Glossary for these definitions.
[2] Suitable lynx habitat on federal lands includes suitable habitat as mapped by the USFS. Estimates for suitable habitat on DNRC lands are derived using DNRC's lynx habitat mapping protocol (see Appendix B, HCP Documents, Document B-3 – DNRC Canada Lynx Habitat Mapping Protocols for Implementation of the HCP).
[3] Applies only to DNRC lands. Complete temporary non-suitable habitat maps were not available for federal lands.
Source: DNRC (2008a).

TABLE 4.9-20. COMPOSITION OF CURRENT LYNX HABITAT, USING THE HCP LYNX HABITAT DEFINITION, WITHIN PROPOSED LMAS IN THE HCP PROJECT AREA

Habitat Class	Proposed LMAs (Land Office)[1] Stillwater West (NWLO)		Stillwater East (NWLO)		Coal Creek (NWLO)		Swan (NWLO)		Seeley Lake (SWLO)		Garnet (SWLO)		Total
	Acres	%	Acres	%	Acres	%	Acres	%	Acres	%	Acres	%	Acres
Winter Foraging Habitat[2]	21,975	61.8	26,065	75.6	5,103	36.0	23,798	64.9	2,556	57.2	1,079	27.5	80,576
~~Young~~Summer Foraging Habitat[2]	6,556	18.4	2,398	7.0	1,954	13.8	2,588	7.1	278	6.2	210	5.4	13,984
Other Suitable Habitat[2]	3,268	9.2	663	1.9	1,832	12.9	3,632	9.9	1,206	27.0	2,100	53.5	12,701
Suitable Habitat Subtotal[2,3]	31,799	89.4	29,126	84.5	8,889	62.7	30,018	81.9	4,040	90.5	3,389	86.4	107,261
Temporary Non-suitable Habitat[2]	3,783	10.6	5,342	15.5	5,299	37.3	6,636	18.1	426	9.5	534	13.6	22,020
Total Potential Lynx Habitat[4,5]	35,582	91.8	34,468	93.9	14,188	93.1	36,654	92.3	4,466	44.9	3,923	52.2	129,281
Non-habitat[5]	3,159	8.2	2,238	6.1	1,048	6.9	3,046	7.7	5,472	55.1	3,586	47.8	18,549
DNRC Total Acres[6]	38,741	100.0	36,706	100.0	15,236	100.0	39,700	100.0	9,938	100.0	7,509	100.0	147,830

[1] No LMAs are proposed within the CLO.
[2] Percentages for these habitat classes describe habitat amounts proportional to total potential lynx habitat.
[3] The Suitable Habitat Subtotal is the sum of Winter Foraging Habitat, ~~Young~~Summer Foraging Habitat, and Other Suitable Habitat, which are all presumed to currently provide habitat.
[4] 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.
[5] Percentages for these classes describe amounts proportional to DNRC Total Acres.
[6] DNRC Total Acres is the sum of Total Potential Lynx Habitat and Non-habitat.
Source: DNRC (2008a).

TABLE 4.9-21. ACRES OF EXISTING LYNX HABITAT ON SCATTERED PARCELS, USING HCP LYNX HABITAT DEFINITIONS, ON DNRC LANDS BY LAND OFFICE IN THE PLANNING AREA AND THE HCP PROJECT AREA

	DNRC Lands in the Planning Area[1] (%)							HCP Project Area[2] (%)						
Habitat Class	**NWLO**		**SWLO**		**CLO**		**Total**	**NWLO**		**SWLO**		**CLO**		**Total**
Winter Foraging Habitat[3]	54,044	(68.0)	10,773	(35.6)	NA	NA	64,817	43,205	(67.7)	9,256	(34.0)	NA	NA	52,461
Summer Foraging Habitat[3]	4,917	(6.2)	3,348	(11.1)	NA	NA	8,265	4,169	(6.5)	3,147	(11.6)	NA	NA	7,316
Other Suitable Habitat[3]	14,509	(18.2)	8,846	(29.3)	43,041	(74.1)	66,397	11,781	(18.5)	7,858	(28.9)	27,928	(75.4)	47,567
Suitable Habitat Subtotal[3,4]	73,471	(92.4)	22,967	(76.0)	43,041	(74.1)	139,479	59,155	(92.7)	20,261	(74.5)	27,928	(75.4)	107,344
Temporary Non-suitable Habitat[3]	6,046	(7.6)	7,266	(24.0)	15,036	(25.9)	28,347	4,661	(7.3)	6,936	(25.5)	9,111	(24.6)	20,708
Total Potential Lynx Habitat[5,6]	79,517	(42.8)	30,233	(14.1)	58,077	(4.6)	167,826	63,816	(44.6)	27,186	(18.8)	37,039	(32.7)	128,052
Non-habitat[6]	106,096	(57.2)	183,942	(85.9)	1,204,453	(95.4)	1,494,491	79,202	(55.4)	117,283	(81.2)	76,143	(67.3)	272,628
Total Acres[7]	**185,612**	**(100.0)**	**214,175**	**(100.0)**	**1,262,530**	**(100.0)**	**1,662,317**	**143,018**	**(100.0)**	**144,469**	**(100.0)**	**113,182**	**(100.0)**	**400,669**

[1] The planning area includes all of the NWLO, SWLO, and CLO.
[2] The HCP project area includes all DNRC lands that would be covered under the HCP within the planning area.
[3] Percentages for these habitat classes describe habitat amounts proportional to total potential lynx habitat.
[4] 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.
[5] 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.
[6] Total acres is the sum of total potential lynx habitat and non-habitat.
[7] Percentages for these classes describe amounts proportional to total acres.
Source: DNRC (2008a).

~~168,000 of suitable habitat out of 199,000 acres of total potential habitat (84 percent). Note, however, that the total acreage value may include a small amount of double counting of scattered parcels within LMAs.~~

The Forest Management ARMs also include a definition of lynx denning habitat. For this analysis, denning habitat is defined as moderate- or well-stocked sawtimber stands with moderate to high levels of CWD. In some areas, CWD data were not available. In these areas, denning habitat is defined as sawtimber stands with crown cover of 40 percent or greater and a poor to very poor vigor index rating. Currently, approximately 73,400 acres of denning habitat occur on HCP project area lands, approximately 67 percent of which is in the NWLO (Table 4.9-22).

Den site requirements include log piles, consisting of downed wood and large logs, in mature forest stands (1 to 5 acres) free from human disturbance, and generally in proximity to foraging habitat (Koehler and Brittell 1990; Mowat et al. 1999; Squires and Laurion 1999; Ruediger et al. 2000). Lynx also occasionally use rock piles as den sites (Koehler and Brittell 1990; Mowat et al. 1999; Squires and Laurion 1999). Because of the diverse habitat requirements for lynx, natural disturbances (e.g., wildfire, insect infestations) have historically played a dominant role in maintaining the mosaic of forest successional stages necessary to support lynx populations (Ruediger et al. 2000).

Critical Habitat

The term "critical habitat" carries an explicit biological and statutory meaning under the ESA. On February 25, 2009, the USFWS announced a final rule designating 39,000 square miles of critical habitat for lynx in the lower 48 states (74 FR 8616-8662, February 25, 2009). Five critical habitat units were established, with two of those units encompassing parts of Montana. Most of the land area in Montana falls within Unit 3, which encompasses western Montana. Unit 5 is the Greater Yellowstone Area in southwest Montana. In total, approximately 182,700 acres of state trust lands were designated as critical habitat. The acres of critical habitat in the planning area, on all DNRC lands, and in the HCP project area are presented in Table 4.9-23. Figure D-20 (Appendix D, EIS Figures) depicts the location of critical habitat in relation to HCP project area lands. On July 28, 2010, the United States District Court for the District of Montana issued a ruling requiring the USFWS to re-evaluate the existing land base designated as critical habitat for Canada lynx. The existing habitat designations will remain in place, however, until the ordered review is completed.

Canada Lynx Habitat Linkage

Habitat linkage and connectivity are important considerations of lynx habitat (McKelvey et al. 1999; Schwartz et al. 2002; Ruggiero et al. 2000; USFS and BLM 2004). 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. 2000). Schwartz et al. (2002) also suggested that management actions in the contiguous United States should focus on maintaining connectivity with the core of the lynx's geographic range, thought to be in northern Canada (McKelvey et al. 1999). Lynx use a variety of habitats for dispersal as they move between home ranges, and are known to travel great distances to utilize suitable habitat patches (Ruggiero et al. 2000). 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. 2000). Areas that provide opportunities for

TABLE 4.9-22. ACREAGES OF EXISTING CANADA LYNX HABITAT (AS DEFINED IN THE DNRC FOREST MANAGEMENT ARMS) ON TRUST LANDS IN THE PLANNING AREA AND HCP PROJECT AREA BY LAND OFFICE

	Trust Lands in Planning Area (%)							HCP Project Area (%)						
Habitat Class	**NWLO**		**SWLO**		**CLO**		**Total**	**NWLO**		**SWLO**		**CLO**		**Total**
Denning[1]	33,205	(22.6)	2,209	(7.7)	17,463	(40.6)	52,877	31,790	(22.5)	1,828	(7.1)	13,172	(40.9)	46,791
Denning/Mature Foraging[1]	17,673	(12.0)	2,637	(9.2)	9,191	(21.4)	29,501	17,228	(12.2)	1,866	(7.3)	7,511	(23.3)	26,606
Denning/Young Foraging[1]	16	(0.0)	0	(0.0)	0	(0.0)	16	16	(0.0)	0	(0.0)	0	(0.0)	16
Mature Foraging[1]	20,338	(13.8)	5,911	(20.5)	496	(1.2)	26,745	19,426	(13.8)	5,456	(21.2)	366	(1.1)	25,247
Other Habitat[1]	55,981	(38.1)	14,879	(51.7)	5,547	(12.9)	76,407	53,343	(37.8)	13,509	(52.6)	3,542	(11.0)	70,394
Young Foraging[1]	987	(0.7)	78	(0.3)	0	(0.0)	1,065	929	(0.7)	14	(0.1)	0	(0.0)	943
Suitable Habitat Subtotal[1,2]	128,199	(87.3)	25,714	(89.4)	32,697	(76.0)	186,610	122,732	(86.9)	22,673	(88.2)	24,592	(76.3)	169,997
Temporary Non-suitable Habitat[1]	18,705	(12.7)	3,064	(10.6)	10,348	(24.0)	32,117	18,507	(13.1)	3,030	(11.8)	7,629	(23.7)	29,166
Total Potential Lynx Habitat[3,4]	146,904	(46.5)	28,778	(12.3)	43,045	(3.4)	218,727	141,239	(51.7)	25,704	(15.9)	32,220	(28.5)	199,163
Non-habitat[4]	169,352	(53.5)	205,966	(87.7)	1,219,485	(96.6)	1,594,803	132,161	(48.3)	136,224	(84.1)	80,961	(71.5)	349,347
Total Acres[5]	**316,256**	**(100.0)**	**234,744**	**(100.0)**	**1,262,530**	**(100.0)**	**1,813,530**	**273,401**	**(100.0)**	**161,927**	**(100.0)**	**113,182**	**(100.0)**	**548,510**

1 Percentages for these habitat classes describe habitat amounts proportional to total potential lynx habitat.
2 The suitable habitat subtotal is the sum of denning habitat, mature foraging habitat, young foraging habitat and other suitable habitat, which are all presumed to currently provide habitat.
3 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.
4 Percentages for these classes describe amounts proportional to total acres.
5 Total acres is the sum of total potential lynx habitat and non-habitat.
Source: DNRC (2008a).

TABLE 4.9-23. ACRES OF LYNX CRITICAL HABITAT IN THE PLANNING AREA AND HCP PROJECT AREA

DNRC Land Office and Administrative Unit	Critical Habitat in the Planning Area (All Ownerships)	Critical Habitat on DNRC Lands in the Planning Area	Critical Habitat in the HCP Project Area
Northwest Land Office	**4,016,029**	**140,377**	**134,887**
Kalispell Unit	322,297	8,989	8,038
Libby Unit	766,119	1,350	1,350
Stillwater Unit	1,221,201	98,553	94,349
Swan Unit	1,706,412	31,485	31,150
Southwest Land Office	**1,260,728**	**41,544**	**39,427**
Anaconda Unit	160,074	5,182	3,793
Clearwater Unit	828,577	18,430	18,095
Missoula Unit	272,077	17,932	17,539
Central Land Office	**2,352,125**	**855**	**812**
Helena Unit	446,753	30	30
Bozeman Unit	1,196,876	826	783
Dillon Unit	0	0	0
Conrad Unit	708,497	0	0
Grand Total	**7,628,883**	**182,777**	**175,127**

Source: DNRC (2008a).

linkage are essential for allowing genetic dispersion between subpopulations of lynx, especially for ameliorating losses associated with catastrophic events. Impediments to lynx dispersal include highways and areas of human settlement, as well as a reduction in vegetative cover (Apps 1999; USFWS 2005c; Ruediger et al. 2000). Forest management activities may alter cover in uplands and riparian zones, which may reduce the effectiveness of linkage zones.

Lynx are highly mobile and have relatively large average home ranges, and they are capable of moving long distances to find abundant prey (68 FR 40076-40101, July 3, 2003, p. 40083). Lynx are thought to frequently travel along linear features such as ridges, saddles, and riparian zones (Ruediger et al. 2000:1-4). Recent studies are providing strong evidence that lynx prefer to travel, hunt, and den where there is an abundance of forested cover (Koehler et al. 2008; Squires et al. 2008; Squires 2008). However, the literature does also contain many examples of lynx crossing large, unforested openings (Roe et al. 2000 *in* 68 FR 40076-40101, July 3, 2003, p. 40079). Connectivity of appropriate habitat types and cover types provides habitat connectivity and may increase the likelihood of survival and successful dispersal of lynx (Ruediger et al. 2000; 68 FR 40076-40101, July 3, 2003, p. 40097). There is little evidence to suggest that forest roads pose an appreciable threat to lynx (68 FR 40076-40101, July 3, 2003, p. 40083).

Effects of and Trends in Climate Change

The types of potential effects of climate change on lynx are expected to be similar to those for wildlife species in general (see Section 4.9.7.3, Other Wildlife Species – Effects of and Trends in Climate Change, below). Some specific observations concerning how lynx may respond to climatic changes are provided here. At this time, however, the scope and scale of such changes are unknown, and the effects (positive or negative) on lynx would likely be variable across the landscape. As discussed in Section 4.1, Climate, research is underway in many regions, including the planning area, to document the effects on wildlife and wildlife habitat from a changing climate.

Decreased snowfall may affect lynx through decreased prey vulnerability and decreased competitive advantage over sympatric carnivores (Carroll 2007). Based on predicted decreases in snowfall, climate change had a greater influence on modeled declines in lynx populations in the northeastern United States than either trapping or timber harvest (Carroll 2007).

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.

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 some areas, changes in the fire regime associated with climate change may increase the availability of suitable habitat for lynx. In areas characterized by low-frequency, high-intensity wildfire, a warmer, drier climate could increase fire frequency, possibly leading to a greater abundance of brushy, early successional habitat (foraging habitat) (McKenzie et al. 2004).

4.9.4.2 Environmental Consequences

Introduction

This analysis identifies the ways forest management activities proposed for coverage under the alternatives could affect lynx by modifying habitat availability and suitability, influencing habitat connectivity, or disturbing lynx at active dens. The elements of the lynx conservation strategy address these risks and provide organizational structure for this analysis. The following subsections identify the criteria by which the effects of the alternatives are evaluated, the rationale for those criteria, and the relative effects of the alternatives. Each subsection is introduced by a bullet statement summarizing a potential effect and likely cause for the effect. Consequences to lynx from the alternatives are based on how well each alternative addresses the risk factors to lynx. Evaluation criteria are used, such as predicted acreages of specific habitat amounts, to assess how well the alternatives provide for lynx conservation. Six elements of the lynx conservation strategy address the potential for forest management activities to affect habitat for lynx. These elements address (1) habitat suitability, (2) den site attributes, (3) CWD and snag retention, (4) foraging habitat attributes, (5) habitat connectivity, and (6) reduction of risk to female lynx with dens.

Habitat Suitability

Potential Effects

- Lynx require a mosaic of early, mature, and late-successional staged forests, some with high levels of horizontal cover and structure. Forest management activities ~~may~~can temporarily convert stands that serve as suitable lynx habitat to stands that do not serve as suitable habitat for up to several decades.

Indicators and Rationale

Management of lynx habitat typically focuses on maintaining forested areas in conditions that provide suitable habitat and stand conditions that help lynx fulfill important life requisites. These conditions can be created or changed through natural processes such as fire, disease, wind, and succession, or ~~manmade disturbance~~human-caused processes such as forestry, thinning, or use of prescribed fire. The LCAS standard for managing federal lands for lynx is maintenance of 70 percent suitable habitat and 30 percent temporary non-suitable habitat within LAUs, typically the size of a female lynx home range. Under historical conditions (pre-forestry) in western Montana within cover types that were likely to support lynx, approximately 38 percent of the landscape was in non-stocked and seedling/sapling stands at any given time (i.e., temporary non-suitable habitat). This estimate is a weighted average derived from Losensky (1997). Therefore, maintaining a range of 60 to 70 percent of potential lynx habitat within occupied lynx habitat as suitable habitat is expected to provide adequate suitable habitat for lynx. 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.

Comparison of Alternatives

Under Alternative 1, within the Stillwater Block and the Swan River State Forest, DNRC would continue to abide by the ARMs that specify the proportion of total potential habitat to be retained as denning habitat (5 percent) and as some combination of mature or young foraging habitat (10 percent). For scattered parcels containing appreciable amounts of lynx habitat, DNRC would maintain at least 5 acres of denning habitat and 10 percent of the lynx habitat acreage in mature or young foraging habitat, where feasible. There would be no constraints on the amount of habitat that could be converted to temporary non-suitable habitat on blocked lands or scattered parcels.

Under all action alternatives, DNRC would be required to maintain target amounts of HCP project area lands in suitable lynx habitat, both within LMAs and on scattered parcels (commitments LY-HB6 and LY-LM1). Target ratios for suitable habitat would be 65 percent of total potential habitat under Alternative 2, 70 percent under Alternative 3, and 60 percent under Alternative 4. Providing target amounts of suitable habitat would contribute toward ensuring long-term habitat availability for lynx. A greater amount of suitable habitat available at any given time would provide greater potential to meet long-term lynx habitat objectives. Thus, Alternative 3 would provide the greatest assurance of lynx suitable habitat in the HCP project area, followed by Alternatives 2 and 4.

Under all action alternatives, commitment LY-LM2 would place additional constraints on the amount of lynx habitat that could be converted to non-suitable habitat per decade within LMAs. Under Alternatives 2 and 3, no more than 15 percent of total suitable habitat could be converted to temporary non-suitable per decade in any LMA; the limit under Alternative 4 would be 20 percent per decade.

To support development of the proposed HCP and this EIS analysis, the forest model used to calculate the annual sustainable yield for trust lands, as described in Section 4.2 (Forest Vegetation), was constrained by the commitments for lynx habitat required under Alternatives 2, 3, and 4 (see Table E3-2 in Appendix E, EIS Tables). The results of this exercise demonstrated that DNRC could apply the proposed habitat retention requirements for lynx and still generate a desirable sustainable yield while also maintaining a healthy and diverse forest.

As shown in Table 4.9-24, DNRC is currently meeting and exceeding its habitat commitments on scattered parcels as specified in the ARMs. This is demonstrated in Table 4.9-24 with acreages under current conditions, which are the actual amounts of habitat calculated to be on the ground today, higher than those under Alternative 1, which are the amounts of habitat required under the ARMs. Table 4.9-24 shows the minimum amount of lynx habitat that would be required under each alternative for scattered parcels within the NWLO, SWLO, and CLO. Alternative 1 does not require a target for total suitable habitat, but the requirements for denning and foraging habitat would result in the maintenance of approximately 11,000 acres of these two habitat categories. The action alternatives would require retention of substantially more habitat on scattered parcels (between approximately ~~53,010~~76,800 and ~~70,680~~89,600 acres, depending on the alternative) than Alternative 1 (approximately 11,100 acres). Alternative 3 would set the highest target for suitable habitat (~~70,680~~89,600 acres), followed by Alternatives 2 and 4 (~~57,427~~83,200 acres and ~~53,010~~76,800 acres, respectively).

Table E4-9 (Appendix E, EIS Tables) shows acres of lynx habitat required for retention by habitat category under the existing ARMs (Alternative 1) and the minimum amount of lynx habitat required for each LMA under the proposed alternatives. Under the existing ARMs for the Stillwater and Swan River State Forests, grizzly bear BMU subunits are used to analyze and apply rule commitments as surrogates for federal LAUs. Thus, there are no requirements for habitat retention within LMAs *per se* under Alternative 1. BMU subunits, LAUs, and LMAs are similarly sized analysis areas, with LAUs tending to be slightly smaller because they are based on estimated average lynx home range size for western Montana, which tends to be smaller than that of grizzly bears. LMAs were designed to have improved fit with trust lands and provide biologically relevant areas to analyze and apply proposed conservation commitments. Under Alternatives 2, 3, and 4, there would be three LMAs on the Stillwater Block, one in the Swan River State Forest, and two composed of scattered parcels of HCP project area lands on the Clearwater and Missoula Units (i.e., the Seeley and Garnet LMAs).

Under Alternative 1, approximately ~~190,251~~199,200 acres of total potential lynx habitat would be managed for lynx (see total potential habitat in Table 4.9-22). Of these acres, 15 percent (~~28,538~~29,900 acres) would be required to be in foraging or denning habitat for lynx. Under all of the action alternatives, the mapping criteria for potential lynx habitat was expanded to include lynx habitat acres in areas mapped as big game winter range. Therefore, ~~approximately 10,000 additional acres would be managed for lynx habitat, for~~ approximately ~~190,251~~257,300 acres of total potential lynx habitat would be managed for lynx (Table 4.9-19)~~derived by adding the total potential habitat under current conditions in Table 4.9-21 and the total potential habitat in the LMAs in Table E4-9 (Appendix E, EIS Tables)~~. Under the action alternatives, DNRC would be required

TABLE 4.9-24. ACRES OF LYNX HABITAT BY DNRC LAND OFFICE ON SCATTERED PARCELS IN THE HCP PROJECT AREA UNDER CURRENT CONDITIONS AND MINIMUM ACRES REQUIRED AS A PERCENTAGE OF TOTAL POTENTIAL LYNX HABITAT AS REQUIRED UNDER THE PROPOSED ALTERNATIVES

Habitat Category	Current Condition (Acres)[1]	Alternative 1		Alternative 2		Alternative 3		Alternative 4	
		Required Habitat	Acres	Required Habitat	Acres	Required Habitat	Acres	Required Habitat	Acres
NWLO									
Foraging Habitat[2]	8,642	10% of TPH	3,979	NA	NA	NA	NA	NA	NA
Denning Habitat	12,244	5 acres / parcel	775	NA[-6]	NA	10% of TPH	6,382	NA[6]	NA
Other Suitable Habitat[3]	15,734	NA	NA	NA	NA	NA	NA	NA	NA
Suitable Habitat[4]	36,636	NA	NA	65% of TPH	41,481	70% of TPH	44,671	60% of TPH	38,290
Total Potential Lynx Habitat[5]	**39,791**	**NA**	**39,791**	**NA**	**63,816**	**NA**	**63,816**	**NA**	**63,816**
SWLO									
Foraging Habitat[2]	1,866	10% of TPH	1,634	NA	NA	NA	NA	NA	NA
Denning Habitat	2,781	5 acres / parcel	700	NA[-6]	NA	10% of TPH	2,719	NA[6]	NA
Other Suitable Habitat[3]	9,591	NA	NA	NA	NA	NA	NA	NA	NA
Suitable Habitat[4]	14,238	NA	NA	65% of TPH	17,671	70% of TPH	19,030	60% of TPH	16,311
Total Potential Lynx Habitat[5]	**16,339**	**NA**	**16,339**	**NA**	**27,186**		**27,186**	**NA**	**27,186**
CLO									
Foraging Habitat[2]	4,122	10% of TPH	3,222	NA	NA	NA	NA	NA	NA
Denning Habitat	16,927	5 acres / parcel	790	NA[-6]	NA	10% of TPH	3,704	NA[6]	NA
Other Suitable Habitat[3]	3,542	NA	NA	NA	NA	NA	NA	NA	NA
Suitable Habitat[4]	24,592	NA	NA	65% of TPH	24,075	70% of TPH	25,927	60% of TPH	22,223
Total Potential Lynx Habitat[5]	**32,220**	**NA**	**32,220**	**NA**	**37,039**		**37,039**	**NA**	**37,039**

NA = not applicable. For this table, "NA" means the current regulations or proposed alternative do not require a specific amount of the subject habitat category.
[1] The current condition presents the actual acres in the habitat category at the present time, whereas Alternative 1 depicts the required amount of habitat for future years.
[2] Foraging habitat consists of winter foraging and young foraging habitat under Alternative 1 and winter foraging and summer foraging habitat under Alternatives 3 and 4. Only winter foraging habitat is included under Alternative 2.
[3] Other suitable habitat is a subset of suitable lynx habitat that does not contain the necessary attributes to classify as foraging or denning habitat.
[4] Suitable habitat is all habitat with structural characteristics capable of providing lynx habitat.
[5] Total potential lynx habitat represents all lands potentially supporting lynx-preferred climax vegetation types over time regardless of their current structural condition.
[6] For Alternatives 2 and 4, the requirement for denning habitat is to retain minimum levels of ~~at least two den sites per square mile~~CWD at the project level, rather than a requirement to retain a certain acreage of habitat as required by Alternative 1, or to maintain an acreage of habitat and at least two potential den sites per square mile as required by Alternative 3.
Source: DNRC (2008a).

to maintain a minimum of ~~123,663~~167,300 acres of suitable habitat under Alternative 2, ~~133,174~~180,100 acres under Alternative 3, and ~~114,151~~154,400 acres under Alternative 4 (65, 70, and 60 percent, respectively).

Under all action alternatives, providing a target percentage of suitable habitat and limiting the habitat that can be converted per decade within LMAs would conserve lynx by promoting a balance of stands in various structural stages, which would ensure sustainability of lynx habitat and populations on HCP project area lands for the term of the Permit.

The requirement for retention of suitable habitat on scattered parcels within an administrative unit is expected to have limited benefit for lynx. This is because lynx occur at low densities and occupy large home ranges, making it difficult to achieve conservation objectives on small parcels of land (USFWS 2007:47). However, benefits could be realized for 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 providing habitat for lynx.

Den Site Attributes and CWD

Potential Effects

- ~~Managing stands of~~Forest management activities in lynx denning habitat ~~may~~can change the stand attributes (dense mature stands and abundant CWD) such that the stands ~~would~~may no longer be classified as denning habitat and subsequently ~~would~~may not provide adequate denning habitat on the landscape at scales important for lynx.

Indicators and Rationale

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~~ning sites are~~ site availability is not ~~believed to be a~~ limiting ~~factor~~ for lynx (USFS and BLM 2004:ROD [2007]:17; Squires et al. 2008; Squires 2009, personal communication). Forest management activities, including salvage of dead and dying trees, can alter structural attributes of denning habitat by removing large downed wood. In addition, young trees in recently harvested areas may be too small to provide ample forest cover desirable for lynx (Squires 2008). The common component of denning habitat ~~appears to be~~is large amounts of CWD and horizontal cover provided by low-growing canopies of subalpine fir and Engelmann spruce trees. 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).~~Potential den sites for this analysis are defined as natural or man-made piles of slash and downed logs that are at least 8 feet in diameter and at least 3 feet tall at their highest poin~~

Comparison of Alternatives

Under Alternative 1, DNRC would continue to maintain 5 percent of total potential habitat on the Stillwater Block and the Swan River State Forest as denning habitat as defined in the ARMs. (Denning habitat is defined in Document B-3 – DNRC Canada Lynx Habitat Mapping Protocol for Implementation of the HCP in Appendix B, HCP Documents). On scattered parcels, DNRC would maintain at least 5 acres of denning habitat per parcel, where available and feasible. Salvage would not be allowed in patches of denning habitat identified as necessary to meet these acreage commitments. Additionally, the ARMs include provisions for snags and snag recruits (36.11.411) and CWD (36.11.414) on all DNRC projects, which would aid long-term CWD recruitment important for the creation of natural den sites for lynx. Therefore, Alternative 1 would provide adequate denning opportunities for lynx on DNRC lands.

~~Under Alternatives 2 and 4, DNRC would not retain specified amounts of denning habitat. Rather, commitment LY-HB2 would require DNRC to retain two potential den sites per square mile in lynx habitat at the project level, except for blowdown salvage units, where 1 percent would be left un-salvaged (this latter requirement would not apply under Alternative 4). Additionally, during project layout, den sites would be positioned adjacent to suitable habitat where possible. Under all three action alternatives, the specific den sites that are retained would be mapped annually and reported to the USFWS at 5-year intervals. Alternative 3 would retain at least 10 percent denning habitat of the total potential lynx habitat within LMAs and at the parcel level for each scattered parcel and require at least two den sites of more than 5 acres of denning habitat per square mile. No salvage would be allowed within units less than 5 acres in size, except around campgrounds or developments, unless field inventories verify more than 10 percent denning habitat and two den sites per square mile are present.~~

All alternatives would require CWD recruitment at the project level, 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. Commercial green tree logging and salvage logging operations under all alternatives would be required to provide for minimum snag and CWD recruitment levels. Monitoring under all action alternatives would require documentation of compliance with retention measures and reporting of results in the 5-year monitoring report. Under Alternative 2, DNRC would also be required to leave 1 percent of blowdown salvage units in an un-salvaged condition. This would further contribute to CWD retention on the landscape. Alternative 2 also includes an additional requirement for monitoring and reporting of potential den sites to substantiate that the CWD and snag retention and recruitment ARMs are retaining adequate amounts of lynx den sites.~~.~~ Alternative 3 requires retention of at least two den sites of more than 5 acres of denning habitat per square mile. No salvage would be allowed within units less than 5 acres in size, except around campgrounds or developments, unless field inventories verify that more than 10 percent denning habitat and two den sites per square mile are present. Under Alternative 4, DNRC would be required to retain two potential den sites per square mile in lynx habitat at the project level. Under all four alternatives, DNRC would ensure retention of legacy woody material important for escape cover for lynx, structure important for snowshoe hares, and future den sites.

Retention of CWD would be further supported through the proposed winter foraging habitat commitments within LMAs and habitat connectivity commitments under all action alternatives. These commitments require retention of well-stocked forest stands with an abundance of trees in habitat important for lynx. The winter foraging habitat commitments and habitat connectivity commitments further ensure that raw materials for future den sites (e.g., large downed logs, large root wads, and piles of dead trees) would be present on HCP project area lands through time.

In addition to CWD, horizontal cover is an important den site requirement for lynx, and it is also a primary component of lynx foraging habitat. (Squires et al. 2008; Squires et al. 2010 in press).

Given the HCP commitments under Alternative 2 for retaining winter foraging habitat and retaining 20 percent of pre-commercial thinning units in an unthinned condition, adequate horizontal cover for lynx denning would likely be available on HCP project area lands. In addition to the commitments described for Alternative 2, Alternative 3 would retain at least 10 percent of total potential lynx habitat as denning habitat within each LMA and at the parcel level for each scattered parcel. Alternative 4 would provide horizontal cover for lynx den sites through the retention of foraging habitat in LMAs and retention of 10 percent of pre-commercial thinning units in an unthinned condition. Alternative 2 does not include a provision for retaining denning habitat.

~~Alternative 3 also requires that 10 percent of the suitable habitat provide denning opportunities for lynx, whereas Alternatives 2 and 4 require retention of two den sites per square mile within total potential lynx habitat. This commitment would be implemented on each timber sale in lynx habitat, and over time would result in a broad distribution of sites with woody material concentrations.~~ Under all action alternatives, there may be situations where DNRC cannot retain CWD at a level that complies with the guidance contained in Graham et al. (1994). Such situations may include (1) projects in the urban interface where fuels management needs and aesthetic considerations must be addressed; (2) projects near recreational areas, where downed wood is collected and burned; (3) harvest units adjacent to open roads; (4) broadcast burning activities; and (5) meeting mandated hazard reduction requirements. Areas where these situations would occur typically provide low-quality lynx denning habitat due to their proximity to the urban interface or high recreational use. These areas are also unlikely to encompass an entire harvest unit, where the remainder of the area would be used to meet the CWD target levels. Therefore, retaining less CWD in these areas than required under Graham et al. (1994) is not expected to affect lynx.

Alternative 3 would maintain more suitable lynx habitat and provide for more denning opportunities than Alternatives 2 and 4. However, given that 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 denning sites are not ~~believed to be~~ a limiting factor for lynx (USFS and BLM 2004:ROD [2007]:17; Squires et al. 2008; Squires 2009, personal communication). Under all action alternatives, DNRC's implementation of existing Forest Management ARMs for CWD and snag retention and recruitment are expected to provide~~ing~~ concentrations of woody material ~~and provisions for retaining attributes~~ important for denning lynx that would help ensure that den sites do not become limiting for them in the future. Under all alternatives, lynx would have adequate den sites for successfully raising young.

Foraging Habitat

Potential Effects

- Forest management activities ~~may~~can convert stands that serve as foraging habitat to stands that do not serve as foraging habitat, thus lowering prey abundance for lynx and increasing their risk of starvation.

Indicators and Rationale

The intent of conserving lynx foraging habitat is to provide assurances that habitat likely to provide high densities of snowshoe hares will be maintained through time. Habitat conditions and food availability, particularly in winter, are ~~likely~~ primary limiting factors for lynx in western Montana

(Squires 2005, personal communication). For this reason, it is important to identify and maintain habitat that provides high levels of horizontal cover preferred by snowshoe hares and lynx in winter. Such habitat consists of pole stands and mature moist forest, typically at elevations above 4,000 feet, that possess multiple forest canopies and cover provided by conifer limbs near the snow surface. In the winter, lynx ~~appear to~~ prefer using and foraging within stands that exhibit these characteristics (Squires 2005, personal communication). In summer, lynx broaden their habitat use to include younger forest stands with an abundance of shrub cover (Squires et al. 2010 in press). Dense, young sapling stands (more than 2,000 trees per acre) can also provide habitat for concentrations of hares in western Montana (Griffin 2004).

Pre-commercial thinning in young stands can reduce the horizontal cover that is critical to maintaining the snowshoe hare prey base (USFWS 2007:42). Reducing this horizontal structure reduces an area's carrying capacity for snowshoe hares (USFWS 2007:42). The amount of habitat needed in various successional forest stages to support lynx foraging habitat is poorly understood, but is likely a function of site productivity and suitability for snowshoe hares. *Lynx Habitat Management Plan for DNR-Managed Lands* (WADNR 2005) describes foraging habitat similarly to the proposed HCP and requires acreage retention of 20 percent at scales comparable to federal LAUs in Montana (or in this case, LMAs). In the absence of ~~clear~~more definitive standards or prescriptions, the DNRC HCP relied on this study to establish the commitment for maintaining 20 percent winter foraging habitat within LMAs.

~~For this analysis, pre-commercially thinned stands are assumed to have potential to continue providing connectivity and are therefore considered suitable habitat, but are not immediately counted in the acres of foraging habitat. Refer to *DNRC Canada Lynx Habitat Mapping Protocols for Implementation of the HCP* (Document B-3 in Appendix B, HCP Documents) for more details regarding how foraging habitat was modeled and defined.~~

Comparison of Alternatives

Currently, Alternative 1 addresses lynx foraging habitat needs by retaining approximately 10 percent of the lynx habitat acreage in mature or young foraging habitat (foraging habitat) at appropriate sites and by delaying thinning in young foraging stands with stem density greater than 4,000 stems per acre until the average tree height is greater than 15 feet.~~In addition, approximately 10 percent of the lynx habitat acreage in mature or young foraging habitat (foraging habitat) would be retained at appropriate site~~

All action alternatives would ~~allow DNRC to continue pre-commercial thinning; however, these acres would not be counted in the requirement for the minimum retention of 20 percent foraging habitat within an LMA. The amount of pre-commercial thinning on trust lands is minimal.~~ also address lynx summer and winter foraging habitat needs with slight differences in how the commitments would be applied. All action alternatives require retention of 20 percent foraging habitat within each LMA. Because habitat conditions and food availability, particularly in winter, are primary limiting factors for lynx in western Montana (Squires 2005, personal communication), under Alternative 2, DNRC would retain 20 percent of total potential lynx habitat as winter foraging habitat in LMAs. Alternatives 3 and 4 would require retention of 20 percent foraging habitat (any combination of young or winter foraging habitat) within each LMA.

Under the proposed HCP, DNRC would continue to pre-commercially thin young stands. The statewide annual average acres of pre-commercial thinning between 1998 and 2004 was approximately 1,780 acres (see HCP Section 1.4.4, Covered Activities, in Appendix A, HCP). However, to address lynx summer foraging habitat needs, all action alternatives require retention of a portion of pre-commercial thinning units in an unthinned condition. The amount of habitat retained would vary by alternative, with Alternatives 2 and 3 retaining 20 percent and Alternative 4 retaining 10 percent. Additionally, DNRC would conduct thinning activities in a manner to maintain some level of snowshoe hare use and to help expedite the development of future foraging habitat. Specifically, under all action alternatives, commitment LY-HB4 would require DNRC to retain small shade-tolerant trees in pre-commercial thinning units within lynx habitat that do not pose substantial competition risks to desired crop trees. This is expected to ensure that, over time, these trees will grow to form a potentially dense understory below the faster-growing crop trees. While these trees do compete with the desired crop trees for limited site resources, retaining some of these smaller shade-tolerant trees would provide potential habitat structure for snowshoe hares by increasing the levels of horizontal cover and accelerating the development of multi-storied stands. This commitment ensures that some of the tree species that provide horizontal cover of tree boughs near the snow surface would be retained in stands receiving pre-commercial thinning treatments. The duration that forest stands would provide these habitat characteristics would be variable. Given the slower growth rates expected from understory species, it is likely that such two-storied or multi-storied stands will provide decades of foraging habitat for hares and lynx. Additionally, commitment LY-HB4 would also require that patches of advanced regeneration of shade-tolerant tree species be retained where operationally feasible as a component of commercial harvest prescriptions in winter foraging habitat to help expedite the development of future foraging habitat.

~~Under Alternative 2, 20 percent of the total potential habitat within LMAs would be maintained as young or winter foraging habitat. Alternative 3 would require this commitment, as well as one requiring unthinned retention patches within pre-commercial thinning units totaling at least 20 percent of the stand acres. Retention patches could not be thinned until lower branches grow to above snow level (about 6 feet) (commitment LY-LM3). For stands to be classified as winter foraging habitat, they must have at least 10 percent crown closure in mature trees and dense sapling undergrowth. Alternative 4 is the same as Alternative 2 with regard to commitment LY-LM3, except that 10 percent of the available thinning acres would be retained until lower branches grow to above snow level in LMAs, more similar to Alternative 3. While the commitments state that any combination of young and mature foraging may make up the required 20 percent, it is likely that a higher percentage of the foraging habitat in LMAs would be composed of mature foraging habitat, which is considered to be potentially limiting for lynx in Montana (Squires 2005, personal communication). This is because of the dynamic condition of young forests and the short time period in which they grow out of foraging habitat and the associated difficulty in accurately tracking and updating these acreages (i.e., to ensure it is meeting this commitment, DNRC anticipates that the majority of foraging habitat retained will be in the mature foraging habitat condition).~~

All action alternatives would require retention of more suitable foraging habitat that would provide better habitat for snowshoe hares, the primary prey species of lynx. This is attributed to requirements for 20 percent foraging habitat within LMAs (versus 10 percent on blocked lands under Alternative 1), retention of unthinned areas in pre-commercial thinning units, modifications to pre-commercial thinning activities, and the juxtaposition of foraging habitat and suitable habitat within LMAs. ~~In addition, Alternative 3 would provide requirements that allow for young foraging~~

~~habitat to remain suitable longer than in the other action alternatives.~~ All action alternatives would also provide for monitoring of ~~thinning projects~~lynx foraging habitat commitments, unlike Alternative 1, which has no specific monitoring requirements for lynx. However, under Alternative 1, lynx habitat amounts and potential for effects would continue to be analyzed and disclosed on individual projects in MEPA documents.

In summary, all three action alternatives would require higher minimum amounts of foraging habitat compared to Alternative 1. Under ~~Alternative 2~~the action alternatives, commitment LY-LM3 would require DNRC to maintain at least 20 percent of the total potential lynx habitat in LMAs as foraging habitat. Alternative 2 also would also provide slightly more summer habitat used by lynx (provided over time as dense sapling stands age and grow).~~Alternative 3 would provide additional thinning restrictions to this requirement, while Alternative 4 would set a target value of 10 percent, but with the same thinning restrictions as Alternative 3.~~ These requirements compare to the 10 percent target on blocked lands (and scattered parcels where practicable) under Alternative 1. However, based on existing acres of foraging habitat in the HCP project area (Table 4.9-20), the action alternatives could result in a substantial reduction in foraging habitat within the LMAs. Because there is no agreement among lynx biologists on the minimum amount of lynx foraging habitat required within a female lynx's home range for her to successfully reproduce and rear her young, it is anticipated that, despite the proposed conservation measures, adverse effects may occur if foraging habitat is reduced to 20 percent of an LMA.

Under the action alternatives, DNRC would continue to pre-commercially thin limited acres in lynx suitable habitat. While Alternative 1 delays thinning in young foraging stands with stem density greater than 4,000 stems per acre, the action alternatives provide greater assurances that summer foraging habitat needs would be met by retaining a portion of pre-commercial thinning units in an unthinned condition. -Greater assurances would be provided because the action alternatives' conservation measures would apply to a greater number and acreage of stands (including some with lower sapling densities) than those addressed under Alternative 1. Alternatives 2 and 3 would provide more habitat than Alternative 4, which would only retain 10 percent in an unthinned condition. ~~However,~~Along with ensuring that thinned areas would retain limited viability (for reasons described above)~~.~~, ~~T~~these measures would minimize the potential effects of pre-commercial thinning on lynx foraging habitat.

Habitat Connectivity and Linkage

Potential Effects

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

Indicators and Rationale

For the purposes of this analysis, the term "linkage" is used to refer to movements across highways or between populations or geographic areas, and defined linkage areas (USFS 2007a; USFWS et al. 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. Cover is also an important component of maintaining the integrity of defined linkage areas. No high-traffic road systems or highways are being considered as a component of any alternative; thus, the effects of highways on habitat linkage and habitat connectivity for lynx will not be addressed further.

This analysis examines the effects of the alternatives on cover, disturbance, and forest openings as a measure of connectivity within lynx habitat and within identified linkage areas (USFS 2007a; USFWS et al. 1995; Servheen et al. 2001).

Comparison of Alternatives

Under Alternative 1 on all DNRC forest management projects, forest patch size, shape, connectivity, and habitat fragmentation would be considered at the project level under ARM 36.11.415. Additionally, habitat connectivity would be addressed as a specific consideration for projects occurring in lynx habitat (ARM 36.11.435 (3)(a)(v)). Therefore, Alternative 1 minimizes effects on lynx and adequately conserves connectivity within lynx habitat.

Under Alternative 2, both within the HCP project area and on all trust lands, forest patch size, shape, connectivity, and habitat fragmentation would be considered in a similar manner at the project level under ARM 36.11.415. Additionally, for all action alternatives, the HCP commitments provide specific direction on lynx habitat connectivity, requiring that harvest units maintain a connected network of suitable lynx habitat along ~~riparian areas~~RMZs, WMZs, ridge tops, and saddles – high terrain areas where lynx seem to prefer to move (Koehler 1990; Staples 1995). Additionally, the HCP commitments provide: (1) threshold levels of suitable habitat that would be maintained in LMAs and scattered parcels outside LMAs and (2) restrictions on the percentage of habitat within LMAs that could be converted to a non-suitable condition each decade. The amounts vary between the alternatives as described in Table E3-2 (Appendix E, EIS Tables).

Habitat connectivity for lynx is further addressed within the HCP project area under Alternative 2 through implementation of the grizzly bear commitments:

- (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 within grizzly bear recovery zones and NROH (lynx habitat frequently overlaps with grizzly bear recovery zones).

Given the commitments for cover under the existing program and the commitments contained in Alternative 2, as shown in Table 4.9-17, grizzly bear hiding cover amounts at a programmatic scale are expected to provide sufficient hiding cover for bears to effectively move through habitats and forage in important habitats without human detection. Under Alternative 2, the grizzly bear commitments that maintain hiding cover for bears and retain vegetation in ~~riparian areas~~RMZs, WMZs, and along roads, and limit forest openings, combined with the lynx commitments to maintain connectivity in areas expected to be favored by lynx would maintain sufficient habitat connectivity for lynx to successfully move within their home ranges and disperse.

Alternative 3 provides additional commitments for connectivity by limiting contiguous occurrences of temporary non-suitable habitat on scattered parcels outside LMAs to less than or equal to

200 acres, with harvest units broken up with 100-meter strips of suitable habitat where possible. This additional commitment would provide a small degree of improved habitat connectivity outside LMAs. The benefit of this commitment is likely to be small because scattered parcels are frequently islands of forested habitat in a sparse forest matrix of multiple ownerships. Thus, connectivity of mature or sub-mature forest cover can be difficult to provide at scales larger than one section (i.e., 640 acres). Improved habitat connectivity on scattered parcels outside LMAs has importance because lynx can roam outside their normal ranges in search of food during some years. To a limited degree, this commitment may facilitate foraging efficiency, travel, and dispersal of lynx.

The effects of Alternative 4 on lynx habitat connectivity would be the same as those described for Alternative 2.

As described earlier in the grizzly bear analysis, with the exception of the Stillwater Block and Swan River State Forest, DNRC's ability to influence linkage areas in western Montana is ~~relatively limited~~constrained by the amount of land in the project area (approximately 2 percent) and distribution of lands in western Montana (Tables 4.9-8 and 4.9-9 and Figures D-18A through D-18C in Appendix D, EIS Figures). The Stillwater Block and the Swan River State Forest are important land areas for linkage with high value for lynx (USFS 2007a), and formally identified linkage zones associated with grizzly bear conservation have been described for these DNRC blocks as well (USFWS et al. 1995; Servheen et al. 2001). Therefore, it is important to maintain cover and limit disturbance within these linkage areas to maintain their integrity.

Under Alternative 1, in the Stillwater Block, existing grizzly bear commitments maintain security core and 40 percent hiding cover in grizzly bear subunits. Similarly on the Swan River State Forest, grizzly bear commitments require harvest unit designs to maintain the 600-feet-to-cover measure, provide visual screening along ~~riparian areas~~RMZs and WMZs, and provide a minimum of 40 percent hiding cover per BMU subunit, as well as establish quiet areas following 3 years of commercial activity, as long as the Swan Agreement is in place. All these measures provide cover and limit disturbance and thereby support habitat connectivity and the integrity of these linkage areas for lynx as well as grizzly bears.

Under Alternative 2, the measures described above for connectivity would also protect the integrity of linkage areas in the Stillwater Block and Swan River State Forest. Further, restrictions on high-intensity activities in grizzly bear spring habitat in the spring period and management of quiet areas (4 years of activity followed by 8 years of rest from commercial logging activities) within blocked lands would limit disturbance in linkage areas to maintain their integrity. The effects of Alternative 4 on these linkage zones would be similar to those described for Alternative 2.

Under Alternative 3, maintenance of security core areas on the Stillwater Block at the DNRC 1996 baseline levels for BMU subunits would continue. Under Alternatives 1 and 3, approximately 36,800 acres in the Stillwater Unit would be managed as secure habitat for intervals of 10 years (Stillwater Core). In contrast, about 19,400 acres (53 percent of the 36,800 acres) would be managed as quiet areas under Alternatives 2 and 4, with a maximum entry period of 4 years of activity followed by 8 years of rest from commercial logging activities. On the Stillwater Block, Alternative 3 would likely provide the greatest degree of habitat quality associated with the formally identified linkage zone along Highway 93, because it requires that the largest amount of blocked secure acreage is maintained, thereby limiting disturbance.

In the Swan River state Forest, the action alternatives would implement a strategy similar to that applied under the existing ARMs. All these measures would maintain cover in linkage areas for lynx.

Collectively, the HCP commitments under the action alternatives help ensure that, within some of the most important areas for lynx in western Montana, habitat connectivity at the scale of a lynx home range would be maintained over time. They also help ensure that habitat linkage at the scale of several lynx home ranges would be maintained in association with these important areas. Commitments contained in all action alternatives provide greater assurances that connectivity would be maintained for essential denning, foraging, and dispersal activities than Alternative 1. All action alternatives would require improved project-level tracking and documentation regarding how connectivity is addressed and maintained, and this would facilitate compliance. Alternative 3 would likely provide a slightly greater level of assurance that connectivity is maintained, followed by Alternatives 2 and then 4. All action alternatives provide for restrictions on access, quiet areas, and cover maintenance in similar ways. Alternatives 2, 3, and 4 would improve on the amount and quality of linkage zones when compared to current conditions, especially within the Stillwater Block and Swan River State Forest, due to the variety of complementary mitigation measures incorporated within those areas.

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. However, all action alternatives provide for restrictions on access, quiet areas, and cover maintenance in similar ways. Alternatives 2, 3, and 4 would improve on the amount and quality of linkage zones when compared to current conditions, especially within the Stillwater Block and Swan River State Forest, due to the variety of complementary mitigation measures incorporated within those areas.

<u>Disturbance of Dens</u>

Potential Effects

- Forest management activities near active lynx dens ~~may~~can disturb denning lynx and cause abandonment and mortality of young.

Indicators and Rationale

Timber harvest or motorized activities associated with project preparation during the spring denning season in lynx habitat ~~may~~can disturb females raising young in dens. Lynx with kittens may be especially vulnerable to disturbance while the kittens are young, and lynx have been known to abandon kittens as a result of disturbance (Claar et al. 1999; Ruediger et al. 2000). Lynx do not readily abandon kittens. Females also are able to move kittens, and typically move to several den sites over a denning period, even without the occurrence of human disturbance (USFWS 2000:7-8).

Comparison of Alternatives

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 before conditions are suitable to initiate motorized forest management activities at the elevations typically occupied by lynx. Under all alternatives, den sites would be protected on a case-by-case basis as they are detected, which would typically occur through correspondence with local researchers that may have marked animals in the vicinity of a project. If an active den site is found, under Alternatives 2, 3, and 4, motorized forest management activities and prescribed burning within 0.25 mile of that site would be prohibited from May 1 through July 15, or earlier if fully vacated (commitment LY-HB4).

Alternative 3 would add to those requirements by prohibiting motorized forest management activities and prescribed burning on LMAs with less than 10 percent denning habitat during the same period and within the same distance to denning habitat, thereby providing additional protection to those LMAs lacking in denning habitat. Therefore, Alternative 3 would provide more protections for denning habitat and den sites than the other alternatives. The action alternatives provide a slight degree of additional protection for denning lynx and specific restriction dates to be applied in addition to how detected active lynx den sites would be treated under Alternative 1.

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 without disturbance and away from snowmobile trails. In addition, snowmobile use occurs primarily during the winter, when lynx are not denning. Thus, disturbance resulting from snowmobile use associated with forest management activities on denning lynx is expected to be minor.

Critical Habitat

When designating critical habitat, the known physical and biological features (PCEs) essential to the conservation of the species are identified. The PCEs for lynx are the physical and biological features essential to the conservation of the species laid out in the appropriate quantity and spatial arrangement. For lynx, these features include boreal forest landscapes supporting a mosaic of differing successional forest stages and containing (1) a presence of snowshoe hares and their preferred habitat conditions, (2) winter snow conditions that are generally deep and fluffy for extended periods of time, (3) sites for denning that have abundant CWD, and (4) matrix habitat that occurs between patches of boreal forest in close juxtaposition such that lynx are likely to travel through such habitat while accessing patches of boreal forest within a home range.

The analysis provided above considers the effects of the action alternatives on several key habitat features for lynx. These key habitat features encompass the PCEs for critical habitat. DNRC's commitments for suitable habitat retention within LMAs and on scattered parcels addresses the overall physical and biological feature essential to lynx – boreal forests landscapes supporting a mosaic of differing successional forest stages. While DNRC would conduct timber harvest within these areas, by retaining 65 percent as suitable habitat for Alternative 2, 70 percent for Alternative 3, and 60 percent for Alternative 4, it would maintain the function of these areas for lynx conservation. DNRC's commitment to retain 20 percent of total lynx habitat as foraging habitat addresses PCE 1. This commitment would require DNRC to retain more lynx foraging habitat compared to what is required under the existing ARMs.

However, data show that DNRC currently supports extensive foraging habitat such that retaining only 20 percent per LMA could result in a net reduction in foraging habitat in the HCP project area. Additionally, lynx researchers have not determined how much foraging habitat lynx require within their home range. Therefore, reductions in foraging habitat would likely result in adverse effects on

PCE 1. DNRC's activities would not affect PCE 2. DNRC's commitment for den site attributes and CWD would address PCE 3. Because no adverse effects on den site attributes or CWD would occur under the HCP, no adverse effects on PCE 3 are expected. As described in the analysis for linkage areas, DNRCs commitments are expected to provide adequate habitat connectivity. Therefore, no adverse effects on PCE 4 are expected.

Summary

All action alternatives provide a greater measure of lynx conservation on trust lands than Alternative 1 by providing greater commitments to maintain suitable habitat and foraging habitat in key areas of known importance for the species in western Montana for the next 50 years. Greater emphasis on monitoring and tracking important habitat conditions and features, such as den sites, would also be a common component of all action alternatives. Alternative 3 overall would provide the greatest measure of conservation benefit to lynx. This alternative does so by (1) maintaining the greatest amount of suitable habitat on blocked lands and scattered parcels, (2) requiring that both stands of denning habitat and potential den sites be maintained on blocked lands and scattered parcels, (3) requiring additional restrictions on pre-commercial thinning in young foraging habitat in LMAs, (4) requiring additional restrictions on allowable patch sizes of non-suitable habitat on scattered parcels to facilitate habitat connectivity, and (5) requiring additional restrictions on motorized activities in lynx habitat in spring in LMAs with less than 10 percent denning habitat to further reduce potential for disturbance to denning lynx. Alternative 2 ranks second in degree of conservation provided for lynx, followed by Alternative 4. Alternative 1 provides no firm numerical commitment to amounts of suitable lynx habitat that would be retained; however, under the existing management approach and sustainable yield, it is unlikely that suitable habitat amounts would fall below the 60 percent requirement contained in Alternative 4 on blocked lands or scattered parcels. One notable difference between Alternative 1 and all action alternatives is the designation of the Seeley and Garnet LMAs and commitments associated with them. The action alternatives would provide improved assurances for maintaining important habitat conditions in these key areas.

The different commitments under the alternatives would provide a range of protection for lynx and lynx habitat, and these measures are expected to reduce the effects of other stressors that may compound the anticipated effects of climate change over the Permit term. Under Alternative 1, ongoing changes and related scientific research would be factored into project-level designs and analyses as they occur, and additional mitigation measures may be required for individual projects to further protect lynx. In contrast, the action alternatives include additional commitments to protect lynx and lynx habitat (e.g., requiring a mosaic of suitable denning and foraging habitat in certain amounts) that would be in effect for the entire Permit term. Through annual and 5-year reviews, the monitoring and adaptive management process, and the changed circumstances process, the action alternatives would also provide continuing opportunities to address ongoing changes and incorporate current scientific research.

Overall, Alternative 3 is expected to result in the lowest potential for forest management activities on trust lands contributing to any adverse effects from climate change, followed by Alternatives 2, 4, and then 1.

4.9.5 Effects of the Transition Lands Strategy (for Both Terrestrial and Fish Species)

4.9.5.1 Affected Environment

As described in EIS Chapter 2, Environmental and Procedural Setting, DNRC manages over 5.1 million surface acres of trust lands under five land use categories: agriculture, grazing, real estate, forest, and minerals. While most trust lands are classified under their predominant land use, DNRC retains flexibility to conduct other uses on those lands. For instance, there are classified forest lands in the HCP project area with secondary, non-forestry uses. DNRC may permit recreation, grazing, or other seasonal or temporary uses when they do not prohibit or limit the predominant forest management land use of that acreage.

DNRC is authorized to identify certain lands for other predominant land uses other than what they were originally classified. Under certain conditions, classified forest land may be identified for another predominant land use such as real estate.

DNRC's decision to reclassify forest lands to a real estate land use (commercial, industrial, residential, or conservation) is influenced by market conditions, financial analysis and expected financial rates of return, direction contained in DNRC's Real Estate Management Programmatic Plan (DNRC 2004f), and DNRC's Real Estate Management Administrative Rules (ARMs 36.25.901 through 918). Generally, lands selected for reclassification for non-forest uses are identified following considerable evaluation and analysis as outlined in the Real Estate Management Administrative Rules. These rules provide a systematic approach to identify lands for potential development or conservation.

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).

As stated above, 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.

The Land Board maintains authority to sell or acquire certain trust lands as long as it is done so to secure long-term advantage to the trust beneficiaries and the people of the state of Montana. Montana statute outlines various restrictions associated with the sale of trust land (MCA 77-2-301 through 77-2-367).

DNRC's decision to sell, exchange, or acquire trust land is influenced by market conditions, financial analysis and expected financial rates of return, direction contained in DNRC Land

Banking Rules (ARMs 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.

DNRC is 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.

4.9.5.2 Environmental Consequences

Alternative 1 (No Action)

Under the No-action alternative, real estate projects would continue to comply with applicable policies, laws, and rules, including MEPA, DNRC's Real Estate Management Programmatic Plan, DNRC's Real Estate Management Administrative Rules, DNRC's Land Banking Rules, and other applicable state and county laws. The timing and amount of projects would continue to be influenced by market conditions, financial analysis and expected financial rates of return, direction contained in the laws and regulations listed above, and the management discretion of the Land Board.

DNRC would continue to sell, acquire, exchange, lease, and develop trust lands. Real estate projects would continue to be prioritized in urban areas and would abide by existing acreage thresholds identified in the Real Estate Management Rules and Section 4.9.5.1, Affected Environment, above. DNRC would likely continue to generally exclude projects that may potentially affect federally listed threatened and endangered species. Effects to ~~wildlife~~species of concern would be analyzed under MEPA on a project-by-project basis. DNRC would continue to allow outside entities to propose conservation use instead of development as outlined in Section 4.9.5.1, Affected Environment.

Action Alternatives

To address the potential for changes in land ownership (into or out of state ownership) and/or land use (to or from management for timber production by DNRC), the HCP for each action alternative defines a process for adding lands to or removing lands from the HCP project area. Lands identified for addition to or removal from the HCP project area due to proposed ownership or land use changes are termed "transition lands."

Similar to Alternative 1, real estate projects occurring under the action alternatives would continue to comply with applicable policies, laws, and rules. Additionally, under all three action alternatives, DNRC would implement the transition lands strategy (HCP Chapter 3 in Appendix A, HCP), under which the habitat needs of HCP species would be assessed when parcels are considered for removal from or addition to the HCP project area. The analysis below describes the potential effects on HCP species from removing or adding lands to the HCP project area.

Effects of Removing Lands from the HCP Project Area

The transition lands strategy would limit the amount of land DNRC could remove from the HCP project area and provide the opportunity and framework for interested parties to extend conservation benefits on HCP project area lands through leases, licenses, or other legal instruments pursuant to existing state laws.

The greatest restriction on the amount of trust lands that may be removed from the HCP project area would be imposed in areas that provide key habitat for grizzly bear, lynx, and bull trout. Under the transition lands strategy, no more than 5 percent (~~10,990~~10,880 acres) of trust lands within bull trout core habitat areas, the NCDE and CYE grizzly bear recovery zones or CYE NROH, or LMAs could be removed from the HCP project area. For all other HCP project area lands, DNRC would cap the removal of lands at ~~10~~15 percent (~~32,870~~49,640 acres) of the original HCP project area. The first 10 percent of the 15 percent cap (33,090 acres) would be available to DNRC at any time during the Permit term. However, DNRC could not remove more than 10 percent of the original HCP project area until it adds at least 15,000 acres to the original HCP project area. Compared to Alternative 1, implementation of these caps would provide a firm commitment to limit the amount of land providing habitat for HCP species that could be removed from DNRC ownership and subsequently subject to development that would pose an elevated risk of adverse effects to HCP species.

For real estate projects, conservation measures would be considered at the project level and would be designed to address impacts to the habitat of grizzly bears, lynx, and/or other relevant wildlife and aquatic species. Under the strategy, parcels identified as important for habitat linkage would receive special consideration for deed restrictions or other binding conservation measures prior to their disposal, which may increase certainty of minimizing risks to fish and wildlife from human development over the Permit term compared to Alternative 1.

Similar to the Alternative 1, the USFWS and other conservation groups would be notified before parcels are removed from the HCP project area, thereby giving them a chance to purchase or otherwise conserve these lands. DNRC would follow a similar notification process as outlined in Section 4.9.5.1, Affected Environment. However, under the action alternatives, entities would have 24 months to secure a conservation license, lease, or similar legal instrument rather than 12 months. If that entity has an existing Permit or agreement with the USFWS under which the leased, licensed, or disposed HCP project area lands will be managed in a manner providing similar or greater benefits to HCP species than the HCP, then those lands would not count against the caps described above. Similar to Alternative 1, DNRC could also consider the application of deed restrictions to land disposals. Under the action alternatives, deed restrictions would be considered at the request of the USFWS and as long as the value of the land is not reduced. For some buyers, deed restrictions that enhance the conservation value of the land or protect the natural features of that land (such as streams) may be an incentive to acquire the land.

The following sections analyze the effects of those uses that would effectively ‘remove’ lands from the HCP project area and count against the 5 and ~~10~~15 percent caps.

Effects on Grizzly Bears

As described in subsection Relationship of DNRC HCP Covered Activities to Grizzly Bear Risk Factors in Section 4.9.3.1 (Grizzly Bears – Affected Environment), the primary risk factors to grizzly bears in Montana are (1) habitat loss and degradation and (2) bear-human conflicts, especially those resulting in grizzly bear mortality. Conversion of lands managed for timber production to development can increase the presence of these risk factors. Development may also reduce the availability of suitable habitat and the effectiveness of linkage habitat, which reduces the ability of grizzly bears to travel between larger blocks of habitat.

Development would have the greatest effect on grizzly bears if it were to occur in DNRC's blocked lands (Stillwater Block and Swan River State Forest), which are in the NCDE grizzly bear recovery zone, because (1) the recovery zone is deemed the highest priority geographical area for recovery of the species, and (2) the blocked ownership configurations (rather than scattered) not only facilitate efficient management, but also increase opportunities for meaningful and effective landscape-scale conservation of wildlife habitat.

The likelihood that DNRC's blocked lands (which are in the NCDE grizzly bear recovery zone) would be adversely affected by the transition lands strategy is expected to be low. DNRC is less likely to develop, exchange, sell, or lease large amounts of land within the blocked forests because it facilitates management to keep lands blocked and to add lands to blocked areas. Additionally, these lands are in the recovery zone and therefore would be subject to the more restrictive cap on removing lands ~~applies to the recovery zone~~ (5 percent of the baseline HCP project area, meaning no more than ~~10,990~~10,880 acres could be removed).

Effects on Lynx

Development can increase the risks to Canada lynx from sources of direct mortality, habitat loss, habitat fragmentation, and disturbance (see subsection Status and Distribution in Section 4.9.4.1, Canada Lynx – Affected Environment).

Areas that provide linkage habitat are essential for allowing genetic dispersion between subpopulations of lynx, especially for ameliorating losses associated with catastrophic events. Development may lead to additional human disturbance; a reduction in the amount of suitable habitat, including foraging habitat; and/or a decrease in the effectiveness of linkage habitat, which reduces the ability of lynx to disperse and/or to move between home ranges to find prey.

Development would have the greatest effect on lynx if it were to occur in some of the scattered DNRC parcels in the Garnet Mountains and the Seeley Lake area or in DNRC's blocked lands, because (1) some of the scattered parcels in the Garnet Mountains and the Seeley Lake area are known to be high-use areas for lynx and (2) the blocked ownership configurations (rather than scattered) not only facilitate efficient management, but also increase opportunities for meaningful and effective landscape–scale conservation of wildlife habitat. These areas are encompassed in DNRC's LMAs established for lynx conservation purposes under the HCP.

The likelihood that LMAs would be adversely affected by the transition lands strategy is expected to be low because~~, coincidentally, four of the six LMAs occur within blocked lands and the NCDE grizzly bear recovery zone. As described above, the blocked lands are less likely to be adversely affected by the transition lands strategy. Additionally~~, LMAs would be subject to the more restrictive cap on removing lands ~~applies to the recovery zone~~ (5 percent of the baseline HCP project area, meaning no more than ~~10,990~~10,880 acres could be removed).

~~Some scattered parcels in the~~ The Garnet and Seeley LMAs are ~~high-use areas for lynx. These~~ comprised of DNRC scattered parcels ~~are part of~~interspersed in a mosaic of Plum Creek, USFS, or BLM lands and limited private ownership. ~~These LMAs are located outside the grizzly bear recovery zone, where removal of HCP project area lands is capped at 10 percent of the baseline HCP project area. Therefore, these LMAs are somewhat more susceptible to development and the associated effects to lynx.~~Some of these parcels are high-use areas for lynx. While scattered parcels are typically more likely to be targeted for disposal, under the HCP's transition lands strategy (see HCP Chapter 3, Transition Lands Strategy, in Appendix A, HCP), these lands would be subject to the 5 percent cap on removing lands from the HCP project area. Additionally, given the importance of these sites to lynx, and DNRC's current procedures for land dispositions, which call attention to listed species issues, these parcels would likely not be disposed to a non-conservation entity. In the unlikely event that any such parcels are disposed to non-conservation entities, changes in land management on these parcels could adversely affect lynx habitat in these areas.

Effects on HCP Fish Species

For aquatic species, such as bull trout, Columbia redband trout, and westslope cutthroat trout, increases in development threaten to alter stream and riparian habitats through streambank modification and destabilization, increased nutrient loads, and increased water temperatures (63 FR 31647-31674, June 10, 1998, p. 31662). Indirectly, urbanization within floodplains alters groundwater recharge by routing water into streams through drains rather than through more gradual subsurface flow (63 FR 31647-31674, June 10, 1998, p. 31662).

The more restrictive cap on removing lands applies to bull trout core habitat (5 percent of the baseline HCP project area, meaning no more than ~~10,990~~10,880 acres could be removed). Coincidentally a large amount of the core habitat lies within blocked lands, which are less likely to be developed as already described. The transition lands strategy also includes opportunities for DNRC to add deed restrictions for the protection of core bull trout streams prior to land disposal. This would help reduce potential effects of development on streams.

Some of the scattered parcels in the HCP project area that provide habitat for HCP fish species are interspersed in a mosaic of other landowners, including federal landowners such as the USFS and BLM. In some of these areas, federal guidelines on timber harvest and road construction are relatively robust (e.g., INFISH) and would lead to a level of protection for HCP fish species that is equal or better than that provided by the action alternatives. Conversely, scattered parcels that are suitable for development are most likely already adjacent to developed parcels, or may be located in areas with developed transportation networks for access. In these cases, basin-wide fish habitat conditions may already be degraded due to urbanization.

Effects of Adding Lands to the HCP Project Area

When the state acquires forested trust lands with habitat for HCP species, DNRC would consider adding the parcels to the HCP project area. If added, DNRC would then conduct forest management projects on the newly acquired parcels under the HCP and the other applicable policies and rules that govern the forest management program. Habitat for grizzly bears, lynx, bull trout, Columbia redband trout, and westslope cutthroat trout would be managed under the full suite of applicable conservation strategies described in the HCP. For newly acquired parcels that would have been subjected to development (possibly resulting in the permanent loss of habitat) if they had not become trust lands, adverse effects on habitat for HCP species would be limited to the effects associated with forest management, which would be mostly temporary and minimized or avoided to the extent practicable through implementation of the HCP.

DNRC anticipates that, with or without an HCP, the amount of forested lands added to trust lands ownership would greatly exceed the amount sold or developed, especially in the near term (5 to 10 years). Some land acquisitions would likely come with conservation easements that minimize or eliminate human development. With or without easements that restrict development, the lands would be managed under the ARMs and/or the HCP, such that the conservation of habitat for grizzly bear, lynx, Columbia redband trout, westslope cutthroat trout, and bull trout is a high priority and other wildlife species are considered appropriately. The current trend is that substantial amounts of forested parcels have either been acquired as trust lands recently or are potentially going to be acquired in the near term (see HCP Chapter 3, Transition Lands Strategy, in Appendix A, HCP). For acquired parcels that possess conservation easements limiting future development, impacts to fish and wildlife habitat would be limited to impacts from forest management activities, which would be minimized or avoided to the extent practicable through implementation of the HCP commitments, as described in this EIS analysis.

Parcels obtained by DNRC through recent and ongoing acquisitions that would be considered for addition to the HCP project area occur within the EIS planning area and are intermingled with lands currently in the HCP project area. The lands recently acquired or soon to be acquired possess similar forest community types and vegetation, have been managed for commercial harvest, and are well-suited for continued long-term management under DNRC's forest management program. After they are acquired, the lands would be managed under DNRC's sustainable yield mandate, and, if they are added to the HCP project area, HCP conservation commitments would provide additional conservation sideboards and certainty over the 50-year Permit term. The total approximate acreage of these near-term acquisitions is 61,340 acres. If all these acquisitions were added to the HCP, it would increase the originally proposed HCP project area by 11 percent.

As ~~identified~~more specifically described in HCP Chapter 3, Transition Lands Strategy (Appendix A, HCP), lands that ~~may~~will be considered for addition to the HCP project area in the near term include

- Imminent acquisition of scattered parcels associated with the Lolo National Forest land exchange, which involves approximately 10,500 acres in the SWLO
- Several recently acquired s~~S~~cattered parcels in the SWLO near Ovando and Lincoln, Montana, which total ~~(~~4,258 acres~~)~~
- Recently purchased parcels in the Chamberlain Creek ~~lands~~acquisition in the SWLO, which ~~(if acquired by DNRC, approximately~~total 14,581 acres~~)~~
- The ongoing Potomac acquisition in the SWLO, which totals approximately 32,000 acres
- ~~Lands in the Montana Working Forests Project (if acquired by DNRC, potentially more than 100,000 acres).~~

These lands are being or will be inventoried by DNRC to assess existing conditions: road conditions, forest stand attributes, presence of HCP species, and presence and condition of habitat supporting HCP species. They will then be evaluated for potential addition to the HCP project area.

Effects on Grizzly Bears

Adding lands to the HCP project area is expected to benefit grizzly bears. The condition of these lands and the potential effects of managing them under the HCP would be similar to those disclosed in the EIS analysis for grizzly bears (Section 4.9.3, Grizzly Bears). Lands most likely to be acquired by DNRC are private timberlands. If these lands are located in recovery zones or NROH, p~~P~~otential benefits of acquiring these lands for bears include increased acres managed under spring restrictions, greater restrictions on motorized access on existing roads, fewer open roads in grizzly bear habitat, and increased connectivity and integrity of linkage areas. More specific discussion of the potential effects of adding lands to the HCP project area from near-term acquisitions is provided below.

The 10,500 acres of lands DNRC would acquire from the USFS under the Lolo Land Exchange include 240 acres within the CYE grizzly bear recovery zone. If added to the HCP project area, the more restrictive conservation commitments that apply to scattered lands within the CYE would apply to these lands as well. None of the other lands DNRC would acquire through this exchange occur within the NCDE recovery zone or associated NROH, although the program-wide grizzly bear conservation commitments would apply on these lands if they are added to the HCP project area. Once these lands are acquired, they may be managed more intensely by DNRC than they currently are under USFS management. However, if these lands are added to the HCP project area, effects on grizzly bears and their habitat would be limited to those associated with forest management and would be mostly temporary and minimized or avoided to the extent practicable through implementation of the HCP.

The other three near-term acquisitions are lands in the SWLO that were formerly owned by Plum Creek. Of the 4,258 acres recently acquired near Ovando and Lincoln, approximately 1,280 acres (2 parcels) occur in NROH near the southern portion of the NCDE grizzly bear recovery zone. All 14,581 acres recently acquired through the Chamberlain Creek land acquisition occur in NROH near the southern boundary of the NCDE recovery zone; however, none of these lands occur in that recovery zone. None of the 32,000 acres that will soon be acquired through the Potomac acquisition occur within a grizzly bear recovery zone or NROH. If added to the HCP project area, all the program-wide grizzly bear commitments would apply to these parcels, and the NROH commitments would apply to those parcels within NROH.

Adding these lands to the HCP project area would expand greater grizzly bear conservation commitments to lands that would otherwise be managed under DNRC’s current Forest Management ARMs. Effects on grizzly bears and their habitat would be avoided or minimized to the extent practicable through implementation of these HCP commitments. In addition to the benefits identified above for the adding lands to the HCP project area, grizzly bears in near-term acquisition areas within NROH would also benefit from a reduction in risks of bear-human conflicts and the processes and caps for removal of lands in grizzly bear NROH from the HCP project area as outlined in the HCP transition lands strategy. The Potomac acquisition area supports transient use by grizzly bears moving to the Rock Creek drainage, so additional HCP commitments implemented in this area would reduce the risk of bear-human conflicts and improve dispersal habitat for those bears.

As former Plum Creek lands, these areas are already roaded, and extensive road building is not expected during the 50-year Permit term. Some roads within these areas may be reclaimed to comply with HCP commitments, resulting in improved conditions for bears. Additionally, for lands within NROH, motorized and commercial forest management activities associated with those roads in spring habitat would be restricted during the spring period.

Effects on Canada Lynx

Adding lands to the HCP project area is expected to benefit lynx. The condition of these lands and the potential effects of managing them under the HCP would be similar to those disclosed in the EIS analysis for lynx (Section 4.9.4, Canada Lynx). Potential benefits include increased acres managed as suitable habitat for lynx, particularly if these acres fall within mapped LMAs; increased acres managed as foraging habitat for lynx; 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.

Increasing the HCP project area by as much as the 61,340 acres identified in this analysis would minimally influence the amount of HCP project area lands within lynx LMAs. Only 30 acres of lynx habitat would be added to the Garnet LMA if the Potomac land are added to the HCP project area, while the amount of lynx habitat within the other LMAs would not be affected. Lynx habitat is present, however, on many of the scattered parcels that are part of the recent and ongoing acquisitions. If added to the HCP project area, these lands would receive additional conservation provided by the lynx habitat commitments (LY-HB1 through LY-HB6) and the caps and processes in the transitions lands strategy. Managing additional lynx habitat on scattered parcels would provide more dispersal habitat for lynx and potentially support lynx movements and habitat needs for lynx occurring on adjacent federal lands.

Effects on HCP Fish Species

The addition of lands to the HCP project area and subsequent management under the long-term conservation assurances of the HCP would benefit HCP fish species. The condition of these lands and the potential effects of managing them under the HCP would be similar to those disclosed in the EIS analysis for HCP fish species (Section 4.8, Fish and Fish Habitat). Lands most likely to be acquired would be private timberlands. Therefore, t~~T~~he primary benefit of adding these lands to the HCP project area would be retention of these areas as working forests that are managed to improve stream connectivity and reduce sediment sources as opposed to development that may contribute to stream alterations as described above. More specific discussion of the potential effects of adding lands to the HCP project area from near-term acquisitions is provided below.

The 10,500 acres of lands DNRC would acquire from the USFS under the Lolo Land Exchange include 3.7 miles of fish-bearing streams (out of 32.3 total miles of stream). A portion of these fish-bearing streams support bull trout and westslope cutthroat trout. Once these lands are acquired, they may be managed more intensely by DNRC than they currently are under USFS management. However, if these lands are added to the HCP project area, effects on HCP fish species and their habitat would be limited to those associated with forest management and would be mostly temporary and minimized or avoided to the extent practicable through implementation of the HCP.

These acquisitions would also allow for a more holistic approach for addressing some potential habitat problems, such as fish passage or management of non-native fish species to discourage hybridization/ resource competition.

The other three near-term acquisitions are lands in the SWLO that were formerly owned by Plum Creek. Use by HCP fish species in these potential acquisition areas is variable. For example, the Ovando and Tupper Lake parcels have a single cutthroat stream on the parcels to be acquired, while the Chamberlain Creek and Potomac acquisitions have multiple streams that provide habitat for native fish, including westslope cutthroat trout. The majority of these former Plum Creek lands are already roaded; therefore extensive road building is not expected during the 50-year Permit term, and any new roads required on these lands would be subject to all provision of the HCP commitments. In addition, HCP implementation on these lands would result in improved conditions for fish, including HCP species, by closing unnecessary roads, addressing road and stream crossing problem sites, and replacing identified fish passage barriers.

4.9.6 Effects of the Changed Circumstances Process (for Both Terrestrial and Fish Species)

4.9.6.1 Introduction

Conditions that affect HCP species in the project area may change during the Permit term. The HCP for each action alternative identifies changed circumstances (as defined in 50 CFR 17.3) that can reasonably be anticipated and planned for by DNRC and the USFWS, and incorporates measures to be implemented if such circumstances occur. DNRC and the USFWS have identified fires, insect and disease outbreaks, wind events, slope failures, floods, and climate change as the natural events to be addressed as changed circumstances in the HCP (see HCP Chapter 6 in Appendix A, HCP). All of these natural disturbances can affect habitat conditions for the HCP and other fish and wildlife species. Natural disturbances can also be beneficial for fish and wildlife because they are part of the natural processes found in the ecosystem, as forest stands are naturally regenerated by disturbances.

Natural events that affect forest canopy cover include fires, severe outbreaks of disease or insect infestation, or high winds. Fires and outbreaks of insects or disease are natural processes that can be exacerbated by climatic warming, drought, and fire suppression. Such events can affect grizzly bears, lynx, and other wildlife species by reducing the amount of available suitable habitat, reducing habitat connectivity, and reducing cover for secure movement. Conversely, events that result in widespread tree mortality may also result in beneficial effects, such as a temporary increase in forage for bears. Events that reduce forest canopy cover in riparian areas can affect HCP and other aquatic species by reducing or eliminating riparian habitat and adversely affecting riparian functions, such as LWD recruitment, shade provision, nutrient loading, and sediment filtration. These changes can affect water temperature and turbidity and reduce the amount of available spawning, rearing, and migration habitat.

~~Aerial detection flights across Montana indicate that the amount of acres infested by various insects is generally increasing (Meyer 2006). Population levels and associated insect damage decreased in 2005 and 2006 but increased again in 2007, when weather conditions where warmer and drier than usual (USFS and DNRC 2008). Overall, in many stands in Montana, beetle-related damage has~~

~~declined because much of the susceptible hosts have been killed; however, beetle populations have increased markedly in a few areas just coming under attack. Diseases are more localized and less prevalent than insect infestations, with a few notable exceptions. Root-disease-caused mortality is more common west of the Continental Divide, causing more than 1 million acres of mortality. White pine blister rust continues to have a serious effect on western white pine populations, which currently comprise less than 5 percent of the original 5 million acres. Recent efforts that may improve conditions include the development of seedling stock with increased resistance and a new pruning technique that improves survival of affected trees.~~

~~Current fire trends toward increasingly severe fire seasons with more acres burned are expected to continue into the near term due to climate change and existing high wildfire fuel loads (Westerling et al. 2006). Among the many factors influencing fire risk, forest management activities are one factor that can directly reduce fire risk in a forest stand (Fiedler et al. 2004). DNRC uses silvicultural treatments to mimic the effects of naturally occurring disturbance regimes in a given forest type by using prescriptions that will create conditions similar to what a naturally occurring event, such as fire, would have historically created. The use of such practices would continue under all alternatives. Therefore, under all action alternatives, there would be no cumulative effects of the proposed action alternatives on fire risk. In most areas, the potential contribution of DNRC-managed lands to the overall fire risk is low, because most forested trust lands are isolated, scattered parcels, relative to the large blocks of federal and private lands.~~

~~There is growing scientific consensus that global greenhouse gas levels are rising. It is widely accepted that increased use of fossil fuels, worldwide reduction of forests, and other human activities are contributing to atmospheric levels of greenhouse gases, especially CO_2, which far surpass historical norms. CO_2 is being produced at a rate faster than the rate at which the biosphere can sequester or fix it, therefore raising the concentration of CO_2 in the earth's atmosphere. Although the degree of temperature change and the extent to which climate will be affected are under debate, the consensus among scientists on the IPCC is that this rise in greenhouse gas levels will cause gradual warming and global climate change (IPCC 2007).~~

~~The rise in global temperature is already apparent; in the past century, mean global surface temperatures have risen between 0.5 and 1.0° F (EPA 2002). While this increase may seem minor, the effects of this warming trend could be significant, especially in light of widely accepted predictions regarding the rate at which warming will continue. In its 2007 assessment report, the IPCC modeled scenarios using various levels of CO_2 mitigation to predict the temperature rise associated with each one, and determined that mean global surface temperature will rise between 1.1 and 6.4° C (2 to 11.5 ° F) by the year 2099, with a mid-range prediction of 3° C (5.4° F) (IPCC 2007).~~

~~Impacts of global climate change will include altered precipitation patterns and an increase in frequency and severity of extreme weather events, such as storms, floods, and drought. Climate change will also likely impact natural ecosystems and associated biodiversity; socioeconomics, especially in areas that rely on resource extraction and agriculture; and human health and activities (RUS and MDEQ 2007).~~

~~Global climate change will affect various regions of the world differently.~~ A detailed discussion of climate and climate change is provided in Section 4.1, Climate. Montana will most likely be affected by changes in precipitation, as weather patterns shift and warmer temperatures influence the frequency and duration of storms. Biodiversity and natural ecosystems will likely display the evidence of subtle climatic differences. These impacts will vary depending on the sensitivities of different habitat types and different species. Montana will also potentially see a socioeconomic impact, as climate change will likely influence timber harvests, agriculture, and recreation. Anticipated effects on HCP fish species from climate change are discussed in Section 4.8 (Fish and Fish Habitat), while anticipated effects on grizzly bear and lynx are discussed earlier in this resource section (Sections 4.9.3, Grizzly Bears, and 4.9.4, Canada Lynx).

~~Climatic conditions play a substantial role in determining the distribution of many species of fish and wildlife, particularly cold-water-adapted species such as bull trout (Rieman et al. 2007). A recent review of the effects of climate change on fish and wildlife (ISAB 2007) identified the following probable consequences of global warming in the Columbia River basin, which extends into western Montana: (1) warmer temperatures will result in more precipitation falling as rain rather than snow, (2) snowpack will diminish and streamflow timing will be altered, (3) peak river flows will likely increase, and (4) water temperatures will continue to rise. Based on modeled changes in the lower elevational limits of bull trout distributions in the interior Columbia River basin, Rieman et al. (2007) determined that a warming climate could result in losses of thermally suitable natal habitat area ranging from 18 to 92 percent. In a study that modeled the effects of geomorphology, climate, and fire on stream temperature across a sixth-order stream network in central Idaho, Isaak et al. (2007) found that most habitat loss in that area was attributable to recent trends of increasing air temperature and decreasing flows. Brick et al. (2008) predicted that a warming climate will cause spring runoff to begin a month earlier, resulting in low water flows during the summer and fall months. This could affect the reproductive success of bull trout, which spawn during late summer low flows, as discussed in Section 4.8.3.1 (HCP Fish Species – Bull Trout).~~

Slope failures (also called mass movements or landslides) are a concern for aquatic species because sediments from landslides can enter watercourses and reduce aquatic habitat quality. Potential effects on aquatic species and habitats may include excess sedimentation, loss of connectivity and habitat complexity, and degradation to spawning, rearing, and migration habitats. If left unstabilized, mass movements can become a chronic source of sedimentation to adjacent streams. Although mass movement events typically occur within a relatively small area, they can have more extensive effects on aquatic habitat by affecting downstream conditions.

Flooding on HCP project area lands occurs most often when a large snow pack melts rapidly, after large rain-on-snow events, or when isolated storm events overwhelm the drainage capacity of a waterbody. The primary concerns in the event of a severe flood are sedimentation of streams, erosion of stream banks, and the incapacitation of stream crossing structures.

Potential effects on individual grizzly bears or lynx or their habitats resulting from mass movements or floods are expected to be minimal; DNRC and the USFWS determined that these events would not warrant additional mitigation measures beyond those identified in the conservation strategies for those two species. Therefore, no triggers or responses were developed for grizzly bears or lynx in the event of mass movement or floods.

DNRC regularly responds to natural disturbance events that affect forest health on trust lands by scheduling timber harvests to capture the salvage value of affected trees. Timber salvage is a covered activity that is specifically addressed through several of the HCP commitments. Because the quality of wood in dead trees deteriorates quickly, the associated environmental review processes are often conducted under compressed timelines. In addition, DNRC's salvage timber program (MCA 77-5-207) provides for 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 an event occurs; therefore, salvage projects are often processed as emergency situations. Blowdown events and subsequent forest management activities are often small, localized projects that typically occur as small salvage sales through a timber permit.

DNRC's response to a mass movement may include small-scale salvage of damaged trees, depending on the stability and accessibility of the site. More typically, DNRC's response includes an attempt to stabilize the site to prevent further erosion and sedimentation to sensitive streams. Similarly, responses to flood events include stabilization of sites with a high risk of sediment delivery.

4.9.6.2 Effects of the Alternatives

Under Alternative 1, DNRC would continue to use interdisciplinary expertise in the design of salvage projects to avoid or minimize impacts to fish and wildlife species (including the HCP species) in compliance with applicable ARMs. There would be no formal, systematic process for incorporating USFWS input into project design and implementation.

Under all three action alternatives**,** DNRC would still use interdisciplinary expertise to design salvage projects in compliance with applicable ARMs. In addition, however, DNRC would apply relevant HCP commitments specifically designed to minimize and mitigate the effects of forest management activities on HCP species. DNRC would also implement the changed circumstances process, which would involve notifying the USFWS of the change, assessing site conditions, and preparing a response plan. Through this process, DNRC would solicit input from the USFWS on mitigation measures to be included in salvage projects stemming from changed circumstances. By including USFWS input and participation in project planning and design, the changed circumstances process under the action alternatives would add assurances that the needs of fish and wildlife species and habitat are addressed in such projects. For lynx, subsequent green harvest in LMAs affected by fires are of primary concern. Under the changed circumstances process, these projects would also receive special consideration and would provide assurances that the needs of lynx are considered in those projects.

In addition to ~~incorporating USFWS participation in~~addressing salvage project planning, the changed circumstances process under the action alternatives would address ~~strategies that would not be implemented~~flood events and mass movements, which would not be addressed in this manner under Alternative 1. The~~se~~ strategies ~~are ~~described for flood events and mass movements in HCP Chapter 6 (Changed Circumstances) in Appendix A (HCP)~~. Collectively, these commitments~~ would result in greater consideration of the needs of HCP fish species~~, grizzly bears, and lynx~~ in the design and implementation of ~~salvage projects~~response plans when these events occur, compared to Alternative 1, and may include additional commitments to address new effects on the HCP fish species specific to the natural disturbance event.

Although the potential effects of climate change are beginning to be understood (including droughts, floods, glacial melting, changes in insect and disease infestations, shifts in species distribution, and changes in the timing of natural events), ~~DNRC and the USFWS lack~~ sufficient site-specific information ~~to plan for and manage~~is not currently available to support planning for and managing the effects of climate change at this time. No policy or change in management related to climate change has been proposed under the HCP, although potential responses have been included in HCP Chapter 6 (Changed Circumstances) in Appendix A (HCP). 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 the HCP species would be a topic of discussion as necessary between DNRC and the USFWS at scheduled annual meetings. Both parties would work together to develop appropriate responses to new research or guidance materials regarding the impacts of climate change on forest management and/or the HCP species. Additionally, several of the HCP commitments, specifically for HCP fish species, would be adapted over time if conditions change. These include increased protection of temperature-sensitive streams, adaptation of BMPs if effectiveness monitoring thresholds are not met, modification of grazing corrective actions if desired outcomes are not achieved, and additional measures for projects through the CWE process.

4.9.7 Other Wildlife Species

While there are no changes being proposed for management of other non-HCP species, this section addresses whether implementing one of the alternatives could affect non-HCP species.

The analyses of non-HCP species are addressed in two ways. First, all species potentially occurring in the planning area are addressed using wildlife habitat associations, where each species is associated with various habitats they use, then the effects, if any, to these habitats are described. Second, several species are analyzed further, due to their special status, or a potential for effects on their habitat from forest management under one or more of the action alternatives.

4.9.7.1 Wildlife Habitat Associations

In Table E4-7 in Appendix E (EIS Tables), each species that is known or expected to occur in the planning area is listed and associated with one or more of the various habitat categories. The information contained in this table is necessarily general due to the large number of species addressed, but serves as a useful tool for understanding general forest structural associations of various species. Where there may be indications of changes associated with an action alternative, such as relative amounts of mature or old-growth forest, corresponding anticipated effects are also likely to be expected for species closely associated with these conditions as indicated in Table 4.9-25.

Upland Forest Successional Stages and Cover Types

Affected Environment

Forest management activities may alter the distribution of forest successional stages and cover types on the landscape. Different wildlife species have varying levels of association with the various successional stages; some species, for example, are primarily associated with young forests, and others are primarily associated with mature and old-growth forests (Table E4-7 in Appendix E, EIS Tables). Similarly, some species are associated with particular forest cover types, which are defined by the dominant tree species present in forest patches or stands. Landscape-scale changes in the

TABLE 4.9-25. ACREAGE OF FOREST SUCCESSIONAL STAGES AND ASSOCIATED WILDLIFE SPECIES ON TRUST LANDS IN THE PLANNING AREA AND HCP PROJECT AREA

Forest Successional Stage[1]	Planning Area				HCP Project Area				Number of Associated Wildlife Species[2]
	NWLO	SWLO	CLO	Subtotal	NWLO	SWLO	CLO	Subtotal	
Grass/forb (non-stocked forests)	6,088	10,121	6,676	22,885	5,830	9,657	1,742	17,230	255
Seedling/sapling (predominantly < 5-inch dbh)	32,382	7,923	2,164	42,469	30,271	7,033	1,056	38,360	179
Poletimber (predominantly 5- to 9-inch dbh)	18,659	7,123	33,784	59,566	17,969	6,115	13,278	37,362	163
Young Sawtimber (predominantly > 9-inch dbh and estimated to be < 100 years old)	42,032	36,407	44,504	122,943	37,688	30,707	24,335	92,730	198
Mature Sawtimber (predominantly > 9-inch dbh and estimated to be > 100 years old)	149,768	79,483	18,027	247,278	129,291	67,185	10,580	207,056	199
Old-growth (based on structural characteristics as defined in Green et al. 1992)[3]	39,173	13,467	11,684	64,324	36,851	10,839	5,666	53,356	174

[1] Successional stages approximating those defined in the SFLMP (DNRC 1996).
[2] From Table E4-7 in Appendix E, EIS Tables.
[3] Characteristic wildlife species for mature sawtimber and old-growth forests are similar.
Source: DNRC (2008a).

availability of these habitat types may affect the distribution and composition of wildlife species communities on trust lands. The species being analyzed and their association with the various forest successional stages are identified in Table E4-7 in Appendix E (EIS Tables).

Current DNRC forest management practices and regulations are designed to provide a range of forest successional stages and cover types across the landscape. The philosophy is that a diverse array of native wildlife is best maintained and promoted by providing for diverse habitat conditions. The DNRC forest inventory program defines six forest successional stages: (1) grass/forb, (2) seedling/sapling, (3) poletimber, (4) young sawtimber, (5) mature sawtimber, and (6) old growth. The Forest Management ARMs do not specify requirements for the spatial or temporal distribution of these successional stages. Currently, more than 50 percent of the forested habitat in the planning area and the HCP project area is in the young sawtimber or mature sawtimber stage (Table 4.9-25). The most common forest cover types in the HCP project area are ponderosa pine, western larch/Douglas-fir, Douglas-fir, and mixed conifer (Table 4.2-7). The distribution of these cover types varies geographically. The CLO and SWLO have a higher proportion of the Douglas-fir and ponderosa pine cover types, which are typically found on the warmer, drier sites more common in the eastern and southern parts of the state. In contrast, the mixed conifer and western larch/Douglas-fir cover types are more prevalent on the cooler, moist sites found in the NWLO (Table 4.2-7). DNRC's forest management activities are designed to move stands toward DFCs, which identify target amounts of each cover type in each land office.

Among forest successional stages, wildlife species diversity is greatest in the mature sawtimber and old-growth stages. Within the planning area, there are 199 species associated with mature sawtimber and 174 species associated with old growth (Table 4.9-25). These two successional stages support diverse communities of flora and fauna and contain ecological features, such as large snags and down logs, often found in lower abundance in younger stands. Some species, while found in more than one successional stage, are associated most closely with the mature sawtimber and old-growth stages.

Risk Factor: Timber harvesting and associated activities may alter the representation of various forest successional stages and cover types, which could adversely affect the amount of habitat for wildlife species found in the planning area and project area.

Environmental Consequences

Similar to current management policies, none of the alternatives would require DNRC to maintain target amounts of specific successional stages. The availability and distribution of these stages in the HCP project area would be a product of varying amounts and intensity of forest management activity under the alternatives. Also, under all alternatives, DNRC would continue to manage stands toward a DFC. As described in Section 4.2 (Forest Vegetation), the various conservation commitments proposed under the action alternatives would not be expected to result in appreciable landscape-scale differences in proportions of different forest successional stages or cover types on HCP project area lands. Analysis in this section is based on material presented in Section 4.2 (Forest Vegetation), which describes the forest modeling process that was used to estimate the anticipated distribution of these successional stages and cover types under the alternatives.

Regarding cover types, the alternatives would not be expected to result in substantial differences in distribution of cover types in the HCP project area (see Section 4.2.2.3, Forest Vegetation – Cover Types and Desired Future Conditions). Under all alternatives, progress toward DFCs would continue, with seral forest types increasing and late-successional forest types decreasing compared to current levels. The effects on wildlife species associated with these cover types would be similar under all four alternatives, and would likely consist of displacement or temporary disturbance of animals in localized areas where cover type changes occur.

Across the project area, model results show the acreage in the seedling/sapling structural stage increasing compared to current conditions under all alternatives, and the poletimber and young sawtimber stages decreasing (Table 4.2-15). Increases in the amount of seedling/sapling forest would range from approximately 54,000 acres under Alternative 3 to approximately 72,000 acres under Alternatives 2 and 4. Wildlife species associated with forest in the seedling/sapling stage would have more success in areas where this habitat type becomes more abundant. Wildlife associated with poletimber and young sawtimber may be displaced from localized areas where timber harvest occurs, dependent upon availability of habitat in adjacent areas.

Throughout the project area, the availability of mature sawtimber would be expected to decrease by approximately 1 percent under Alternative 1 and 6 percent under Alternatives 2 and 4, but increase by approximately 1 percent under Alternative 3. These differences reflect varying levels of management restrictions in the Stillwater Core and riparian areas under the alternatives, with the least restrictions under Alternatives 2 and 4 and the greatest restrictions under Alternative 3. These slight variations in the availability of mature sawtimber under the alternatives would not be expected to result in discernable effects on wildlife species associated with this successional stage at the landscape scale. Some localized effects may occur such as displacement or disturbance of wildlife.

DNRC's policies and management approach for old-growth stands would not change under any of the alternatives. Under all four alternatives, the amount of old-growth forest would be expected to decrease throughout the project area from a current level of 11 percent to approximately 8 percent of HCP project area lands. Within the Stillwater Block, the amount of mature sawtimber and old-growth forest within the Stillwater Unit would likely be less under Alternatives 2 and 4 because of increased management flexibility in the Stillwater Core, which would not occur under Alternatives 1 and 3. Potential effects on wildlife from loss of old-growth habitat would be addressed at the project level.

Summary

Acres of forest successional stages and cover types would vary over the Permit term. However, all successional stages and cover types would continue to be represented across the landscape. Localized effects on wildlife attributed to the removal of a particular successional stage would be addressed at the project level.

Large Trees, Snags, and Coarse Woody Debris

Affected Environment

Structures such as large trees, snags, and CWD are important habitat components for a variety of wildlife species (Table E4-7 in Appendix E, EIS Tables). These habitat components are often available in mature and old-growth forest stands, but less available or absent from younger stands. Some younger forests, however, may provide remnant large trees, snags, and CWD, particularly in burned areas or where forest management emphasizes the retention of such structures. Current DNRC forest management rules require maintaining large snags and snag recruits (live trees that provide future sources of snags) and CWD for a variety of species dependent on this type of habitat (Table E4-8 in Appendix E, EIS Tables). Some bird species, such as the pileated woodpecker, prefer large trees or snags for nesting, while some mammals, such as lynx, often use debris piles or large fallen logs for den sites. CWD also provides habitat for species that serve as prey for lynx and grizzly bears.

Risk Factor: Forest management activities under the alternatives may result in the removal or destruction of structural elements, reducing the availability of these elements for wildlife. Over time, large, live trees, large snags, and CWD may become less common in intensively managed forests without intentional efforts to retain these elements on the landscape.

Environmental Consequences

Under all four alternatives, DNRC would continue to implement administrative rules that require CWD recruitment and retention of 4.5 to 24.5 tons of CWD per acre, depending on vegetation type (Graham et al. 1994). This amount is considered adequate to maintain desirable soil properties and site productivity. DNRC also addresses CWD retention for wildlife through these same requirements.

As previously discussed in Section 4.9.4 (Canada Lynx), each of the alternatives, in various ways, increases the amount of CWD retained in lynx habitat for the specific purpose of providing denning habitat. Therefore, in managed lynx habitat, more CWD would be retained in the form of piled wood than outside lynx habitat, which would potentially benefit other species that use CWD within these habitats, such as hares, voles, mice, and shrews. The amount of additional CWD left for the purpose of lynx habitat is not quantified, but for the sake of other species associated with the use of CWD, it would be very similar between alternatives.

Under all four alternatives, continued implementation of ARMs specific to fishers, flammulated owls, black-backed woodpeckers, and pileated woodpeckers would also encourage the retention of additional snags on projects in habitats of these particular species. Under all alternatives, salvage operations would continue to retain minimum snag and CWD recruitment levels, so no differences regarding effects on species are expected for this activity under any of the alternatives.

Summary

Under all four alternatives, DNRC would continue to retain the minimum amounts of snags and snag recruitment trees currently specified in the ARMs. Because these ARMs are now part of the HCP, all action alternatives would provide greater certainty that these important habitat attributes would be present on HCP project area lands because these requirements would be in place under the 50-year Permit term.

Forested Riparian Habitats

Affected Environment

Forested riparian areas are among the most valuable habitats for wildlife (O'Neil et al. 2001). In the planning area, approximately 300 wildlife species utilize forested riparian areas (Table E4-7 in

Appendix E, EIS Tables). These areas typically contain diverse and complex forest structural components (e.g., diversity of trees, shrubs, and forbs) that provide forage, cover, and nest sites for wildlife. In addition, forested riparian areas provide travel and dispersal corridors for a variety of species, such as marten, fisher, and mountain lion. On all ownerships in the planning area, there are 75,604 miles of streams, which contribute to the presence of riparian habitat. Of these stream miles, 31,646 are perennial streams and 43,959 miles are intermittent. On DNRC lands in the HCP project area, there are 1,578 miles of streams, of which 534 are perennial and 1,043 are intermittent (Table E4-4 in Appendix E, EIS Tables). HCP fish-bearing streams account for 451 stream miles (29 percent) of the 1,578 stream miles in the HCP project area. Streams in the project area comprise 2 percent of the total streams occurring on all ownerships in the planning area.

Current Forest Management ARMs define riparian, streamside, and wetland management zones and provide restrictions on timber harvest and associated activities in these areas (Table E4-8 in Appendix E, EIS Tables). Note that the term “riparian” in this discussion includes those areas defined as “riparian,” “wetland,” and “streamside” in the ARMs.

Risk Factor: Forested riparian habitats may be altered over time across the landscape such that habitat for dependent species is adversely affected.

Environmental Consequences

The aquatic conservation strategy is the only strategy responsible for differences between the alternatives regarding conservation measures for riparian, streamside, and wetland habitat associated with prescriptive removal of timber; therefore, this strategy is the only one discussed in this section.

The measures for riparian harvest differ between alternatives ~~solely~~ for the stands adjacent to Class 1 streams ~~(those that support HCP fish species)~~. Definitions and management strategies for the RMZ and CMZ differ between the alternatives. ~~Management strategies adjacent to streams that do not support HCP fish species are the same for all alternatives~~.

Under Alternatives 2 and 4, DNRC anticipates conducting from 45 to 90 acres of Class 1 riparian harvest annually within the 548,500-acre project area, compared to approximately 7,000 acres of total harvest annually within the project area. No harvest is allowed in the riparian area of Class 1 streams supporting HCP fish species under Alternative 3. ~~Under the action alternatives, of the 1,578 miles of streams in the HCP project area, 451 miles (29 percent) would be classified as Tier 1 streams.~~

Alternative 1 (No Action)

Alternative 1 reflects the current management practices regarding conserving riparian habitat as defined by Tables E3-3 and E4-8 in Appendix E (EIS Tables). In Alternative 1, for Class 1 and 2 streams and lakes, the SMZ is defined as beginning from the OHWM to 50 or 100 feet, depending on the slope, and must be extended to include adjacent wetlands. Where fish exist in waterbodies, the RMZ extends from the OHWM to the SPTH. Adequate amounts of shade and CWD retention are determined at the project level. No clearcutting is allowed in the SMZ, and harvest must retain 50 percent of the trees greater than or equal to 8 inches dbh or 10 trees per 100-foot segment, whichever is greater, as well as shrubs and sub-merchantable trees. Some allowances for salvage harvest are permitted. In Class 3 streams and other bodies of water, the SMZ is defined as the OHWM to 50 feet. An RMZ is not established. Montana Forestry BMPs regulate borrow and gravel pits, which should be located as close to road activities as possible. Large gravel pits also follow requirements for Opencut Mining Permits. DNRC and grazing licensees are required to mitigate or rehabilitate riparian and stream channel damage when it is greater than the level specified in the ARMs, but no specific timeframes or structured commitments that verify when corrective measures would be implemented are provided in the ARMs. In this alternative, there is flexibility to manage stands in the RMZ outside the SMZ. In RMZ stands that are managed intensively, terrestrial species that prefer riparian edge habitat with more open canopies, such as red-tailed hawks and yellow pine chipmunks, would potentially benefit within the limited amount of stream miles treated.

Alternative 2 (Proposed HCP)

Under Alternative 2, Class 1 streams and lakes ~~with HCP fish species~~ would have an RMZ of the OHWM to the 100-year site index tree height (typically 80 to 120 feet). For HCP fish-bearing streams, t~~T~~his can be extended for CMZ with specific harvest prescriptions for Type 1 and Type 2 CMZ that include the entire flood-prone area. There would be a 50-foot no-harvest buffer in the RMZ. The remainder of the RMZ would retain 50 percent of trees greater than or equal to 8 inches dbh, as well as shrubs and sub-merchantable trees. ~~No less than 15 percent of the total riparian area within each DNRC administrative unit would be in a non-stocked or seedling/sapling stage.~~The requirements for ~~Class 1 streams and lakes with non-HCP fish species, and~~ Class 2 and 3 streams and lakes are the same as Alternative 1.

Similar to Alternative 1, this alternative has some flexibility to manage stands in the RMZ outside the SMZ. In RMZ stands that are managed intensively, species that prefer more open canopies, such as meadow voles and Wilson's warblers, would benefit. The conservation of riparian stands adjacent to Class 1 streams is more prescriptive and certain than that specified in Alternative 1, and would provide somewhat more diverse and closed canopies than Alternative 1. Species that benefit from those stand conditions for nesting, foraging, and dispersal would have slightly more success in stands managed under this alternative. In managed stands adjacent to Class1 streams, the 50-foot no-harvest buffer would benefit species that rely primarily on minimal ground disturbance and closed stands in the area closest to the stream, such as the veery thrush and kingfishers. ~~However, since only 29 percent of the streams in the project area are Tier 1 streams, the majority of the riparian buffers would be managed similarly to Alternative 1.~~

Alternative 3 (Increased Conservation HCP)

Under Alternative 3, ~~is the same as Alternative 2, but~~ the no-harvest buffer would be the entire RMZ and would be extended to include the CMZ for Class 1 streams supporting HCP fish species. No harvest in the entire floodprone width of both Type 1 and Type 2 CMZs is part of this alternative. This alternative would offer the widest and most intact riparian corridor, adjacent to Class 1 HCP fish-bearing streams, to the benefit of species that utilize closed canopy riparian habitat, such as red-backed voles and fishers. Of the 1,578 miles of streams in the HCP project area, 451 miles (29 percent) are estimated to support HCP fish species (Table E4-4 in Appendix E, EIS Tables). Therefore~~However~~, because only 29 percent of the streams in the project area are HCP fish-bearing ~~Tier 1~~ streams, the majority of the riparian buffers would be managed similarly to Alternative 1.

Alternative 4 (Increased Management Flexibility HCP)

Alternative 4 is the same as Alternative 1, but a 25-foot no-harvest buffer would be in place, and from 25 to 50 feet, all shrubs and sub-merchantable trees and at least 50 percent of trees greater than or equal to 8 inches dbh would be retained. CMZs would be managed as in Alternative 2, but only for HCP fish-bearing streams. This alternative would offer more protection of riparian resources than Alternative 1, but not as much as Alternatives 2 or 3. Among the alternatives, Alternative 4 has the most flexibility to manage stands in the ~~Tier 1~~ RMZ outside the SMZ. In RMZ stands that are managed intensively, species that prefer more open canopies, such as chipping sparrows and song sparrows, would have more opportunities to benefit under this alternative. As previously discussed under Alternative 2 above, in managed stands adjacent to Class 1 HCP fish-bearing streams, the no-harvest buffer would benefit species that rely primarily on minimal ground disturbance and closed stands in the area closest to the stream. However, because 29 percent of the streams in the project area are Class 1 HCP fish-bearing streams, the majority of the riparian buffers would be managed similarly to Alternative 1.

Displacement Effects

Under all alternatives, species that utilize riparian corridors for nesting, foraging, and dispersal may be temporarily displaced, depending on the time of year nearby activities occur. Displacement would occur due to the physical presence of humans and logging equipment in and around riparian areas during implementation of project activities. Under Alternative 3, the effect may be slightly less in stands adjacent to Class 1 HCP fish-bearing streams, due to the wider no-harvest buffer; however, some displacement would still be likely.

Gravel Pits

All action alternatives would prohibit construction of gravel pits within SMZs and RMZs associated with all Class 1 streams and lakes and Class 2 streams. This commitment would protect the majority of the riparian areas from habitat loss due to removal of vegetation, disturbance, and potentially detrimental effects on water quality. However, one medium non-reclaimed pit would be allowed within the portion of the RMZ extending beyond the SMZ in the Stillwater Block and Swan River State Forest. Under all alternatives, along Class 3 streams, gravel pits would adhere to the Montana Forestry BMPs described for Alternative 1. All action alternatives would protect riparian habitat and riparian dependent species from gravel pits similarly, and slightly more than Alternative 1.

Summary

Alternatives 1~~, 2,~~ and 4 allow for the most intensive management in the riparian area. Species that prefer canopies that are more open may have more success in stands managed under these alternatives. Alternative 3 would provide the largest and most intact buffers of all alternatives for SMZs, RMZs, and CMZs. Alternative 2 would provide ~~protection for the~~both closed canopy areas adjacent to Class 1 streams that protect valuable nesting and dispersal habitat for species, as well as more open areas in the outer portion of the riparian area, ~~but also offers some management within that zone while protecting valuable nesting and dispersal habitat for species~~. Alternative 4 would offer more management flexibility than Alternative 2, but would provide more protection of riparian habitat than the current situation, Alternative 1. Alternatives 2, 3, and 4 each have a no-harvest buffer. Species that rely primarily on the area closest to the stream, or that prefer closed, dark canopies, or that prefer undisturbed soil would benefit by having the no-harvest buffer, particularly under Alternative 3, which has the widest no-harvest buffer on HCP fish-bearing streams and lakes. Under Alternative 1, those same species may experience more impacts due to the lack of a no-harvest buffer. Alternative 4 allows the most flexibility for management outside the no-harvest buffer and subsequently would provide the most benefits to species that prefer open stands, and the least benefits to species that prefer closed stands. Outside the 50-foot no-harvest buffer, the difference in effects of Alternatives 1 and 2 are minimal when considered at the landscape level.

Habitat Linkage for Non-HCP Species

Habitat linkage is important for a wide variety of species in addition to grizzly bears and lynx. Species with large home ranges require broad expanses of habitat of varying vegetation types and seral stages relative to their life history requirements. Examples of species with large home ranges are elk, mountain lions, and wolverines. Combinations of multiple human actions on the landscape that can fragment habitat and disrupt linkages include residential developments, highways, large clearcuts, transmission lines, and ski areas, to name a few. In addition, species with moderate- and small-sized home ranges can also be affected by the same or similar actions, but at smaller scales. Small mammals (such as northern bog lemmings), amphibians, and reptiles can have suitable habitat patches and riparian corridors bisected by roads, railways, transmission lines, and homes, which can serve to affect habitat quality and/or restrict movement and isolate local populations.

Affected Environment

The affected environment and analysis methodologies in the grizzly bear and lynx analyses (Sections 4.9.3, Grizzly Bears, and 4.9.4, Canada Lynx) were used to consider effects to linkage for non-HCP species.

There are more than 6 million estimated acres of potential linkage lands in the planning area, of which 123,513 acres (2 percent) lie within the HCP project area (Table 4.9-9).

Environmental Effects

The effects to linkage habitat for non-HCP species would closely resemble the effects to linkage habitat for grizzly bear and lynx. In terms of scale, 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 by DNRC forest management.

Under Alternative 1**,** forest patch size, shape, connectivity, and habitat fragmentation would continue to be considered at the project level under ARM 36.11.415. Linkage habitat for non-HCP species would be conserved through the implementation of that rule and through rules pertaining to grizzly bears, lynx, and fishers.

All three action alternatives provide a greater certainty of maintaining linkage habitat than Alternative 1. The action alternatives would improve on the amount and quality of linkage zones when compared to Alternative 1, especially within the Stillwater Block and Swan River State Forest, due to the variety of complementary mitigation measures incorporated within those areas, such as limits on road densities, cover requirements, and requirements to provide quiet areas with limited commercial activity.

Alternative 3 provides tighter controls on public and administrative motorized access and retains the Stillwater Core, thereby providing the greatest degree of habitat quality associated with a formally identified linkage zone along Highway 93. Collectively, these additional measures would result in more conservation of linkage habitat than Alternatives 1, 2, or 4.

4.9.7.2 Further Analysis for Specific Non-HCP Species

In this section, several species are analyzed in more detail due to their particular status, or an increased potential for effects to their habitat from forest management under one or more of the action alternatives. To identify which species required more analysis, several important designations of species were reviewed: federally listed species, DNRC-listed species, state-listed species, big game, game birds, furbearers, and migratory birds.

Federally Listed Species

Gray wolf receives further analysis, because it is a federally listed wildlife species that occurs in the planning area and HCP project area.

DNRC-listed Species

DNRC-listed species are identified in Table E4-10 in Appendix E (EIS Tables). They are sensitive species that are closely associated with, or indirectly associated with, forested habitats in Montana. They are species DNRC routinely considers in project planning when the species has the potential to occur in the project area. DNRC generates and modifies the list relying principally on information and classification systems developed by the USFS and MNHP. The listing is based on the general geographic distribution and habitat affinities of the animal species and does not require site-specific evidence of their presence on state land.

All the DNRC-listed species are included in the analysis of wildlife habitat associations (Section 4.9.7.1). The DNRC-listed species identified below for further analysis are fisher, bald eagle, black-backed woodpecker, flammulated owl, pileated woodpecker, and peregrine falcon. The remainder of the DNRC-listed species will not be discussed further in this EIS, because they are rarely encountered in forest habitats, they do not occur in the HCP project area, and/or they are not affected or are likely to be minimally affected by forest management activities.

State-listed Species

State-listed species are identified in Table E4-10 in Appendix E (EIS Tables). For this analysis, state-listed species include the species that the MNHP ranks S1 or S2 in its species status rankings and are known to occur in the planning area. A ranking of S1 indicates a species that is “at high risk because of extremely limited and potentially declining numbers, extent, and/or habitat, making the species vulnerable to extirpation in the state.” A ranking of S2 indicates a species that is “at risk because of very limited and potentially declining numbers, extent, and/or habitat, making it vulnerable to extirpation in the state” (MFWP 2005b). Status determinations are made by MNHP and MFWP biologists in conjunction with representatives of the Montana Chapter of the Wildlife Society, the Montana Chapter of the American Fisheries Society, and other experts.

The full complement of state-listed species that occur within the planning area are included in the analysis of wildlife habitat associations (Section 4.9.7.1). The state-listed species included below for more detailed analysis are fisher, bald eagle, black-backed woodpecker, flammulated owl, and peregrine falcon. The remainder of the state listed species identified in Table E4-10 in Appendix E (EIS Tables) will not be discussed further in this EIS.

Big Game

Species listed as big game species are hunted at some time during the year and are a vital economic resource for both Montana residents and out-of-state hunters (MFWP 2003b). Big game species are identified in Table E4-11 in Appendix E, EIS Tables. Of these species, upland forests and/or forested riparian areas are important habitats for black bear, mountain lion, mule deer, white-tailed deer, elk, and moose (MFWP 2005a). These species are analyzed below. Preferred habitat of pronghorn, mountain goat, and bighorn sheep would not be affected appreciably by projects proposed in the HCP project area; therefore, there will be no further discussion of these species in this EIS.

Game Birds

Game birds are identified in Table E4-11 in Appendix E (EIS Tables). They are all included in the analysis of wildlife habitat associations (Section 4.9.7.1). No specific concerns regarding game birds were raised, therefore they are not analyzed further in this EIS.

Furbearers

Furbearers are identified in Table E4-11 in Appendix E (EIS Tables). They are all included in the analysis of wildlife habitat associations (Section 4.9.7.1). Wolverine and fisher receive further analysis below. They are both DNRC-listed and state-listed sensitive species. Wolverine has been petitioned for listing under ESA and precluded for reasons documented elsewhere, but continues to be litigated for protection under ESA.

Migratory Birds

Migratory birds refer to bird species whose breeding range occurs at latitudes higher than their wintering range and who engage in regular seasonal movement between those two ranges. Generally the breeding and wintering ranges for individual species do not overlap, although there are some exceptions. Migratory birds are given special protection and consideration through the Migratory Bird Treaty Act and Executive Order 13186 (Responsibilities of Federal Agencies to Protect Migratory Birds).

A 1988 amendment to the Fish and Wildlife Act of 1980 directs the USFWS to monitor and assess the status of migratory nongame birds, determine effects to those species, and identify appropriate actions to be taken for species likely to be candidates for listing under the ESA. Under the authorization of this Act, the USFWS maintains a list of nongame migratory birds that, without additional conservation actions, are likely to become candidates for listing under ESA (USFWS 2002b). This list is referred to as "Birds of Conservation Concern" (BOCC) and is revised every 5 years.

Similarly, Montana Partners in Flight (MPIF), a partnership of government and non-governmental agencies, organizations, and individuals committed to the conservation of land birds and their habitats in Montana, has developed a prioritized list of migratory and non-migratory bird species and their habitats that are in need of conservation consideration. Priority I species refer to species of moderate or high global vulnerability, who have shown declining population trends from 1966-1996, and/or who have a relatively high proportion of their global population overlapping with Montana (MPIF 2000). MPIF suggests conservation actions be prioritized for species on this list.

Migratory birds that are known or expected to occur in the planning area and are included in the USFWS BOCC and MPIF Priority I lists are found in Table 4.9-26. These species and their habitat associations are also listed in Table E4-7 in Appendix E, EIS Tables and are subsequently included in the analysis of effects on wildlife habitat associations (Section 4.9.7.1). Migratory species that are also DNRC-listed species that may be affected by forest management activities are analyzed in more detail in the following sections. Those species include black-backed woodpecker, peregrine falcon, and flammulated owl. Golden eagles are also analyzed in further detail below due to their coverage under the Bald and Golden Eagle Protection Act.

Non-HCP Individual Species Analyses

Gray Wolf

Affected Environment

The planning area includes portions of three designated recovery areas for gray wolves in the northern Rocky Mountains (Table 4.9-27). Wolves in the Northwestern Montana Recovery Area are currently listed under ESA as endangered, while those in the Greater Yellowstone Recovery Area and Central Idaho Recovery Area are considered experimental, non-essential populations. The planning area makes up 53 percent of the Northwest Montana Recovery Area, 12 percent of the Central Idaho Experimental Population Area, and 10 percent of the Greater Yellowstone Experimental Population Area (Table 4.9-27). Trust lands make up a small portion of these recovery areas at 0.9 percent (Table 4.9-27).

Status and Distribution

~~In April 2009, the USFWS announced their intent remove the Northern Rocky Mountain Distinct Population (NRM) of gray wolves from the endangered species list (74 FR 15123-15188, April 2, 2009). The delisting would become effective on May 4, 2009.~~In April 2009, the USFWS issued a final rule removing the Northern Rocky Mountain Distinct Population Segment (NRM) of gray wolves from the endangered species list (74 FR 15123-15188, April 2, 2009). The delisting became effective on May 4, 2009. On August 5, 2010, the Montana Federal District court vacated the delisting rule, which means the NRM gray wolf is once again listed as endangered, except where designated as a non-essential experimental population. Regardless of the listing status, the MFWP is planning to continue to manage wolves under its wolf conservation and management plan (MFWP 2002b).

~~When wolves are delisted, management authority would return to the state and tribal governments where wolves reside. The State of Montana adopted a wolf conservation and management plan prior to the USFWS' proposal to delist wolves, but the plan would not be implemented until the USFWS transfers legal authority.~~ The purpose of the state wolf management plan (MFWP 2002b)

TABLE 4.9-26. USFWS LIST OF MIGRATORY BIRDS OF CONSERVATION CONCERN AND MONTANA PARTNERS IN FLIGHT PRIORITY MIGRATORY BIRD SPECIES IN THE PLANNING AREA

	USFWS, Region 6, List of Birds of Conservation Concern	Montana Partners in Flight Priority Level I Migratory Bird Species[1]
Swainson's Hawk	Yes	No
Ferruginous Hawk	Yes	No
Golden Eagle	Yes	No
Peregrine Falcon	Yes	No
Prairie Falcon	Yes	No
Yellow Rail	Yes	No
American Golden-Plover	Yes	No
Piping Plover	No	Yes
Mountain Plover	Yes	Yes
Solitary Sandpiper	Yes	No
Upland Sandpiper	Yes	No
Whimbrel	Yes	No
Long-billed Curlew	Yes	No
Marbled Godwit	Yes	No
Sanderling	Yes	No
Wilson's Phalarope	Yes	No
Yellow-billed Cuckoo	Yes	No
Flammulated Owl	Yes	Yes
Burrowing Owl	No	Yes
Williamson's Sapsucker	Yes	No
Red-naped Sapsucker	Yes	No
Lewis's Woodpecker	Yes	No
Black-backed Woodpecker	No	Yes
Loggerhead Shrike	Yes	No
Pygmy Nuthatch	Yes	No
Baird's Sparrow	No	Yes
Brewer's Sparrow	Yes	No
McCown's Longspur	Yes	No
Common Loon	No	Yes
Trumpeter Swan	No	Yes
Harlequin Duck	No	Yes
Least Tern	No	Yes
Olive-sided Flycatcher	No	Yes
Brown Creeper	No	Yes
Northern Harrier	Yes	No
Black-billed Cuckoo	Yes	No
Short-eared Owl	Yes	No
Red-headed Woodpecker	Yes	No
Le Conte's Sparrow	Yes	No
Bobolink	Yes	No
Grasshopper Sparrow	Yes	No
Chestnut-collared Longspur	Yes	No
Sprague's Pipit	No	Yes

[1] MPIF defines Priority Level I species as those species with declining population trends and/or high area importance.
Sources: USFWS (2002b); MPIF (2000).

is to manage wolves consistent with Montana's own state laws, policies, rules, and regulations. MFWP intends to implement conservation and management strategies over time to make sure that all federal requirements are met, recovery is ~~complete~~maintained, and that wolves are integrated as a valuable part of Montana's wildlife heritage.

Regulated public harvest of wolves was included in Montana's final wolf management plan (MFWP 2002b). Montana's 2009 hunting season resulted in the legal harvest of 72 wolves (Sime et al. 2010). Even with this allowed mortality and increased depredation control, Montana's wolf population increased in 2009 (Sime et al. 2010, Table 4b). Because the wolf is listed again, MFWP is canceling the 2010 hunting season, but plans to pursue options for reinstating a hunting season that can be in compliance with the Endangered Species Act.

The *Northern Rocky Mountains Wolf Recovery Plan* (USFWS 1987) specifies a recovery criterion of 10 breeding pairs of wolves (defined in 1987 as two wolves of opposite sex and adequate age, capable of producing offspring) for 3 consecutive years in each of three distinct recovery areas: (1) northwestern Montana (Glacier National Park; the Great Bear, Bob Marshall, and Lincoln Scapegoat Wilderness Areas; and adjacent public and private lands); (2) central Idaho (Selway-Bitterroot, Gospel Hump, Frank Church River of No Return, and Sawtooth Wilderness Areas and adjacent, mostly federal, lands); and (3) the Yellowstone National Park area (including the Absaroka-Beartooth, North Absaroka, Washakie, and Teton Wilderness Areas and adjacent public and private lands). The plan also states that if two recovery areas maintain 15 breeding pairs for 3 successive years, gray wolves in the NRM could be reclassified to threatened status. And, if all three recovery areas maintain 15 breeding pairs for 3 successive years, the NRM wolf population could be considered fully recovered and could be considered for delisting.

In ~~2007~~2009, estimates indicated there are about ~~213~~308 wolves in at least ~~23~~64 breeding pairs in northwestern Montana Wolf Management Unit 1 (WMU) (Sime et al.~~ 2008~~2010). In western Montana WMU2, 110 wolves were documented by MFWP in 20 packs, and in southwest Montana WMU3, a minimum estimate of 106 wolves in 17 verified packs were reported (Sime et al 2010). The resulting total reported for Montana in 2009 was approximately 524 wolves. In 2006, the ranges of about 20 wolf packs overlapped DNRC lands within the HCP project area (Table E4-12 in Appendix E, EIS Tables).~~ The Northwestern Montana Recovery Area has sustained fewer wolves than the other recovery areas. Wolf packs in this area may be near their local social and biological carrying capacity (72 FR 6105-6139, February 8, 2007, p. 6109).~~ State management, pursuant to the Montana State wolf management plan, would ensure this population continues to persist (72 FR 6105-6139, February 8, 2007, p. 6109).

The wolf population in the Northern Rockies has been expanding in numbers and distribution, and it was determined that biological recovery levels have been met (USFWS et al. 2006). In the state of Montana at the end of 2005, there were 46 wolf packs (a pack is defined as two or more wolves traveling together) composed of 256 wolves distributed primarily in northwestern Montana and the Greater Yellowstone area (USFWS et al. 2006) (Table 4.9-28). In 2005, Montana's recovery goal was 19 breeding pairs of wolves. Territories used by these packs included over 2 million acres in the planning area, approximately 66,802 acres of which are trust lands. Of these acres, 45,804 are trust lands within the HCP project area (Table 4.9-29 and Figure D-21 in Appendix D, EIS Figures).

TABLE 4.9-27. NORTHERN ROCKIES GRAY WOLF RECOVERY AREAS WITHIN THE PLANNING AREA AND HCP PROJECT AREA

Gray Wolf Recovery Area and Corresponding States	Recovery Area Acres (State Subtotals)	Acreage (% of Total Recovery Area or Population Area) of Wolf Recovery Area within Planning Area		Acreage (% of Total Recovery Area or Population Area) of Wolf Recovery Area on Trust Lands within the Planning Area		Acreage (% of Total Recovery Area or Population Area) of Wolf Recovery Area on HCP Project Area Lands	
Northwest Montana Recovery Area	40,838,296	21,602,504	(52.9)	976,600	(2.4)	416,703	(1.0)
Idaho	(3,014,756)	—	—	—	—	—	—
Montana	(37,823,540)	—	—	—	—	—	—
Greater Yellowstone Experimental Population Area	119,473,651	11,745,105	(9.8)	626,962	(0.5)	69,787	(0.1)
Idaho	(6,749,432)	—	—	—	—	—	—
Montana	(49,954,100)	—	—	—	—	—	—
Wyoming	(62,770,119)	—	—	—	—	—	—
Central Idaho Experimental Population Area	49,729,114	6,038,518	(12.1)	209,848	(0.4)	61,918	(0.1)
Idaho	(43,616,316)	—	—	—	—	—	—
Montana	(6,112,798)	—	—	—	—	—	—
Total	**210,041,061**	**39,386,127**	**(18.8)**	**1,813,410**	**(0.9)**	**548,408**	**(0.3)**

Source: DNRC (2008a).

TABLE 4.9-28. NORTHERN ROCKIES GRAY WOLF RECOVERY AREA PACK AND BREEDING PAIR SUMMARIES FOR YEAR 2005

Recovery Area	Number of Wolf Packs (Individuals)	Wolf Breeding Pairs (by State)
Northwest Montana Recovery Area Subtotal	**20 (130)**	**11**
Idaho	1 (4)	(1)
Montana	19 (126)	(10)
Greater Yellowstone Experimental Population Area Subtotal	**45 (325)**	**20**
Idaho	1(7)	(1)
Montana	16 (66)	(3)
Wyoming	28 (252)	(16)
Central Idaho Experimental Population Area Subtotal	**68 (565)**	**40**
Idaho	57(501)	(34)
Montana	11(64)	(6)
Total	**133 (1,020)**	**71**

Sources: USFWS et al. (2006); DNRC (2008a).

TABLE 4.9-29. ACREAGE ESTIMATES OF GRAY WOLF TERRITORY AREA FOR YEAR 2005 WITHIN THE PLANNING AREA AND HCP PROJECT AREA

Montana Wolf Packs by Recovery Area	Acreage of Wolf Pack Territory within the Planning Area[1]	Acreage of Wolf Pack Territory on Trust Lands within Planning Area (% of Total in Planning Area)		Acreage of Wolf Pack Territory on Trust Lands within the HCP Project Area (% of Total in Planning Area)	
Northwest Montana Recovery Area Subtotal	904,820	38,279	(4.2)	33,015	(3.6)
Greater Yellowstone Experimental Population Area Subtotal	433,766	8,772	(2.0)	4,829	(1.1)
Central Idaho Experimental Population Area Subtotal	827,116	19,752	(2.4)	7,960	(1.0)
Total	**2,165,702**	**66,802**	**(3.1)**	**45,804**	**(2.1)**

[1] Values presented in this column will not add up to the corresponding subtotals due to overlap of pack territories, which was removed for the analysis.
Sources: USFWS et al. (2006); DNRC (2008a).

Life History

Wolves are highly social animals that establish themselves in packs with large annual home ranges, or territories, averaging 185 square miles in northwestern Montana and 344 square miles in the greater Yellowstone area (MFWP 2003a). Distribution of wolves is primarily based on the availability of ungulate prey (e.g., deer and elk), in conjunction with areas with no or minimal conflicts with human uses and interests and with suitable den and rendezvous sites (USFWS 1987; MFWP 2003a). In Montana, wolves establishing new packs have demonstrated a greater tolerance of human presence and disturbance than previously thought characteristic of this species (MFWP 2005a). In Montana, ungulate prey for wolves includes white-tailed deer, mule deer, elk, and moose.

In the Northern Rockies, the breeding season peaks in mid to late February (Boyd et al. 1993). Wolves localize their movements around a den site and give birth in late April, following a 63-day gestation period. After the pups are 8 weeks old, they are moved to rendezvous sites, which are gathering sites for members of a wolf pack that are used primarily during the summer. Pup survival is highly variable and influenced by several factors, including disease, predation, and nutrition (Johnson et al. 1994). From late April until September, pack activity is centered at or near the den or rendezvous sites. Pups travel and hunt with the pack by September. The pack hunts throughout its territory until the following spring (MFWP 2003a).

Habitat Requirements

As habitat generalists, wolves utilize a wide variety of habitats, including forests, shrublands, and grasslands. In a study of 22 dens in Idaho, Montana, and Canada, Trapp (2004) found that wolves denned in areas that had greater canopy cover, hiding cover, herbaceous ground cover, and woody debris, and were closer to water, compared to random sites. Rendezvous sites are generally located in meadows or forest openings near the den, but sometimes are several miles away (MFWP 2002b). Suitable den sites for wolves generally consist of secluded areas with moderate slopes and adequate cover. In northwestern Montana, Matteson (1993) found that, relative to available habitat, wolves selected for den site locations that were on valley bottoms, flat to moderate slopes, and lower slopes; south and east aspects; close to trails, meadows, and other openings; and far from human presence. Distance to the nearest road did not appear to be a factor in wolf den site selection, but many of the roads identified by Matteson were closed for a portion of the year or lightly used.

MFWP (2002b) determined that wolves in Montana, Idaho, and Wyoming should be functionally connected through emigration and immigration events, resulting in the exchange of genetic material between sub-populations (MFWP 2002b). This functional relationship is consistent with the biological intent of the recovery plan and is an underlying prerequisite for successful wolf recovery in the northern Rockies. Designation of actual habitat linkage zones or migration corridors is impossible for a habitat generalist and highly mobile species like the gray wolf (MFWP 2002b). Isolation is unlikely as long as populations remain at or above recovery levels and regulatory mechanisms prevent chronically low wolf numbers or inhibit dispersal (Forbes and Boyd 1997). The extent to which linkage is a limiting factor for wolf recovery is currently being further considered as a component of the ongoing delisting process. For further discussion on linkage areas and related impacts, see the relevant components contained in the grizzly bear analysis and lynx analysis, which are applicable also to large-ranging species such as wolves.

Between the mid 1980s and the late 1990s, about half of the packs recolonizing northwestern Montana did so outside of the anticipated recovery area and linkage corridors suggested in the recovery plan (Forbes and Boyd 1997; USFWS et al. 2000a). It appears that overall management for wolf survival across broad landscapes already used by wolves is more realistic than discrete corridors because of the dispersal rates and distance capabilities (Fritts and Carbyn 1995). Outside refuges, such as national parks, legal protection and public education across broad landscapes will facilitate those functional connections across the region (Forbes and Boyd 1997).

Risk Factors

The primary risk factor to gray wolves in northwestern Montana is human-wolf conflicts resulting from control actions to resolve conflicts due to livestock depredation (MFWP 2003a; USFWS 2006b). Other legal killing, illegal killing, and collisions with cars or trains are also substantial sources of mortality. Disease and parasites and inadequate abundance of ungulate prey are also risk factors (USFWS 2006b). However, according to the USFWS (2006b), decline in ungulate prey in the northern Rocky Mountains is not expected to occur at levels that would affect wolf recovery or long-term viability, and substantial effects to wolf populations from disease or parasites are not expected because wolf exposure to these diseases and parasites has been occurring for decades.

In Montana, the total number of livestock confirmed killed by wolves between 1987 and 2004 is 190 cattle and 409 sheep. The USFWS and the State of Montana work with livestock producers to reduce the risk of wolf-caused losses and resolve conflicts through a combination of non-lethal deterrents and lethal control. Between 1987 and 2003, a total of 166 wolves were killed in Montana to resolve conflicts (MFWP 2003a).

Like many wild animals, wolves are capable of posing a threat to human safety, but such occurrences are rare and unlikely. In the past 100 years, there have been several published accounts of human fatalities due to habituated wolves (MFWP 2008). It is unusual, however, for a wild wolf to associate or interact with people or linger near buildings, livestock, or domestic dogs for extended periods of time (MFWP 2003a).

Timber harvest may be a source of disturbance within 1 mile of wolf dens and rendezvous sites while pups are young (Claar et al. 1999; MFWP 2002b; Fontaine 2004, personal communication). During this period, aerial yarding may be less disturbing to wolves than a ground-based yarding system (Fontaine 2004, personal communication). Forest management activities involving motorized equipment may impact wolves by disrupting den sites or rendezvous sites, which could cause abandonment of dens and pups increasing their risk of mortality.

Wolves are not known to demonstrate behavioral aversion to roads. In fact, they readily travel on roads, frequently leaving visible tracks and scat (Claar et al. 1999). The underlying concern about road densities stems from the potential for increased human-caused mortalities and illegal killings (Mech et al. 1988; Mech 1989; Pletscher et al. 1997; Fontaine 2004, personal communication; Meier 2004, personal communication). Thus, increases in the amount of roads on the landscape may indirectly influence human-caused mortality risk to wolves.

Wolves' sensitivity to timber harvest is closely tied to potential impacts of these activities on ungulates, their primary prey. Disturbance and removal of forest cover by timber harvest generally creates young growth that is a necessary element of moose, deer, and elk habitats (Thomas et al. 1988; Armleder et al. 1989; Meier 2004, personal communication). However, the condition of winter range is important in maintaining ungulate populations, particularly the availability of adequate amounts of dense, mature forest cover near forage areas (Thomas et al. 1988; Armleder et al. 1989; Baty et al. 1996). Reductions in forest cover on important wintering areas can have adverse impacts on elk and deer, which may subsequently influence prey availability for wolves. Timber harvest on winter range used by elk can also be a significant source of disturbance causing elk to be displaced from preferred areas (Thomas et al. 1988).

Grazing of forest lands may degrade ungulate winter range (Thomas et al. 1988) and may also bring domestic livestock in contact with wolves, thus facilitating wolf/livestock conflicts. Overall, wolves cause a small number of the total livestock losses in Montana compared to other sources of livestock mortality (MFWP 2002b, 2003a). However, wolf depredation may disproportionately impact one or a few livestock producers because of where a wolf pack territory is established relative to livestock distribution, livestock type, and/or grazing practices (MFWP 2002b). Thus, changes in livestock management practices on forest lands or increases in the abundance of livestock on forest lands could increase wolf vulnerability to human-caused mortality.

Environmental Consequences

Currently, DNRC's Forest Management ARMs provide protection for wolves and their habitat and require acknowledgement of the importance of habitat elements for elk, mule deer, and white-tailed deer. The ARMs also allow for coordination of management actions with a statewide management plan that would be put in place if wolves are delisted. Under all four alternatives, DNRC would continue to cooperate with state and federal wolf managers, and minimize disturbance risk near known den sites and rendezvous sites by suspending all mechanized activities, including use of roads, within 1 mile of den sites and 0.5 mile of rendezvous sites. Four subsections in this analysis identify the ways in which Forest Management ARMs and activities proposed for coverage under the HCP alternatives could affect gray wolves: (1) disturbing wolves at denning and rendezvous sites, (2) increasing risk of disturbance and human-caused mortality due to road increases, (3) affecting cover abundance and habitat suitability for ungulate prey species, and (4) changing livestock management on forest lands.

Disturbance of Den Sites and Rendezvous Sites

Under all alternatives, the ARMs and existing practices such as adding protective clauses to contracts would minimize risk to denning wolves by providing adequate disturbance buffers around dens. DNRC specialists and foresters would also continue to cooperate with state and federal managers and comply with measures provided by MFWP pertaining to wolf management and control actions in both the endangered population recovery area and experimental population zone. Cooperation would occur on a case-by-case basis at the project level to minimize risk of conflicts where wolves are known to occur.

The risk of disturbance to wolves at dens and rendezvous sites may also depend somewhat on the availability of areas that are managed for minimal human presence. Thus, for this analysis it is relevant to consider differences between the alternatives in the amount of areas specifically designated as grizzly bear security core or quiet areas as criteria for evaluating additional potential for den site disturbance.

Alternative 1. Under the no-action alternative**,** DNRC would commit to keeping the Stillwater Core (approximately 36,800 acres) intact for at least 10 years, as practicable. The potential for disturbance would be further minimized by the requirement that management activities be conducted only during the grizzly bear denning period (November 16 to March 31), which is outside the period of greatest activity at wolf dens and rendezvous sites (late April through September). The Swan River State Forest would be managed for quiet areas, where 3 years of active management would be followed by 6 years of rest. During rest periods, such areas may provide large blocks of undisturbed habitat available for denning habitat and rendezvous sites. No specific provisions for secure habitat or quiet areas would be required on scattered parcels; however, management of scattered parcels typically occurs on a sporadic basis, often leaving them minimally disturbed for many years at a time following individual projects.

Alternatives 2, 3, and 4. Compared to Alternative 1, the total amount of land area managed for minimal human disturbance would increase under all of the action alternatives, from approximately 66,300 acres under Alternative 1 to almost 95,000 acres under Alternatives 2 and 4 and more than 102,000 acres under Alternative 3. The management emphasis in these areas would differ under the alternatives, however. Under Alternatives 2 and 4, areas currently managed as security core in the Stillwater Block (Stillwater Core) would instead be managed as quiet areas, with reduced restrictions on where and when management activities may occur. These changes could increase the risk of such activities occurring at locations that would result in harassment or displacement of wolves at dens or rendezvous sites. In contrast, under Alternative 3, DNRC would maintain its commitment to keeping the Stillwater Core intact for at least 10 years, similar to Alternative 1. Within the Stillwater Block, implementation of the transportation plan under Alternatives 2 and 4 would be expected to reduce, but not eliminate, the risk of disturbance to wolves at undetected den or rendezvous sites, compared to Alternative 1.

Management for quiet areas in the Swan River State Forest would be the same as under Alternative 1 as long as the Swan Agreement remains in effect. If the Swan Agreement is terminated, the forest would be managed as five independent subzones, with each subzone managed on a schedule of 4 years of active management and 8 years of rest, with allowances for salvage harvest. Compared to Alternative 1, the longer rest periods may make potential denning and/or rendezvous habitat available with minimal disturbance for longer periods.

Disturbance and Human-caused Mortality Risk Associated with Road Density

In Montana, recovery measures have not stressed restrictions on road densities to protect wolves. However, this discussion does acknowledge there is some potential for additional impacts to wolves associated with roads by increasing the incidence of contact with humans. Anticipated changes in road density under the alternatives are described in detail in Section 4.9.3.2 (Grizzly Bears – Environmental Consequences). Higher road densities, depending on their location relative to denning and rendezvous sites, can reduce the habitat effectiveness of an area and increase the risk of mortality due to illegal killing.

Alternative 1. In the Stillwater Core, open road densities would remain at current levels. Elsewhere, road management decisions would be made on a project-by-project basis, and would be constrained by requirements to avoid take under Section 9 of the ESA. As a result, any increase in the miles of road open for motorized public access would likely be offset by the imposition of access restrictions (either seasonal or year-round closures) of an equal amount of open road elsewhere on the Stillwater Block or the Swan River State Forest. In scattered parcels, Alternative 1 would allow no permanent increases in open road density for parcels exceeding 1 mi/mi^2; this requirement would be imposed only within the grizzly bear recovery zones, however. DNRC anticipates minimal increases in open road density on the HCP project area over the next 50 years (see Tables 4.9-13 and 4.9-14); thus, future additional impacts to wolves associated with open roads are not anticipated. However, risk of vehicle collisions could occur on all open roads where wolves are present should traffic volumes increase appreciably. Additional risk over the next 50 years could be created due to projected increases in total road densities by providing additional access for non-motorized recreational users and conduits for illegal motorized use (Table 4.9-11). Such increases on scattered parcels range from 0.4 to 1.2 mi/mi^2 (Table 4.9-12).

Alternative 2, 3 and 4. Within the Stillwater Block, implementation of the transportation plan under Alternatives 2 and 4 would be expected to result in some localized increases in road densities, compared to Alternative 1. In the Stillwater Core, open road densities would increase because some roads that are currently closed year round to motorized public access would be open with seasonal restrictions. This risk would be offset in part by the implementation of more rigorous requirements for monitoring and maintaining road closures. Under Alternative 3, DNRC would maintain existing road closures in the Stillwater Core. If the Swan Agreement is terminated, open road densities could increase dramatically, depending on the status of access agreements with neighboring landowners. Similar to Alternative 1, DNRC anticipates minimal increases in open road density in the HCP project area over the next 50 years (see Tables 4.9-13 and 4.9-14); thus, future additional impacts to wolves associated with open roads are not anticipated under any action alternative. Also similar to Alternative 1, projected increases in total road miles in the HCP project area (Tables 4.9-11 and 4.9-12) would provide additional access for non-motorized recreational users and conduits for illegal motorized use, which could increase the human-caused mortality risk for wolves.

Compared to Alternative 1, all three action alternatives would impose greater restrictions on the location of new road construction and the granting of access easements, potentially lessening the risk of effects on wolves due to the presence of roads in key habitat areas. Alternative 3 would include additional commitments, prohibiting any net increase in total road densities at the administrative unit level in grizzly bear recovery zones.

Cover Abundance and Habitat Suitability for Ungulate Prey Species

Discussion of big game habitat is found in Section 4.9.7.2 (Further Analysis for Specific Non-HCP Species), and summary information from that analysis is presented here. As noted in that section, patches of dense forest cover are an important component of big game habitat, depending on their location. This analysis, therefore, focuses on cover abundance.

Alternative 1. Under this alternative, habitat management for big game species (including riparian areas, which provide important habitat for many species) would continue current management practices as defined by Table E4-8 in Appendix E, EIS Tables. Current rules allow for consideration of hiding cover, fawning/calving habitat, and summer range and winter range, and encourage coordination with MFWP. No specific mitigations are required for retention of cover for big game species, such as elk and deer. If cover for big game is identified as an environmental issue on a particular project, it is addressed at the project level with input from a DNRC wildlife biologist. Some other required commitments do provide cover and provide some assurances for big game species in addition to project-level recommendations. ARMs pertaining to wolves, biodiversity, management of SMZs, grizzly bears, lynx, and fishers provide measures that address maintenance of cover that would also be usable by elk and deer. Due in large part to DNRC's sustainable yield requirement for planting and continued successional growth, forested vegetation at the landscape scale that would provide coniferous forest hiding cover is not expected to change appreciably on HCP project area lands due to logging activities over the next 50 years (Table 4.9-17). Acreages of pole timber, young sawtimber, and mature sawtimber stands would continue to be well represented under Alternative 1, with a sizable increase expected in the seedling/sapling class at year 50 (Table 4.2-15). Thus, some noticeable differences and elevated risk to big game, and subsequently wolves, could be realized at local scales due to removal of hiding cover or cover important to wintering deer and elk. Under current ARMs, such risks would be required to be considered by DNRC specialists and foresters at the project level.

Alternatives 2, 3 and 4. Under all three action alternatives, ~~increased widths of areas managed as~~implementation of no-harvest buffers ~~adjacent to Tier 1 waterbodies~~ would likely increase the availability of hiding cover and undisturbed fawning/calving habitat, particularly for species that are closely associated with riparian areas. In addition, the requirement to provide visual screening in riparian areas and in wetlands would likely result in increased cover habitat for big game species. In upland areas in the grizzly bear recovery zones and NROH, additional visual screening requirements would likely provide cover habitat. Additional visual screening provisions between open roads and clearcut or seed tree harvest units would be implemented under Alternatives 2 and 3, but not Alternative 4. Collectively, these measures would increase the availability of cover habitat in riparian areas, near harvest openings, and along open roads, potentially increasing big game habitat effectiveness, compared to Alternative 1. Under all action alternatives, ARMs pertaining to wolves, biodiversity, and big game would continue to be implemented. As under Alternative 1, forested vegetation at the landscape scale that would provide coniferous forest hiding cover is not expected to change appreciably on HCP project area lands due to logging activities over the next

50 years (Tables 4.9-17). Acreages of pole timber, young sawtimber, and mature sawtimber stands would continue to be well represented under these alternatives, with a sizable increase expected in the seedling/sapling class at year 50 (Table 4.2-15). Thus, some noticeable differences and elevated risk to big game, and subsequently risk to wolves, could be realized at local scales due to removal of hiding cover or cover important to wintering deer and elk. Under current ARMs, such risks would continue to be required to be considered by DNRC specialists and foresters at the project level.

None of the alternatives would specifically limit the size of patches or how patch patterns would be represented through time on the landscape; thus, there would be no measurable differences between how any of the alternatives would affect these cover attributes for elk, deer, and moose over the 50-year Permit term.

Livestock Management on Forest Lands

Alternative 1. Under this alternative, DNRC specialists and managers would also continue to cooperate with state and federal wolf biologists and comply with measures provided by MFWP pertaining to wolf management and control actions in both the endangered population recovery area and experimental population zone. Cooperation would occur on a case-by-case basis at the project level to minimize risk of conflicts where wolves are known to occur. Additional grazing licenses could be established on lands suitable for grazing, which could elevate risks for wolves. However, DNRC specialists and managers would continue to cooperate with licensees and wolf biologists to maintain good husbandry practices on a situation-by-situation basis to minimize impacts to wolves associated with livestock grazing.

Alternatives 2, 3 and 4. None of the action alternatives would differ with regard to how livestock grazing concerns would be addressed. In addition to the ongoing measures that would occur as indicated above for Alternative 1, under Alternatives 2, 3, and 4, grizzly bear commitment GB-NR5 would require in NROH weed grazing mitigation plans for sheep and goats and prompt removal of all livestock carcasses identified as creating the potential for bear-human encounters, which would also lessen risk for wolves. Within recovery zones, GB-RZ4 would also 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 in recovery zones. Compared to Alternative 1, the grazing measures contained in all action alternatives would help reduce the risk of wolf-human conflicts associated with livestock on trust lands. None of the measures in any of the alternatives would be expected to compromise DNRC's ability to implement the management plan for wolves in Montana following their delisting.

Summary

Overall, Alternative 3 is designed to provide the lowest road densities; more seasonal restrictions on vehicles and harvest activities; longer rest periods in spring bear habitat, which may overlap with gray wolf denning and rendezvous habitat; and the best options for improved big game habitat. Alternative 2 also would provide lower road densities, seasonal restrictions, spring rest rotation periods, increased cover in critical areas such as riparian zones, and other factors required for wolf habitat, although to a lesser degree than Alternative 3, as more management flexibility is built into this alternative. Alternative 4 would provide greater management flexibility with improved protection over current conditions by incorporating the same rest periods and road closures as Alternative 2, but generally with more management options and less protection for wildlife needing these features. The combination of mitigations built into these alternatives for grizzly bear also play an important role in protecting gray wolf habitat and reducing disturbance to important areas, such as rendezvous sites and denning habitat. It is expected that all action alternatives would provide additional protections for gray wolves. Alternative 3 would provide the most protections and the least amount of harvesting, while keeping security habitat intact, which could benefit wolves; therefore, this alternative would provide the most complete package of beneficial measures. Alternative 2 would also provide a complete package of beneficial measures, with just slightly less protection for gray wolf habitat than Alternative 3, but more than Alternative 4.

Wolverine

Affected Environment

Wolverines are not DNRC-listed species. However, they were petitioned for federal listing and are thus given more detailed consideration in this analysis.

In July 2000, wolverines were petitioned for federal listing, and in October 2003, the USFWS presented a finding that there was insufficient information on wolverines to warrant listed status (68 FR 60112-60115, October 21, 2003). In June 2005, a complaint was filed against the USFWS for using inappropriate standards in its evaluation. Shortly after, the U.S. District Court of Montana ruled the USFWS petition finding in error and ordered it to undertake a status review of the species. The USFWS completed the review, and in March 2008 determined that the population of the North American wolverine in the contiguous United States was not discrete and did not meet the definition of a distinct population segment. The USFWS, therefore determined that the wolverine was not a listable entity within the contiguous United States (73 FR 12929-12941, March 11, 2008). In addition, the USFWS concluded that the contiguous United States population of the North American wolverine did not constitute a significant portion of the entire North American subspecies, meaning a listing of the wolverine as a subspecies was also not warranted. This determination has been formally challenged as environmental groups again filed suit to federally list the species on September 30, 2008.

Wolverines are rare, medium-sized carnivores that are generally described as opportunistic scavengers in the winter and opportunistic omnivores in summer, consuming prey that includes snowshoe hares, marmots, ground squirrels, red squirrels, salmon, porcupine, mice, voles, and berries (Banci 1994; Copeland and Whitman 2003). All studies have shown the importance of large mammal carrion, and the availability of large mammals influences the distribution, survival, and reproductive success of wolverines. Over most of their range, ungulates provide this carrion (Banci 1994). Wolverines are generally solitary and wide-ranging. They occur at relatively low densities (e.g., one per 65 square kilometers in northwestern Montana) (Hornocker and Hash 1981). Home ranges of males are larger than those of females, with home ranges of up to several hundred square kilometers. The mean annual home range of males was 422 square kilometers, and female home ranges were 388 square kilometers in Montana (Hornocker and Hash 1981).

Wolverines historically inhabited forested regions across the northern tier of North America. Their distribution in North America included much of Canada, southward into the United States from Maine to Washington State (van Zyll de Jong 1975; Copeland and Whitman 2003). In the southerly portion of their distribution, wolverines extended down the Cascade Mountains of Oregon and into the southern Sierras in California, and down the Rocky Mountains into Arizona and New Mexico (Banci 1994; Hash 1987). Wolverines have experienced dramatic reductions in their southern distributional extent (Banci 1994; Heinemeyer and Copeland 1999), although in Montana their distribution likely decreased to a minimum around 1920 and has since expanded (Newby and McDougal 1964). Increases in Wyoming (Hoak et al. 1982) and Idaho (Groves 1988) in the past have also been suggested. In the United States, their present distribution is restricted to the Rocky Mountains, and only Idaho, Montana, and Wyoming are known to support populations (Hoak et al. 1982; Copeland and Whitman 2003). Recent findings suggest that wolverine range in the contiguous United States contracted substantially by the mid-1900s (Aubry et al. 2007). There are also several concerns about wolverines in the northern Rockies including low-population densities, population isolation, and long-term threats due to warming climate trends (Ruggiero et al. 2007). Wolverines have been documented within the NWLO, SWLO, and CLO.

Excessive mortality associated with trapping and human-associated developments are usually suspected to be the primary causes of wolverine reductions (Proulx 2000; Copeland and Whitman 2003). In Montana, MFWP authorizes limited harvest, which is primarily maintained to allow for the incidental take of wolverines in traps set for other target species (Banci 1994; Heinemeyer and Copeland 1999; Giddings 2003, personal communication). Since 1993-1994 (i.e., in the previous 10 years), the number of wolverines harvested in Montana annually ranged from 4 to 15, with an average of 11 (Giddings 2003, personal communication). Low wolverine densities, the fragmented nature of suitable habitat at the southern extent of their North American range, and high demographic sensitivity to adult mortality raise concerns that the harvesting of wolverines in southern boreal forests could have a detrimental effect on their metapopulation dynamics (Ruggiero et al. 2007).

At the landscape scale, particular plant associations do not appear to define wolverine habitat as much as the presence of abundant food supplies (i.e., ungulate carrion) and sparsely inhabited wilderness areas that contain persistent snow until late spring (Kelsall 1981; Banci 1994; Aubry et al. 2007). Copeland and Whitman (2003) suggested that vegetative characteristics appear less important to wolverine than physiographic structure of the habitat, and Copeland et al. (2007) found that topographic variables provided greater predictive power in their habitat models than vegetative parameters. Other studies have found that, within home ranges (and except for denning, see below), wolverines exhibit no strong affinity for specific habitats (Krott 1982; Banci and Harestad 1990; Landa et al. 2000; Raphael et al. 2001). Hornocker and Hash (1981) reported that wolverines were "reluctant to cross openings of any size such as clearcuts or burns" in Montana (Hornocker and Hash 1981). However, in that same study, Hornocker and Hash (1981) also found no differences in movements, habitat use, or behavior between wolverines occupying logged areas and those occupying unlogged areas, and that wolverines evidently were not inhibited from crossing clearcuts. In addition, wolverines in Idaho were documented to commonly cross natural openings and areas with sparse overstory (e.g., burns, meadows, and open mountaintops) (Copeland 1996). In Scandinavia, wolverines exist in a much more intensively developed environment and can cross highways at least occasionally (Landa et al. 2000). Consequently, avoidance of open areas by wolverines may have been over-stated by Hornocker and Hash (1981), even though wolverines in the Rocky Mountains do appear to prefer forested areas over open areas, particularly when they are active. Hornocker and Hash (1981) found 70 percent of wolverine use in medium to scattered timber, particularly for forests featuring subalpine fir. Research in Idaho showed similar results, with montane coniferous forest types accounting for 70.2 percent of wolverine use (Copeland 1996). Copeland et al. (2007) reported that wolverines used an elevation zone year round that ranged from about 7,218 to 8,530 feet, with only minor shifts to lower elevations in winter. In that study, wolverines primarily used vegetation communities dominated by whitebark pine in summer, and shifted use into Douglas-fir and lodgepole pine communities in winter, possibly to take advantage of a greater abundance of ungulate carrion (Copeland et al. 2007).

Although abundance of food and large tracts of undisturbed wilderness are important factors for wolverines at the landscape scale, denning habitat may be an important factor at the watershed level for wolverines in Montana and other portions of their Rocky Mountain range (Copeland 1996; Magoun and Copeland 1998). Where denning habitat is absent or made unavailable due to excessive human disturbance, wolverines will probably be absent (Copeland 1996; Copeland and Whitman 2003; Copeland 2004, personal communication).

Den sites in forested habitats below tree line have been found to include a variety of features, such as avalanche chutes, caves, uprooted trees, burrows, overhanging banks, snow tunnels, snow-covered tree roots, rocks and boulders, and logjams (Hash 1987). Snow cover that persists through the spring denning period appears vital to reproduction. Elevations and habitats associated with this attribute may be critical for successful natal (birthing) dens throughout the wolverine's range (Ruggiero et al. 2007). Female wolverines appear to prefer high-elevation, north-facing talus slopes for natal denning. Often located within cirque basins, the females occupy extensive snow tunnels that form a complex of dens (Magoun and Copeland 1998). Two marked females and one unmarked female in Copeland's (1996) study used subalpine talus habitat for denning sites, whereas coniferous riparian sites were used at lower elevations, characterized by dense shrub and regenerating understory and multiple layered downed timber.

There is a body of evidence that suggests females are prone to disturbance at natal den sites (Heinemeyer et al. 2001). Other studies also report den abandonment as a result of human disturbance (Pulliainen 1968; Myrberget 1968; Copeland 1996). The movement of kits to less suitable habitat because of interface with winter recreationists and other human activities may result in detrimental energy expenditures, stress, increased susceptibility to predation, exposure, or competition for limited den sites. Resource extraction (including timber harvesting), backcountry skiing and snowmobiling, roads, and other forms of human disturbance are concerns where wolverines are found (Ruggiero et al. 2007) and are risk factors that may be an issue in the HCP project area.

In general, DNRC does not maintain trails, winter recreation areas, or other facilities devoted to outdoor recreation that could disturb denning wolverines. However, DNRC does manage lands that support some of these facilities. In addition, DNRC licenses other parties to groom and maintain snowmobile and cross-country ski trails on trust lands. The Stillwater Block has existing land use licenses with three commercial snowmobile outfitters and with the Flathead Snowmobile Association for grooming trails. The Stillwater Unit has also issued land use licenses for a commercial dogsled outfitter and a commercial groomed Nordic ski track. In addition, there are several ski trail licenses on the Swan River State Forest, the Libby Unit, and the Kalispell Unit. However, the Libby and Kalispell Units do not possess habitat likely to be suitable for use by wolverines (Table 4.9-30).

TABLE 4.9-30 ACRES OF WOLVERINE HABITAT IN THE HCP PROJECT AREA BY ELEVATION RANGE FOR EACH LAND OFFICE AND ADMINISTRATIVE UNIT OFFICE

	Acres within Elevation Range (Feet)							
Land Office and Administrative Unit	6,001 to 6,500	6,501 to 7,000	7,001 to 7,500	7,501 to 8,000	8,001 to 8,500	8,501 to 9,000	9,001 to 9,500	Total
NWLO								
Stillwater	9,050	3,964	230	0	0	0	0	13,243
Swan	1,727	1,049	104	0	0	0	0	2,880
Plains	14	27	0	0	0	0	0	41
Libby	0	0	0	0	0	0	0	0
Kalispell	0	0	0	0	0	0	0	0
Subtotal	**10,792**	**5,040**	**333**	**0**	**0**	**0**	**0**	**16,165**
SWLO								
Missoula	0	685	360	16	0	0	0	1,060
Clearwater	8	72	23	0	0	0	0	104
Anaconda	0	0	0	0	0	0	0	0
Hamilton	0	0	0	0	0	0	0	0
Subtotal	**8**	**757**	**383**	**16**	**0**	**0**	**0**	**1,164**
CLO								
Bozeman	0	638	173	36	0	0	0	847
Dillon	0	0	0	0	484	245	0	729
Helena	210	228	58	0	0	0	0	496
Subtotal	**210**	**866**	**231**	**36**	**484**	**245**	**0**	**2,071**
Total	**11,010**	**6,663**	**947**	**52**	**484**	**245**	**0**	**19,400**

Source: DNRC (2008a).

Wolverines are capable of very long dispersal movements (Vangen et al. 2001; Copeland and Whitman 2003) and appear capable of recolonizing appropriate habitats if travel routes are not entirely disrupted (Landa et al. 2000). However, genetic subdivision among populations have been documented, particularly in the southern extent of their North American distribution (Cegelski 2002; Kyle and Strobeck 2002; Schwartz et al. 2007); gene flow is primarily male-mediated (Wilson et al. 2000). Banci (1994) states that wolverine habitat needs must be met at more than one scale: (1) at the stand scale to meet requirements for food and dens, and (2) at the landscape scale to meet requirements for home range sizes, travel corridors, and dispersal corridors. Banci (1994) has stressed the importance of refugia in the form of large protected areas connected by adequate travel corridors. Such refugia are important for providing dispersers to surrounding habitats. Rivers, lakes, mountain ranges, or other topographical features do not seem to block movements of wolverines (Hornocker and Hash 1981; Banci 1987, 1994). However, because wolverines tend to avoid human developments, extensive human settlement and major access routes may function as barriers to dispersal. Thus, linkages are required to connect wolverine habitats among areas that generally lack broad-scale human influence. Habitat alteration, or fragmentation, may isolate subpopulations of wolverines, increasing their susceptibility to local extinction processes.

For this analysis potential wolverine habitat on HCP project area lands was identified by using a combination of three attributes: (1) persistent late spring snow cover for year 2008, (2) elevation, and (3) consideration of the spatial extent of snow cover within 5 square miles of trust land parcels that possessed abundance of snow cover (DNRC 2008i). Because of influences of latitude, varying climatic patterns, and variability in the distribution and elevation of mountain ranges in western Montana, information in addition to the elevation range wolverines used in Idaho, as described by Copeland et al. (2007), was used to predict habitat acreages and locations. Satellite imagery for 2008 was used because snow pack was normal to slightly above normal for most of western Montana and provided a reasonable predictive snapshot for identifying areas with persistent snow late in spring. Areas exhibiting these attributes are expected to be those most likely to provide conditions suitable for denning females and where disturbance influences may be most limiting for wolverines on trust lands.

DNRC owns and manages relatively few acres of high-elevation habitat containing persistent snow late into spring. This is due to the relatively limited amount and distribution of trust lands in western Montana. As a general rule, trust land parcels tend to be situated more in valley bottoms and on mid-slopes, rather than on large, extensive high-elevation ridgelines and mountain peaks where late persistent snow typically occurs. In the planning area, there are 23,060 acres of wolverine habitat (Table 4.9-31). These acres comprise 1.3 percent of the total 1,813,300 acres of trust lands in the planning area. Approximately 91 percent of the DNRC wolverine habitat acres occur at elevations between 6,000 and 7,500 feet, and 70 percent exist on the NWLO. Of the wolverine habitat on trust lands in the planning area, 13,243 acres (57 percent) occur within the Stillwater Block. In the HCP project area, there are 19,400 acres of wolverine habitat, of which 16,123 acres (83 percent) occur on the Stillwater Block and Swan River State Forest (Table 4.9-30). The remaining 3,277 acres are scantily distributed across the Plains, Missoula, Clearwater, Bozeman, Dillon, and Helena Units (Table 4.9-30).

Environmental Consequences

The following analysis identifies and compares the rules, policies, and commitments that address the provision of suitable habitat under the alternatives in the HCP project area, as well as a quantitative comparison of anticipated habitat availability.

Den Site Disturbance

At high elevations, where potential habitat occurs in zones where snow persists into late spring, DNRC rarely conducts logging activities or administrative activities, such as sale planning and project preparation, until after June 15 each year. This is because plowing costs are prohibitive, conditions are more dangerous, and snow cover restricts the ability to conduct most activities. Thus, the potential for forest management activities to disturb female wolverines in dens on trust lands at elevations greater than 6,000 feet is minimal under all alternatives. Under a grizzly bear commitment contained in all action alternatives, DNRC would be prohibited from conducting motorized forest management activities at elevations greater than 6,300 feet from November 16 through May 31 each year, which would provide additional certainty of minimal disturbance risk to denning wolverines compared to Alternative 1.

TABLE 4.9-31 ACRES OF WOLVERINE HABITAT IN THE PLANNING AREA BY ELEVATION RANGE FOR EACH LAND OFFICE

	Acres within Elevation Range (feet)									
Land Office	5,501 to 6,000	6,001 to 6,500	6,501 to 7,000	7,001 to 7,500	7,501 to 8,000	8,001 to 8,500	8,501 to 9,000	9,001 to 9,500	9,501 to 10,000	Total
NWLO	0	10,813	5,050	334	0	0	0	0	0	**16,197**
SWLO	0	9	764	383	16	0	0	0	0	**1,171**
CLO	774	570	2,208	812	344	403	480	101	0	**5,692**
Total	**774**	**11,392**	**8,022**	**1,529**	**360**	**403**	**480**	**101**	**0**	**23,060**

Source: DNRC (2008a).

Habitat Alteration and Linkage

As described earlier in the grizzly bear and lynx subsections, with the exceptions of the Stillwater Block and Swan River State Forest, DNRC's ability to influence linkage areas in western Montana is relatively limited by the amount of HCP project area lands in the planning area (approximately 2 percent) and distribution of lands in western Montana (Tables 4.9-8 and 4.9-9 and Figures D-18A through D-18C in Appendix D, EIS Figures). The Stillwater Block and the Swan River State Forest are important land areas for linkage with high value for lynx, grizzly bears (USFS 2007a; USFWS et al. 1995; Servheen et al. 2001), and most likely, wolverines, given the amounts and locations of persistent snow zones in these areas (Table 4.9-30). All of the alternatives are similar in how they contribute to, or may impact, habitat linkage for wolverines, and all action alternatives provide greater certainty and protection for wolverines than Alternative 1.

Under Alternative 1 on all DNRC forest management projects, forest patch size, shape, connectivity, and habitat fragmentation would be considered at the project level under ARM 36.11.415. In the Stillwater Block, commitments to the Stillwater Core would remain in place and the 40 percent hiding cover in grizzly bear BMU subunits commitment would remain. Similarly, on the Swan River State Forest, harvest unit design would require the 600-feet-to-cover measure, visual screening would continue to be required along riparian areas, and a minimum of 40 percent hiding cover would be maintained per BMU subunit, as long as Swan Agreement is in place. These are all measures that would support maintaining cover, habitat connectivity, and linkage for wolverines.

Under Alternatives 2, 3, and 4, forest patch size, shape, connectivity, and habitat fragmentation would continue to be considered in a similar manner at the project level under ARM 36.11.415. Given that particular plant associations do not appear to explain wolverine habitat as much as topographic variables (Copeland et al. 2007), no appreciable impacts are anticipated to wolverines associated with human-influenced changes in forest cover type representation over the next 50 years under any of the alternatives considered. Also, given the results contained in Table 4.9-17 and DNRC's commitment by statute to a sustainable harvest volume (MCA 77-5-222), hiding cover amounts at a programmatic scale are not expected to vary appreciably under Alternative 1 or any of the action alternatives**.** Under all action alternatives, projects planned in lynx habitat would be designated harvest units to maintain a connected network of suitable lynx habitat along riparian areas, ridgetops, and saddles, which would also benefit wolverines. All action alternatives would also require that threshold levels of suitable habitat be maintained in LMAs at levels from 60 percent (Alternative 4) to 70 percent (Alternative 3), with additional restrictions on the rates habitat could be converted to a non-suitable condition each decade. Under all action alternatives, a grizzly bear program-wide commitment for all HCP lands would ensure that visual screening associated with riparian zones and wetland management zones is retained, and that limited road construction and restrictions on gravel pit development would occur within riparian areas. Under all action alternatives, a grizzly bear requirement to restrict harvest unit size to ensure cover is available within 600 feet from any point within a clearing would be expanded in application to include all of the Stillwater Block and all scattered parcels within grizzly bear recovery zones and NROH. This measure would also benefit wolverines where recovery zone lands and NROH overlap or occur in relatively close proximity to high-elevation habitats preferred by wolverines; overlap is most substantial on the Stillwater Block and Swan River State Forest. Under Alternative 1, the 600-feet-to-cover measure is only applicable on the Swan River State Forest. Collectively, these measures help ensure that, within some of the most likely areas of importance for wolverines in western

Montana, habitat connectivity would be maintained over time. Commitments contained in all action alternatives would provide greater assurances that connectivity would be maintained for essential denning, foraging, and dispersal activities than Alternative 1. All action alternatives would require improved project-level tracking and documentation regarding how connectivity is addressed and maintained, which would facilitate compliance. Alternative 3 would likely provide for the greatest level of protection (subtle difference), followed by Alternative 2 and then 4.

Under Alternative 3, maintenance of security core areas on the Stillwater Block at the DNRC 1996 baseline levels by BMU subunit would continue. Under Alternatives 1 and 3, approximately 36,800 acres in the Stillwater Block would be managed as secure habitat for intervals of 10 years (Stillwater Core). Most of the high-elevation wolverine habitat occurs on these lands. In contrast, fewer acres (19,400 acres, or 53 percent of the 36,800 acres) would be managed as grizzly bear quiet areas under Alternatives 2 and 4, with a maximum entry period of 4 years of activity followed by 8 years of rest from commercial logging activities. On the Stillwater Block, Alternative 3 would likely provide the greatest degree of habitat quality associated with the formally identified linkage zone along Highway 93, because it requires that the largest amount of blocked secure acreage is maintained. Any beneficial effect of the scattered parcels grizzly bear or lynx commitments associated with cover retention are likely to be small because scattered parcels are frequently islands of forested habitat in a sparse forest matrix of multiple ownerships. Thus, connectivity of mature or sub-mature forest cover can be difficult to provide at scales larger than one section (i.e., 640 acres).

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. However, all action alternatives provide for restrictions on access, quiet areas, cover maintenance, and control of development in similar ways. Alternatives 2, 3, and 4 would improve on the amount and quality of linkage zones when compared to current conditions, especially within the Stillwater Block and Swan River State Forest, due to the variety of complementary mitigation measures incorporated within those areas.

Fisher

Affected Environment

The fisher is a state-listed and DNRC-listed sensitive species, and it is managed by MFWP as a furbearer. Fishers were extirpated from Montana by the 1930s (Foresman 2001), and no fishers were detected in harvest records from 1929 to 1959 (Vinkey 2003). Reintroduction efforts in 1959 and 1960 in Lincoln, Granite, and Missoula Counties resulted in the establishment of populations in those counties. More recent reintroductions were made in the Cabinet Mountains between 1988 and 1991 (Foresman 2001).

Fishers occur primarily in dense coniferous or mixed forests (Thomas et al. 1993). The general living requirements for fishers are met through the interspersion of habitats providing large areas of continuous overhead cover, food availability (which is often found in higher abundance in edges and ecotones), and den sites. These elements are interspersed primarily in mature, dense, conifer-dominated forests and riparian forests (Lieffers and Woodard 1997). Fishers may also occur in early successional forests with dense overhead cover (Thomas et al. 1993).

Fishers are snag-dependent secondary cavity users (Powell and Zielinski 1994). Fisher kits are born and raised in maternal dens, which are typically located high in hollow trees (Powell 1993; Olsen et al. 1996). Large snags (greater than 20 inches dbh) are important as maternal den sites (Thomas et al. 1993). Diet consists primarily of mammals (small rodents, shrews, squirrels, hares, muskrat, beaver, porcupine, raccoon, deer carrion), although fishers also may consume birds and fruit. Snowshoe hares are an important dietary item for fishers in Montana, as is deer carrion (Foresman 2001).

Mature structural stages and climax successional stages provide the best combination of required overhead cover for foraging and security, as well as potential den sites for fisher. Avoidance of non-forested and early seral stage habitats with little overhead cover has been documented in several studies (Kelly 1977; Powell 1977; Arthur 1987; Weir and Harestad 1997). Because dense, mature, conifer-dominated canopies are the most critical feature required for suitable fisher habitat, the availability of dense overhead cover is considered the primary habitat-limiting factor for this species. Timber harvesting is the primary human-related cause of habitat loss (Douglas and Strickland 1987; Thompson 1986; Thompson 1991; Buck et al. 1994; Thompson and Harestad 1994). Timber harvest can also contribute to habitat fragmentation, which reduces the suitability of habitat for fisher (Powell 1993; Badry et al. 1997). The connection of habitat units with adjacent units provides landscapes that are effectively large enough to maintain healthy populations of fisher (Jones and Garton 1994).

Environmental Consequences

Under all four alternatives, DNRC would continue to analyze effects to fishers on a project-by-project basis and implement conservation measures for fisher habitat as they do under the current Forest Management ARMs (ARM 36.11.440). These measures emphasize the maintenance of dense forest, snags, and LWD in riparian areas. These rules also require DNRC to manage for at least one forested patch providing connectivity between adjacent third-order drainages, preferably in saddles, where landscape conditions allow. No additional rules specifically address the availability or connectivity of dense, mature, conifer-dominated forest in upland areas, although biodiversity rules require that these factors are considered in project planning.

Effects on fishers would be related primarily to the availability of mature and old-growth forest and snags. In addition, anticipated variations in the condition of forested riparian habitat in the HCP project area may indicate differences in the effects of the alternatives. None of the alternatives include any provisions to change the Forest Management ARMs that address the removal of standing snags or LWD. DNRC's policies and management approach for old-growth stands would not change under the HCP alternatives. DNRC would continue to have the same old-growth management options it currently has as outlined in ARM 36.11.418 (old-growth restoration maintenance, and removal).

Differences among the alternatives in the availability of mature and old-growth forest in the project area are discussed in Sections 4.2.2.4 (Forest Vegetation – Size Class) and 4.2.2.5 (Forest Vegetation – Age Class), and summarized below for the pileated woodpecker. As noted in those discussions, Alternatives 2 and 4 would yield slightly lower proportions of acres in the mature sawtimber size class and the old-growth age class, compared to Alternatives 1 and 3. The most prominent differences would be seen in the Stillwater Block. Comparatively higher proportions of mature sawtimber and old-growth forest would be expected under Alternative 3, attributable in part to the wider riparian zones associated with this alternative, along with other conservation strategies that would limit activities associated with timber management in certain areas, such as the Stillwater Core.

With regard to riparian habitat, timber management under the alternatives would primarily differ ~~only in stands adjacent to Tier 1 streams (streams that support HCP fish species)~~in the area managed as a no-harvest buffer.~~ Of 1,578 miles of stream in the project area, 451 miles (29 percent) are Tier 1 streams.~~ For Alternative 2, this area would encompass 50 feet along all Class 1 streams. For Alternative 3, the no-harvest buffer would encompass the entire RMZ and CMZ along Class 1 streams supporting HCP fish species. For Alternative 4, the no-harvest buffer would be 25 feet along Class 1 streams supporting HCP fish species. While Alternative 3 would provide greater protection to streams supporting HCP fish species, Alternative 2 would provide measures for a greater number of streams within the HCP project area. ~~The alternatives would not differ, therefore, in the management of forested riparian habitat along most streams in the project area.~~ Under all alternatives, existing ARMs would require that within cover types preferred by fishers, 75 percent of the acreage within 100 feet of Class 1 streams, and 50 feet of Class 2 streams, must be maintained in a moderate to dense mature forest condition. Under Alternatives 2 and 4, the 50-foot and 25-foot no-harvest buffer, respectively,~~ adjacent to Tier 1 streams~~ would minimize reductions in riparian forest canopy cover, potentially increasing the likelihood that fishers may use riparian corridors for forage, travel, and security, compared to Alternative 1. Alternative 3 would offer the widest and most intact riparian corridors adjacent to ~~Tier 1~~HCP fish-bearing streams, resulting in the greatest amount of closed-canopy riparian habitat among the alternatives. See subsection Forested Riparian Habitats in Section 4.9.5.1 (Wildlife Habitat Associations) for additional detail on this habitat type.

Bald Eagle

Affected Environment

The USFWS removed the bald eagle from the federal list of endangered and threatened species, effective August 8, 2007 (72 FR 37346-37372). The delisting of bald eagles under ESA was challenged, and while the Court re-initiated the listing in certain areas of the United States, the species remains delisted in Montana. Bald eagles remain protected by the Bald and Golden Eagle Protection Act and the Migratory Bird Treaty Act. In 1994, the Montana Bald Eagle Working Group published the Montana Bald Eagle Management Plan, which identifies risks and directs management activities. As a signatory to this document, DNRC follows guidelines in this plan as appropriate and as stated in the ARMs. Monitoring of all bald eagle nests occurs as part of the statewide monitoring plan. In Montana, the number of known breeding bald eagles increased from 12 pairs in 1978 to 308 pairs in 2002, well above the minimum recovery plan target of 99 pairs (MBEWG 1994; Dubois 2003, personal communication; DNRC 2005b). The population still appears to be increasing, with about 10 to 15 new nests found each year (DNRC 2005b). Many of the nesting pairs in Montana are year-round residents. Montana also supports significant numbers of wintering bald eagles (up to 600 in Glacier National Park during the 1980s) and is an important bald eagle migratory corridor, particularly along the Rocky Mountains and Yellowstone River (MBEWG 1994). The state's wintering bald eagle population increased from 470 eagles in 1982 to 782 in 1997 (Buehler 2000). Within the planning area, there are 333 documented bald eagle nesting territories that have been active within the past 5 years, 242 of which include some trust lands and

113 of which are associated with trust lands within the HCP project area (Figure D-22 in Appendix D, EIS Figures).

Bald eagles prefer to nest and perch in large trees (usually conifers or cottonwoods), typically within 1 mile of a lake or reservoir greater than 80 acres in size, or a large river (MBEWG 1994). Typically, nests are re-used in subsequent years. Nest stands are usually greater than 20 acres in size and contain several large trees (MBEWG 1994; MPIF 2000). Roost sites are typically located in mature conifer or cottonwood stands less than 10 acres in size (MBEWG 1994).

Winter roosting habitat is characterized by large stands of coniferous old growth, usually located on north-facing slopes away from prevailing winds. In Montana, wintering eagles are associated with unfrozen portions of large lakes and free-flowing rivers, but are also scattered through upland areas feeding on ungulate carrion, game birds, rabbits, and hares (Swenson et al. 1981). Although large communal roosts are often associated with bald eagle wintering areas, none have been discovered in Montana (MBEWG 1994). As a signatory to the *Montana Bald Eagle Management Plan*, DNRC mitigates for such areas as they become known and are managed on a project-by-project basis. Therefore, this issue will not be addressed in detail in this analysis.

~~As identified by the USFWS (59 FR 35584-35594, July 12,1994), the primary risk factors to bald eagles include habitat loss and degradation, especially the loss of shoreline nesting trees through human development in shoreline areas, human disturbance associated with recreational use of waterways and shores, and contamination. Disturbance can cause nest abandonment and can also negatively affect foraging and roosting bald eagles (MBEWG 1994).~~Many of the primary threats to bald eagles described at the time of their listing, including habitat loss and degradation (especially the loss of shoreline nesting trees through human development in shoreline areas), human disturbance associated with recreational use of waterways and shores, and contamination, are no longer a great enough threat to affect the stability of the population (64 FR 36454-36464; July 6, 1999). Other risk factors associated with human activity include disturbance at nest sites; collisions with vehicles, power lines, or other structures; electrocution; gunshot; and incidental poisoning from pesticides or other toxins. All of these risk factors are still present, but they occur at an acceptable level to allow bald eagles to persist (64 FR 36454-36464; July 6, 1999).

Environmental Consequences

DNRC's Forest Management ARMs ensure that timber harvest is conducted pursuant to the *Montana Bald Eagle Management Plan* (MBEWG 1994) and the *Habitat Management Guide for Bald Eagles in Northwestern Montan*a (MBEWG 1991). Under all four alternatives, all identified nesting territories would be protected utilizing the guidelines in these two plans. The guidelines include site-specific protective measures that minimize risk of nest failure, nest abandonment, or harm to fledglings. Such measures include setting up "no disturbance zones" and "activity restriction periods" around active bald eagle nests. Timber harvest, road and trail construction and use, and various other activities would be conducted in a manner that would minimize disturbance to eagles during the nesting season and prevent or minimize impacts to their habitat within their nesting territories. None of the alternatives would change the way bald eagle nesting territories would be managed. SMZs adjacent to large streams and lakes provide for the retention of large trees that may be used as nest sites in the future. The amount of potentially suitable nest sites protected within SMZs under each alternative would depend on SMZ width and activity restrictions within SMZs. Alternative 3 would be expected to result in the greatest number of potentially suitable nest sites, followed in descending order by Alternatives 2, 4, and 1.

Golden Eagle

Affected Environment

Like bald eagles, golden eagles receive protections under the Bald and Golden Eagle Act and the Migratory Bird Treaty Act. A 1978 amendment to BGEPA authorized the 'taking' of golden eagle nests that interfere with resource development. Through this amendment, the USFWS is authorized to issue permits for the removal of inactive nests that interfere with resource operations (e.g., mining, timber extraction) as long as the taking is compatible with preservation of the area nesting population (50 CFR 22.3). However, take of golden eagles is currently being limited by the USFWS due to recent concerns about population declines. Golden eagles are also considered a "potential species of concern" in Montana, because current or limited information suggests that the species may potentially be vulnerable within the state or that more information is needed before an accurate status assessment can be made (MNHP 2008c).

Golden eagles are found year-round throughout Montana (MFWP 2009). They frequently nest on rocky outcrops, cliff faces, and buttes and occasionally nest in large diameter trees (Domenech 2009, personal communication). Nesting territories typically occur near open grassland or shrub steppe habitats (Kochert et al. 2002). Nests are large – sometimes over six feet in diameter – and vary in density from 55 to 105 square miles per pair (MFWP 2009). Availability of food and preferable nesting sites ultimately determines nesting density. Golden eagles typically forage in open habitats such as grasslands or shrublands where jackrabbits, hares, ground squirrels, and carrion make up the majority of their diet. Occasionally, golden eagles prey on young deer or antelope, waterfowl, grouse, weasels, and skunks. In the winter, golden eagles typically prefer open habitats and tend to avoid urban, agricultural, and forested areas (Kochert et al. 2002).

Population data for golden eagles in the state of Montana and the planning area are limited. Several observations of breeding, foraging, and overwintering individuals have been documented throughout the state (MNHP 2009). Good et al. (2004) estimated that approximately 11,500 golden eagles populate two Bird Conservation Regions (BCRs) that encompass Montana (BCR 10 and BCR 17); population estimates for the state of Montana were not determined in the study. Some researchers estimate that approximately 900 breeding pairs are interspersed throughout the state (Domenech 2009, personal communication).

Primary risk factors to golden eagles include: accidental trauma as a result of collisions with vehicles, power lines, or other structures; electrocution; gunshot; incidental poisoning from pesticides, other toxins, consumption of prey exposed to chemicals, or toxic baits intended to attract other animals; and habitat loss and degradation resulting from shrubland wildfires, urbanization, energy development, mining, agriculture, and other activities that occur in golden eagle habitat (Kochert et al. 2002).

Environmental Consequences

Although DNRC Forest Management ARMs do not contain specific management standards for golden eagles, DNRC must continue to comply with the Bald and Golden Eagle Act and the Migratory Bird Treaty Act. Because golden eagles tend to be associated with non-forest habitats, encounters associated with DNRC forest management activities are rare. ~~Therefore, w~~When encountering active golden eagle nests during forest management activities, DNRC typically implements something similar to the following strategy. DNRC staff conduct species occurrence searches of MNHP records for sensitive species and site reviews for each project. If a nest is found, DNRC checks with other local biologists to assist in developing site-specific protective measures that minimize risk of nest failure, nest abandonment, or harm to fledglings. Such measures include setting up 'no disturbance zones' and 'activity restriction periods' around active golden eagle nests. DNRC also refers to suggested management guidelines set forth in publications such as the *Interagency Rocky Mountain Front Wildlife Monitoring/Evaluation Program Management Guidelines for Selected Species* (BLM 1987) and *Draft Guidelines for Raptor Protection from Human and Land Use Disturbances, Mountain-Prairie Region* (USFWS 2005d).

None of the alternatives would change the way golden eagle nesting territories would be managed. Under all four alternatives, all identified active golden eagle nests that may be affected by forest management activities would be protected utilizing the strategy described above. Timber harvest, road and trail construction and use, and various other activities would be conducted in a manner that would minimize disturbance to eagles during the nesting season.

Black-backed Woodpecker

Affected Environment

The black-backed woodpecker is a state-listed and DNRC-listed sensitive species. Black-backed woodpeckers are non-migratory residents west of the Rocky Mountain Front in Montana (MPIF 2000) and have been documented near the CLO, NWLO, and SWLO. This species inhabits dense boreal and montane coniferous forests between 2,500 and 5,500 feet elevation (Dixon and Saab 2000; MPIF 2000). Black-backed woodpeckers are strongly associated with standing, recently dead trees, especially burned forests (Hutto 1995). Kreisel (1998) and Hutto (1995) found that black-backed woodpecker densities are greatest in stands up to 5 years following fires. They forage almost exclusively on standing dead trees, and rarely on logs or on the ground (Kreisel 1998). Black-backed woodpeckers are primary excavators and cavity nesters (Caton [1996] *in* Dixon and Saab 2000). They show a strong preference for nesting in clumps of snags, rather than isolated snags (Saab and Dudley 1998). For nesting, they strongly prefer burned, unlogged Douglas-fir stands with a pre-fire canopy closure greater than 70 percent (Saab et al. 2002), but will also use lodgepole pine and ponderosa pine (Hitchcox 1996).

The population and distribution of black-backed woodpecker are limited by the availability of recently burned stands and by post-fire salvage harvest (Hutto 1995; MPIF 2000). Hillis et al. (2002) concluded that fire suppression between 1940 and 1988 had significantly reduced the acreage of available recently burned forest below historical levels for black-backed woodpeckers, likely causing a decline in black-backed woodpecker population numbers. Between 1988 and 2000, they found the acreage of recent burns had increased above historical conditions, providing an opportunity for black-backed woodpecker population expansion. Black-backed woodpeckers are sensitive to post-fire salvage harvest (Hillis et al. 2002). In a study in northwestern Montana, Hitchcox (1996) reported that 10 of 10 black-backed woodpecker nests found were in unlogged burned stands of Douglas-fir, lodgepole, and ponderosa pine. No nests were found in salvage-logged burned stands.

Environmental Consequences

Under all four alternatives, DNRC would continue to analyze effects on a project-by-project basis and implement conservations measures for black-backed woodpecker habitat as they do under the current ARMs. These measures apply in areas that meet the definition of black-backed woodpecker habitat (fire-killed stands of trees greater than 40 acres, less than 5 years since disturbance, and with more than 40 trees per acre that are greater than or equal to 9 inches dbh). They include minimizing mechanized activity within 0.25 mile of black-backed woodpecker habitat from April 15 through July 1 and retaining approximately 10 percent of burned acreage in an unharvested condition. None of the alternatives includes any provisions to change the ARMs that address the harvest of standing snags.

Effects on black-backed woodpeckers would be related primarily to the anticipated availability of recently burned stands and to the conduct of salvage harvest in burned areas. As noted in Section 4.2.2.7 (Forest Vegetation – Wildfire), the frequency of wildfire is likely to increase somewhat on forested trust lands through the 50-year Permit term under all four alternatives. This is not due to management activities or commitments in the alternatives, but instead to outside factors such as persistent drought, increasingly warmer and drier summers, and the influence of management on adjacent ownerships.

Salvage harvest and fuel wood collection in recently burned stands reduces the availability of snags black-backed woodpeckers need for foraging, nesting, and roosting. In addition, the removal of unburned, diseased trees, and snags eliminates potential cavity sites and a forage source (Goggans et al. 1989; MPIF 2000). Post-fire management that reduces the availability of these habitat features below critical levels may lead to local or widespread declines in black-backed woodpecker populations (Dixon and Saab 2000; USFS 2002).

Under all four alternatives, the design and implementation of salvage operations would take into consideration minimum recruitment levels for snags and CWD. These measures, along with those implemented in areas identified as black-backed woodpecker habitat, would be expected to ensure the maintenance of adequate amounts of habitat in the HCP project area. The effects of salvage harvest on black-backed woodpeckers and their habitat are not expected to differ appreciably among the alternatives. Under the action alternatives, large fires ~~that have 90 percent stand mortality on 1,000 to 10,000 acres in the HCP project area within a sixth-order HUC containing a Tier 1 RMZ, and where 20 percent or more of the watershed area has been subject to 90 percent stand mortality,~~ would likely trigger a changed circumstance. ~~In such situations~~When the criteria are met for a changed circumstance, post-fire salvage harvest would require development of a site-specific plan in cooperation with the USFWS to address watershed mitigation concerns. Although such plans would be required infrequently and would focus on the needs of HCP fish species, some minimization and mitigation measures that might be implemented (e.g., retaining remnants of unburned timber) would be expected to benefit black-backed woodpeckers.

Flammulated Owl

Affected Environment

The flammulated owl is a state-listed and DNRC-listed sensitive species. Flammulated owls are typically present in the northern portion of their range between May and October (McCallum 1994a). Their distribution in Montana is principally west of the Continental Divide

(MPIF 2000). Flammulated owls are strongly associated with mid-elevation, relatively open, dry old-growth conifer forests that include ponderosa pine and Douglas-fir (McCallum 1994b; MPIF 2000; Hillis et al. 2002). Flammulated owls require forest stands that are larger than 20 acres, are on south- or west-facing slopes, have abundant large trees or snags, and are situated less than 400 feet from areas that provide suitable foraging sites and cover for roosting (Linkhart et al. 1998; McCallum 1994b; MPIF 2000). Foraging habitat includes open-canopy forest and grassy openings; dense patches of xeric shrub or sapling/pole conifers provide cover for roosting and singing (Wright et al. 1997; McCallum 1994b). Flammulated owls require cavities for nesting, preferring large (greater than 20 inches dbh) Douglas-fir or ponderosa pine as nest trees, and therefore depend on healthy populations of medium- and large-sized woodpeckers, such as flickers and pileated woodpeckers (McCallum 1994b,c; Powers et al. 1996; Yasuda 2001).

Based on the loss of favored habitat, the population of flammulated owls has likely declined and may continue to decline (McCallum 1994c; MPIF 2000). In a landscape-level assessment of flammulated owl habitat conditions in USFS Region One (western and central Montana), Hillis et al. (2002) concluded that as much as 88 percent of suitable flammulated owl habitat has been lost since the implementation of fire suppression and logging. Flammulated owls are sensitive to a fire suppression management regime, which may allow shrub and conifer encroachment into grasslands, may lead to denser forest stands, and may increase the risk of catastrophic, stand-replacing fires (McCallum 1994a; Hillis et al. 2002). Large, old pines may become more susceptible to insects and disease if Douglas-fir is allowed to become more common in ponderosa pine stands (Hillis et al. 2002). Flammulated owls may tolerate or even benefit from selective harvest that maintains 35 to 65 percent canopy closure if large trees or snags are retained, but clearcutting renders stands unsuitable as flammulated owl habitat for decades (McCallum 1994a; Marshall et al. 1996; Wright et al. 1997).

Environmental Consequences

Under all four alternatives, DNRC would continue to analyze effects on a project-by-project basis and implement conservation measures for flammulated owl habitat as they do under the current ARMs. In areas identified as preferred habitat for flammulated owls, this includes commitments to favor seral ponderosa pine where appropriate (based on historical fire regimes); favor older-aged ponderosa pine for retention or recruitment on warm, dry slopes; manage for open stand conditions on warm, dry slopes; and promote non-uniform stands while retaining occasional dense patches of conifer regeneration and shrubs. None of the alternatives includes any provisions to change the ARMs that address the removal of standing snags. DNRC's policies and management approach for old-growth stands would not change under the action alternatives. DNRC would continue to have the same old-growth management options it currently has as outlined in ARM 36.11.418 (old-growth restoration, maintenance, and removal). The relative amounts of selective harvest versus clearcut harvest would not be expected to vary under the alternatives.

Effects on flammulated owls would be related primarily to anticipated changes in the availability of seral and older-aged ponderosa pine, as well as the frequency and severity of wildfire. Under all four alternatives, DNRC would continue to manage stands toward DFC cover types (see Section 4.2.1.2, Forest Vegetation – Forest Vegetation Management). The emphasis on managing to increase the abundance of ponderosa pine (rather than Douglas-fir) on warm, dry sites would be expected to increase the availability of suitable habitat for flammulated owls. Under all alternatives in managed areas, seral cover types dominated by shade-intolerant species (e.g., ponderosa pine, western larch/Douglas-fir, and western white pine) would be expected to increase in the project area, while late-successional cover types dominated by shade-tolerant species would be expected to decrease. The inverse would be true in unmanaged stands. Attainment of DFCs is discussed further in Section 4.2.2.3 (Forest Vegetation – Cover Types and Desired Future Conditions).

As noted in Section 4.2.2.7 (Forest Vegetation – Wildfire), the frequency of wildfire is likely to increase somewhat on trust lands through the 50-year Permit term under all four alternatives. This is not due to management activities or commitments in the alternatives, but instead to outside factors, such as persistent drought, increasingly warmer and drier summers, and the influence of management on adjacent ownerships. Under all four alternatives, DNRC would continue to suppress human-caused and naturally ignited fires, possibly contributing to further erosion of the quality and quantity of suitable habitat for flammulated owls.

Pileated Woodpecker

Affected Environment

The pileated woodpecker is a state-listed and DNRC-listed sensitive species. Pileated woodpeckers are non-migratory, year-round residents limited to the northwest portion of the state, west of the forested eastern slopes of the Rocky Mountains (McClelland and McClelland 1999). Pileated woodpeckers are found at elevations up to 6,200 feet in western Montana and 7,400 feet east of the Continental Divide (Hillis et al. 2003), occasionally moving to lower elevations in the local area during winter (Bull and Jackson 1995; MPIF 2000). They inhabit dense coniferous and deciduous forests with large trees (greater than 20 inches dbh) that provide habitat for nesting and roosting (Bull and Jackson 1995; MPIF 2000). Pileated woodpeckers prefer large, contiguous blocks of mature and old-growth forest with a canopy closure between 50 and 75 percent (Schroeder 1983; Bonar 1999; McClelland and McClelland 1999; MPIF 2000). They may occur in younger stands if trees or snags remain that are adequate for nesting (Aubry and Raley 2002). Pileated woodpeckers eat insects, which they locate primarily by excavating cavities in dead wood (snags, logs, stumps) and trees (Bull and Jackson 1995; Aubry and Raley 2002).

Pileated woodpeckers require large trees infected with heart rot, which allows excavation to the tree core. Older forests typically contain more diseased trees and, therefore, potential cavity sites (McClellan and McClellan 1999; Aubry and Raley 2002). The large excavations that pileated woodpeckers create for nesting, roosting, and foraging provide habitat for a variety of cavity-dependent wildlife, including several species of owls and ducks, American marten, and fisher (Aubry and Raley 2002). Pileated woodpeckers are very sensitive to stand-replacing timber harvest in mature and old-growth forests, and the associated removal of diseased trees, snags, and logs (Schroeder 1983; McClelland and McClelland 1999).

Environmental Consequences

Under all four alternatives, DNRC would continue to analyze effects on a project-by-project basis and implement conservations measures for pileated woodpecker habitat as they do under the current ARMs. This includes a commitment to retain pileated woodpecker habitat in patches that are as large as possible where it is feasible to do so. None of the alternatives includes any provisions to change the ARMs that address the removal of standing snags or LWD. DNRC's policies and management approach for old-growth stands would not change under the action alternatives.

DNRC would continue to have the same old-growth management options it currently has as outlined in ARM 36.11.418 (old-growth restoration, maintenance, and removal).

Effects on pileated woodpeckers would be related primarily to the anticipated availability of mature and old-growth forest, where suitable large trees and snags are most likely to occur. As noted in Section 4.2.2.4 (Forest Vegetation – Size Class), the proportion of HCP project area lands in the mature sawtimber size class (which includes old growth) at Year 50 would vary from 55 percent to 59 percent under the alternatives (Table 4.2-15). Alternatives 2 and 4 would yield slightly lower proportions of acres in the mature sawtimber size class, compared to Alternatives 1 and 3. This difference can be attributed to the increased acreage available for active management in the Stillwater State Forest under Alternatives 2 and 4. The reduced availability of potentially suitable habitat for pileated woodpeckers under Alternatives 2 and 4 may result in localized reductions in woodpecker numbers (particularly in the Stillwater Block), but the differences among the alternatives are small and are not likely to appreciably affect habitat availability for pileated woodpeckers in the project area. Alternative 3 would yield a slightly higher proportion of mature sawtimber than the other alternatives. This can be attributed in part to the wider riparian zones associated with this alternative, retention of the Stillwater Core, and additional provisions for lynx denning habitat.

Under all alternatives, the amount of old growth on HCP project area lands is expected to decrease because the proportion of lands in the oldest age classes is currently high and is likely to receive the most harvesting (Section 4.2.2.5, Forest Vegetation – Age Class). The magnitude of the decrease is likely to vary among alternatives, particularly at the localized scale. Under Alternatives 2 and 4, the increased flexibility for management in the Stillwater Core would result in greater decreases in the amount of old growth in the Stillwater Core, compared to Alternatives 1 and 3. Under Alternative 3, the decrease in the amount of old growth is likely to be less than other alternatives, at least within riparian areas. The increased riparian area width outlined by the conservation strategies for this alternative would promote the development of old growth in those areas because they would essentially be excluded from active management.

Peregrine Falcon

Affected Environment

The peregrine falcon is a state-listed and DNRC-listed sensitive species. Falcon populations declined throughout North America during the middle of the 20th century, but rebounded in response to a ban on the use of dichloro-diphenyl-trichloroethane (DDT) and other chlorinated hydrocarbons, combined with a successful captive breeding, rearing, and release program (USFWS 2003). The peregrine falcon was delisted on August 25, 1999 (64 FR 46542-46558). The number of active nest sites in Montana has increased steadily over the last decade, growing from 13 in 1994 to 68 in 2007 (Montana Peregrine Institute 2008).

Peregrine falcons usually nest on cliffs, typically 150 feet or more in height. Eggs are laid and young are reared in small caves or on ledges. The birds are sensitive to disturbance during all phases of the nesting season (Pacific Coast American Peregrine Falcon Recovery Team 1982; Towry 1987). Disturbance can cause desertion of eggs or young, and later in the breeding season can cause older nestlings to fledge prematurely (Hays and Milner 2004). Peregrine falcons arrive in northern breeding areas between late April and early May; departure begins in late August to early

September. In the Bozeman area, observations in the 1950s and 1960s suggested migration periods around May 5 and September 15 (Skaar 1969).

Environmental Consequences

Under all four alternatives, DNRC would continue to analyze effects on a project-by-project basis and implement conservations measures for peregrine falcon habitat as they do under the current ARMs. These measures are designed to minimize the risk of disturbance to nesting falcons by limiting human activity and the use of mechanized equipment within 0.5 mile of known nest sites. No ARMs address the potential for disturbance at undetected nest sites (e.g., by limiting activity near cliffs that provide suitable nesting habitat); however, DNRC considers this species in fine-filter analyses on all projects and evaluates the presence of cliff features that may offer potential nest sites. If potential nest sites are detected, DNRC consults with other local biologists, experts, and databases (such as the MNHP database) to determine if nesting birds have been detected at the site. Because large cliff features are their primary limiting habitat element in western Montana, there are few potential influencing factors associated with any of the alternatives other than those and the associated mitigations described above. Thus, no appreciable effects or differing effects to peregrines or their habitat would be anticipated under any of the alternatives considered.

Big Game Species

Affected Environment

The planning area provides habitat for nine big game species with open or restricted hunting and trapping seasons (Table E4-11 in Appendix E, EIS Tables). Species listed as big game are hunted at some time during the year and are a vital economic resource for both Montana residents and out-of-state hunters (MFWP 2003b). Of these species, upland forests and/or forested riparian areas are important habitats for black bear, mountain lion, mule deer, white-tailed deer, elk, and moose (MFWP 2005a).

Preferred habitat by pronghorn, mountain goat, and bighorn sheep would not be affected appreciably by forest management projects proposed in the HCP project area; therefore, there will be no further discussion of these species in this EIS. The presence of mature forest is particularly important for deer, elk, and moose winter range. The planning area contains over 16 million acres of winter range for these species, approximately 1 million of which is on trust lands and approximately 383,098 acres of which is in the HCP project area (Table 4.9-32). Management of big game species on trust lands is addressed under ARM 36.11.443 (Table E4-8 in Appendix E, EIS Tables).

Elk and deer herds inhabit the planning area. Both elk and deer utilize coniferous forests interspersed with natural or man-made openings (mountain meadows, grasslands, burns, and logged areas) (MFWP 2005a). They require some basic habitat components, such as security cover, shelter (may use to maintain thermal equilibrium), and adequate forage areas. High open road densities reduce habitat effectiveness. Good winter range is critical for their survival and should comprise adequate forage and cover combinations at lower elevations (MFWP 2005a). In addition, summer range, migration corridors, and calving or fawning areas with adequate forage and cover are important for survival of these species. Big game species, such as elk, deer, and moose are prey for species such as grizzly bears, mountain lions, and wolves, and are of importance in the ecological relationships of forested ecosystems for the large carnivores.

TABLE 4.9-32. BIG GAME WINTER RANGE IN THE PLANNING AREA AND HCP PROJECT AREA

Species	Acres in the Planning Area (All Ownerships)	Acres (Percent) on Trust Lands within the Planning Area		Acres (Percent) within the HCP Project Area	
White-tailed deer	2,164,509	142,521	(6.6)	100,793	(4.7)
Mule deer	8,885,160	578,107	(6.5)	123,280	(1.4)
Elk	8,660,960	568,840	(6.6)	236,344	(2.7)
Moose	5,151,573	262,059	(5.1)	182,996	(3.6)
Total[1]	**16,807,993**	**1,042,126**	**(6.2)**	**383,098**	**(2.3)**

[1] Given area may provide winter range for more than one ungulate species. Consequently, the total acreages are not the sum of the acreages for each species.

Source: DNRC (2008a).

Hunting is a popular sport in Montana, and several hunting seasons are focused mostly during the fall and winter on trust lands within the planning area for big game species such as black bear, mountain lion, elk, deer, and moose, although a spring black bear hunt is offered as well (MFWP 2007c). Refer to Sections 4.10 (Recreation) and 4.13 (Socioeconomics) for further details on hunting.

Environmental Consequences

This analysis will focus on the six primary big game species: black bears, mountain lions, mule deer, white-tailed deer, elk, and moose. The four ungulate species are described in more detail, with greatest emphasis on elk, mule deer, and white-tailed deer.

Black bears are habitat generalists, utilizing a wide range of habitats. Because black bears are omnivores, foraging sites will be similar to grizzly bears; therefore, black bear habitat needs are assumed to be met within the implementation of the grizzly bear conservation strategy on HCP project area lands in recovery zones and NROH. Refer to the discussion of environmental consequences in Sections 4.9.3.2 (Grizzly Bears – Environmental Consequences) and 4.9.7 (Other Wildlife Species), as well as Table 4.9-25 and Table E4-7 in Appendix E (EIS Tables) for further information.

Mountain lions are also habitat generalists strongly influenced by deer and elk populations, because these species are their primary prey. Thus, many of the factors that affect the abundance of deer and elk can indirectly affect mountain lions for this reason. See the discussion of impacts to ungulates for these further details. It is not expected that mountain lions would be affected by any of the alternatives appreciably or differentially, other than as related to those parameters that may influence habitat suitability for elk, mule deer, and white-tailed deer as described below. Therefore, specific effects on mountain lions will not be addressed further, but should be inferred in the analysis of effects related to ungulates as described below.

Risk Factors

There are five habitat elements in the HCP project area that elk, mule deer, white-tailed deer, and moose require for maintaining adequate population levels – hiding and thermal cover, calving/fawning areas, winter range, summer range, and travel corridors.

Big game habitat would primarily be affected by the grizzly bear conservation strategy, as timing of harvests, location relative to spring bear habitat and security cover, as well as road closure options all would impact elk, deer, and moose to some degree. The aquatic conservation strategy would also affect use of riparian zones by moose, as well as deer and elk, because all these species utilize these highly productive zones for some, if not all, of their habitat requirements. The lynx conservation strategy contains habitat connectivity commitments that would assist in providing cover along riparian areas, saddles, and ridgetops that big game will utilize.

Primary factors from the conservation strategies discussed in the HCP that have the potential to affect the five habitat elements needed for big game species and that are used as evaluation criteria are:

- **Cover retention and location.** Size and spacing from cover stands, visual screening of units and roads, cover retention, and location of units with respect to wintering areas, calving/fawning areas and summer range
- **Road management.** Timing and location of road closures and road construction relative to the five habitat elements on the landscape
- **Spring management.** Spring management coinciding with calving/fawning areas
- **Security habitat.** Rest period commitments in relation to summer range and fall security needs.

Each of these primary factors that affect elk, white-tailed deer, mule deer, and moose will be discussed separately.

Cover Retention and Location

Location and size of units all potentially could affect how big game populations utilize their winter and summer range, as well as calving/fawning areas and migration corridors, depending on the location of these units with respect to the critical elements of their range. Timing of harvesting next to a known calving area could have detrimental impacts to elk, for example.

Alternative 1. Current regulations that are part of Alternative 1 allow for consideration of all the factors mentioned above, and coordination with MFWP is encouraged; however, no specific mitigation is currently required when timber sales are planned to provide for specific cover retention needs.

Alternatives 2, 3 and 4. Distance to visual screening (commitment GB-NR4) in NROH in all three action alternatives, and visual screening consisting of 100 feet of vegetation alongside open roads and clearcuts (commitment GB-RZ2) within the recovery zone for Alternatives 2 and 3 provide for escape cover adjacent to harvest units. This provides for better utilization of forage in clearcuts by elk and deer than that provided by Alternative 1. Analysis at the landscape scale does not allow for more detailed discussion of how harvest patterns associated with any of the alternatives would affect big game. That determination would have to be made at the project level. Refer to subsection Upland Forest Successional Stages and Cover Types in Section 4.9.7.1 (Wildlife Habitat Associations) and Table 4.2-15 for further information on effects of projected timber harvest upon successional stages by alternative.

In summary, Alternatives 2 or 3 provide the most complete mitigation package for the potential loss of cover during harvest activities. However, all alternatives would maintain an abundance of similar amounts of hiding cover (Table 4.9-17) over the 50-year Permit term. Because more cover is retained within RMZs, SMZs, and WMZs in all action alternatives, where calving or fawning areas can be located throughout the HCP project area, this commitment in the grizzly bear conservation strategy would improve big game habitat in these areas.

None of the alternatives specifically limits the size of patches or how patch patterns would be represented through time on the landscape; thus, there would be no measurable differences between how any of the alternatives would affect these cover attributes for elk, deer, and moose over the Permit term.

Road Management

Alternative 1. Refer to Section 4.9.3.2 (Grizzly Bears – Environmental Consequences) for a more detailed analysis of the differences between the alternatives regarding road amounts. In general, this alternative generally considers the needs of wildlife when considering construction of new roads on HCP project area lands. It also has provisions for repairing defective closures in the Stillwater Block and Swan River State Forest; however, there are no long-term commitments for a transportation plan in these areas, although a commitment to maintaining no more than 1 mi/mi^2 open road density is made in the Stillwater Block and within 33 percent of the BMUs subunits in the Swan River State Forest. Outside these areas, on scattered parcels in grizzly bear recovery zones, a commitment to not allow increases in open roads beyond 1 mi/mi^2, or increases on parcels that already exceed 1 mi/mi^2, is in place. Without the firm 50-year commitments provided in the proposed HCP, as specified in the transportation plans found in the action alternatives, it is likely that this alternative would result in more adverse effects on elk and deer using winter range, summer range, and critical fawning/calving habitat due to disturbance and displacement associated with greater road densities.

Alternatives 2, 3, and 4. These alternatives provide improvements over the current situation. Conservation strategy commitments for grizzly bear regarding road closures, road density, and other aspects of a transportation plan in the Stillwater Block and Swan River State Forest would also benefit elk and deer. Lower road densities and closures in some areas for roads and gravel pits that would benefit grizzly bear would also promote habitat use of these same areas for big game. Therefore, alternatives that maintain the lowest road density and close the most roads and gravel pits are expected to benefit big game the most and have the least indirect effects from secondary use of roads, such as motorized and non-motorized use. This would be especially important within big game winter range and during fall hunting season. Refer to Section 4.9.3.2 (Grizzly Bears – Environmental Consequences) for a more detailed description of the effects of roads across the landscape and their relation to wildlife species, as well as a comparison between alternatives.

In summary, of the three action alternatives, Alternative 3 offers more restrictive seasonal closures and vehicle use limitations; therefore, this alternative would have lower direct and indirect impacts from the transportation package of any of the alternatives. Alternative 2 also provides a reasonably protective transportation package that also would allow some management flexibility, while Alternative 4 retains most of the same features as Alternative 2, but also would offer the most management flexibility.

Spring Management

Alternative 1. There are no specific spring management restrictions incorporated in this alternative for elk and deer, with the exception of spring management restrictions associated with the Swan Agreement; therefore, no additional protections are in place during fawning/calving season for deer and elk compared with the action alternatives.

Alternatives 2, 3 and 4. Spring management periods for grizzly bear coincide with fawning and calving seasons to a degree, allowing for secure fawning/calving habitat during that important time of year. Spring management and rest period commitments would only improve use of summer range and calving or fawning areas. Alternatives 2 and 3 are very similar and provide the most restrictive spring management of all the alternatives, with Alternative 3 providing the most restrictions on timing of and activities allowed within spring bear habitat, and potentially important summer range for deer and elk. Refer to Section 4.9.3.2 (Grizzly Bears – Environmental Consequences) for a complete description of details regarding spring management and rest periods between the alternatives. Alternative 4 is similar to Alternative 2, but allows more flexibility for site preparation, road maintenance, and bridge replacement. These spring management scenarios would keep human activities, both direct (such as harvesting) and indirect (such as motorized recreation), away from important calving/fawning habitat during the critical times of the year within recovery zones and NROH, and should adequately promote habitat use by big game in most years, particularly under Alternative 3, which provides more restrictive spring management in NROH.

Security Habitat

Alternative 1. In this alternative, the Stillwater Block has no Class A and Class B land designations (as proposed in the action alternatives), which provide for additional mitigation for forest management and transportation issues, but does maintain the Stillwater Core. Within the Swan River State Forest, there are rest periods (3 years active management followed by 6 years rest) implemented in cooperation with the USFS and Plum Creek to provide for large blocks of undisturbed habitat available for summer and fall use.

Alternatives 2, 3, and 4. Designation of Class A and B lands in the Stillwater Block offers commitments for grizzly bear that provide for a rest period schedule, limiting how often harvesting can occur, imposing seasonal restriction for roads, and retaining hiding cover. These commitments apply to all the action alternatives in the Stillwater Block. In addition, Alternative 3 maintains the same security core as Alternative 1, whereas Alternatives 2 and 4 do not. The Swan River State Forest and scattered parcels also have similar restrictions in place that provide quiet areas free from commercial management during 8-year rest periods. In Alternatives 2 and 4, the CYE would provide for more restrictive rest periods than other areas, with Alternative 3 providing even more restrictions than these two alternatives regarding road use and construction. All of these restrictions would only benefit big game use of the five habitat elements (cover, calving/fawning areas, winter range, summer range, and travel corridors). Alternative 3 provides the most security core, Class A and B land designations, and provisions for securing road closures; therefore, it is likely to provide the most cover and secure, undisturbed habitat for summering, calving, or fawning areas.

In summary, Alternatives 2 and 3 appear to provide improved cover and increased road closures throughout the grizzly bear NROH and recovery zones as they relate to big game habitat needs, with Alternative 3 committed to a few more restrictions than Alternative 2 as they apply to all but the first criterion (hiding and thermal cover). Alternative 4 is either the same as Alternative 2 or contains slightly fewer restrictions, providing more management flexibility. None of the alternatives specifically limits the size of patches or how patch patterns would be represented through time on the landscape; thus, there would be no measurable differences between how any of the alternatives would affect these cover attributes for elk, deer, and moose over the Permit term.

4.9.7.3 Effects of and Trends in Climate Change

A variety of effects from climate change are being observed in wildlife species globally. Many of these effects have also been observed in plant species, as was discussed in Section 4.2 (Forest Vegetation). Below is a summary of observed and anticipated responses of wildlife populations to climate change. Some of the literature cited in this discussion represents reviews of studies from all over the world, while others (e.g., Parmesan and Galbraith [2004], Saunders et al. [2008]) focus on the United States. All of the responses described are likely relevant to what is occurring and is expected to occur in the planning area.

- The ranges of many species have shifted northward and upward in elevation (Karl et al. 2009; Mohr 2008; Parmesan 2006). Montane species may face the risk of decreased habitat availability, as suitable habitats are compressed by upward shifts in climate zones (Karl et al. 2009; Parmesan 2006). Species assemblages and ecosystems are changing as a result of different species' responses to climate change (Karl et al. 2009; Mohr 2008).
- As climate changes, the composition of communities may be altered (Karl et al. 2009; Mohr 2008; Parmesan and Galbraith 2004). The ability of an individual species to shift its range and when that shift occurs depends on that species' sensitivity to changing climatic conditions, mobility, lifespan, and the availability of the resources it needs to survive (Karl et al. 2009). Some species that shift their ranges may experience constraints related to food, the presence of other species, habitat fragmentation, development, or other factors (Karl et al. 2009).
- Individual population demographics are thought to be changing in response to changes in climate (Mawdsley et al. 2009). Temperature shifts can result in physiological changes, such as altered sex ratios, reproductive biology, and metabolic rates, which can then affect population abundance (Mohr 2008).
- Changes in the timing of seasons, such as earlier springs, appear to be affecting the timing of breeding, migration, and hibernation of some species (Karl et al. 2009; Mawdsley et al. 2009; Mohr 2008; Parmesan and Galbraith 2004; Saunders et al. 2008).
- Changes in plant and animal phenology appear to have resulted in asynchrony in some predator-prey and insect-plant species relationships (Karl et al. 2009; Mawdsley et al. 2009; Mohr 2008; Parmesan 2006; Saunders et al. 2008).
- The spread of wildlife diseases, parasites, and diseases has increased (Karl et al. 2009; Mawdsley et al. 2009).

Research is underway in many regions to document the effects on wildlife and wildlife habitat from a changing climate (see Section 4.1, Climate). A wide range of responses is anticipated for species in Montana. The information presented below summarizes studies of species and forest types that occur in the planning area.

- Increased concentrations of atmospheric carbon dioxide may lead to increases in the primary productivity of terrestrial vegetation, possibly increasing the availability of forage for deer, elk, and other ungulates (Malcolm and Pitelka 2000). Such increases could be offset, however, by increased fire frequency (McKenzie et al. 2004; Smith 2004) or by the lower nutritional quality of fast-growing plants (Koch 2006; Nowak et al. 2004; Zvereva and Kozlov 2006).
- Decreased snow pack may reduce late-winter mortality of elk by allowing easier access to food and decreasing the energy expenditures required for movement (Wilmers and Getz 2005). The positive influence of warmer, drier winter conditions could outweigh the negative influence of warmer, drier summer conditions, leading to net increases in elk populations (Wang et al. 2001; Hobbs et al. 2006).
- Decreased winter mortality of large ungulates such as elk could reduce the availability of carrion, reducing the availability of food for scavenging species during later winter and early spring; such reductions would likely be less in areas where wolves are present, however (Wilmers and Getz 2005).
- Accelerated vegetation growth during the late spring green-up period may lead to a shorter period of availability of high-quality forage, decreasing the opportunity for some mountain ungulates to exploit high-quality forage. Pettorelli et al. (2007) documented reductions in the growth of mountain goat kids and in the growth and survival of bighorn sheep lambs in areas with rapid changes in primary production during green-up.
- Whitebark pine seeds, which are an important food source for numerous species (Tomback et al. 2001), may become increasingly scarce. Climate change may affect whitebark pine communities through three mechanisms: (1) range expansions of pathogens, particularly white pine blister rust (Koteen 2002); (2) competitive replacement by heat-tolerant species, such as lodgepole pine, at lower, warmer elevations (Romme and Turner 1991); and (3) increased frequency of severe fires (while whitebark pine is adapted to small fires, large, stand-replacing fires may be detrimental to the species' overall distribution and abundance [Koteen 2002]).
- In response to the increased frequency, intensity, and acreage of wildfires (see Section 4.2.1.4, Forest Vegetation – Effects of and Trends in Climate Change), populations of species adapted to stand-replacing fires, such as the black-backed woodpecker, may increase (McKenzie et al. 2005).
- If climate change leads to longer or more severe wildfire seasons, the probability of losing local populations of species that depend on late-seral habitat will increase (McKenzie et al. 2004).
- Responses of amphibians and reptiles to climate change may be influenced by (1) changes and variability in local environmental and habitat conditions, (2) changes in phenology (e.g., timing of breeding and egg laying), (3) interactions with emerging pathogens and

invasive species, and (4) interactions with other environmental stressors such as chemicals (Lind 2008). In Yellowstone National Park, McMenamin et al. (2008) documented declines in four once-common native amphibian species, due primarily to wetland desiccation associated with decreased annual precipitation and increased summer temperatures.

The State of the Birds 2010 Report on Climate Change (North American Bird Conservation Initiative, U.S. Committee 2010) assessed the relative vulnerability of about 800 United States bird species to climate change. This report concluded that birds in every terrestrial and aquatic habitat are expected to experience effects of climate change; across all habitats, species of conservation concern showed higher levels of vulnerability to climate change than species not threatened by other factors. Findings from this report that are applicable to habitats within the planning area are summarized below (North American Bird Conservation Initiative, U.S. Committee 2010).

- Wetland-breeding birds, such as western grebe, Clark's grebe, and northern pintail, are vulnerable primarily due to changes in water level and distribution of wetland breeding habitats.
- Species that migrate over long distances, especially aerial insect-eaters such as swifts and nightjars, may experience mismatches in the timing of breeding with the availability of seasonal food resources.
- The ranges of many forest birds are expected to shift as ranges of tree species shift. Because of their large ranges and high reproductive potential, forest birds are generally expected to fare better in a changing climate than birds dependent on other habitats. Exceptions include species that are specialized on highly seasonal resources, such as aerial insects or nectar, or that are dependent on high-elevation or riparian forests (which may be limited in their ability to shift upward in elevation or affected by changes in hydrologic regimes).
- Resident species in alpine habitats, such as the white-tailed ptarmigan, may experience the greatest effects due to their inability to shift their range.

Under all alternatives, climate change is expected to continue affecting wildlife and wildlife habitats in the various ways discussed above. However, the different commitments under the alternatives would provide a range of protection for wildlife species and their habitat that are expected to reduce other stressors that may compound the anticipated effects of climate change over the Permit term. Under Alternative 1, ongoing changes to wildlife species and their habitat, as well as current scientific research on those changes, would be factored into project-level analyses as they occur, and additional mitigation measures may be identified at that time to further protect some species.

In contrast, the action alternatives include additional commitments to protect the HCP species and their habitat, and other species and habitat indirectly, that would be in effect for the entire Permit term. Through annual and 5-year reviews, the monitoring and adaptive management process, and the changed circumstances process, the action alternatives would also provide continuing opportunities to address ongoing changes and incorporate current scientific research. In general, Alternative 3 is expected to provide the least amount of effects that would compound species' responses to climate change, followed by Alternatives 2, 4, then 1. The ranking of the alternatives is reversed for some species, including those that prefer more open canopies or recently burned areas.

On a local level, more active forest management in the Stillwater Core under Alternatives 2 and 4 may increase or reduce stress on species responding to climate change in that area. For example, increased levels of harvest in mature sawtimber stands would reduce the availability of habitat for species that depend on mature forest. If such habitat reductions are exacerbated by increased frequency, intensity, and acreage of wildfires, some species in the Stillwater Block could face an elevated risk of localized population reductions. Additionally, the stress on species facing geographic and temporal shifts in the availability of food and other resources may combine with the stress associated with increased levels of disturbance from forest management activities to reduce rates of survival or reproductive success. Conversely, increased forest management in the existing Stillwater Core could increase habitat diversity in these areas over time and create mosaics of younger forest conditions favored by other wildlife species that prefer such habitat conditions.

4.10 Recreation

This section addresses recreational opportunities (including access and recreational activities) on HCP project area lands, and evaluates how the alternatives may affect recreational access and the quality of the recreational experience. Analysis of recreational access considers both motorized access (i.e., open roads) and non-motorized access (primarily on roads with seasonal or year-round use restrictions). Analysis of the recreational experience considers visual resources and the availability of different types of recreational opportunities.

4.10.1 Affected Environment

This section describes recreational access and recreational uses of forested trust lands.

4.10.1.1 Introduction

In 2005, Montana hosted more than 10 million non-resident visitors. Total spending impacts of these travelers exceeded $3.9 billion, which generated almost 46,000 jobs and $211 million in state and local tax revenues (ITRR 2006). The most frequently cited reasons for visiting Montana were the state's parks, mountains, and forests. Recreational activities (driving for pleasure, wildlife watching, day hiking, and picnicking) made up four of the five most popular activities for non-residents (ITRR 2006). During 2004, visitors to western Montana spent more than $1.17 billion in the pursuit of nature-based activities (Swanson 2004). Recreationists value public lands as places to relieve stress and connect with nature (Swanson 2004).

Montana residents and non-residents enjoy recreation opportunities on DNRC-managed trust lands, as well as lands managed by MFWP; federal agencies including NPS, USFS, BLM; and various local and private entities. The planning area wholly or partially encompasses two national parks (Glacier and Yellowstone), 10 national forests, 36 state parks, a national battlefield, a national historical site, along with numerous local parks and other outdoor recreation areas. The planning area also encompasses numerous surface water recreational resources, including reservoirs, Flathead Lake, and the Flathead Wild and Scenic River (Figures D-6A through D-6C in Appendix D, EIS Figures).

Western Montana is characterized by rugged, beautiful landscape and abundant year-round recreation opportunities. Springtime offers wildflowers and whitewater rafting. In summer there are numerous opportunities for fishing, hiking, horseback riding, boating, and berry picking. The most popular activity in autumn is hunting, and winter is a time for skiing, snowmobiling, sledding, and ice fishing. Other popular outdoor recreation activities in the planning area include mountain biking, bird watching, camping, climbing, off-road vehicle use, and photography.

4.10.1.2 Recreational Access

Trust lands are open to recreational use if they are legally accessible and have not been closed or restricted to such use by rule or by DNRC (ARMs 36.25.146 through 162). Legally accessible state lands are those that can be accessed by public roads, public rights-of-way, or public easements; by public waters that are recreationally navigable under the Stream Access Law; by adjacent federal, state, county, or municipal land if that land is open to public use; or by permission of an adjacent landowner (ARM 36.25.145(15)). Of 5.2 million acres of trust lands statewide, about 3.6 to 3.7 million acres (70 percent) are legally accessible from public land (Frickel 2005, personal communication). No estimates are available for the proportion of trust lands in the planning area or HCP project area that are legally accessible.

Certain lands are categorically closed to recreational use, meaning recreational activities are prohibited. Such closures include agricultural lands (between planting and harvest) as well as lands leased for home sites or cabin sites, active military purposes, or commercial purposes. Some tracts are temporarily, seasonally, or permanently closed or restricted on a site-specific basis. Reasons for such site-specific closures or restrictions may include the protection of public safety, livestock activities, threatened and endangered or sensitive species, or a lessee's improvements. In addition, some tracts may be closed for short durations for management purposes (e.g., concentration of livestock, recent weed spraying, timber harvest). The amount of land closed for management purposes fluctuates in accordance with on-the-ground activities.

Most recreational users gain access to trust lands in the planning area by driving, and most access in the HCP project area is for hunting, fishing, or wildlife-associated recreation (see Section 4.10.1.3, Recreational Use, below). There are 5,426 miles of road on trust lands within the planning area. Of this total, 4,005 miles are classified as open to public access (including highways and county roads), 49 miles are restricted seasonally to motorized public access, and 1,199 miles are restricted year-round (Table 4.4-2). The remaining road miles are split between abandoned (115 miles) and reclaimed (58 miles). The Swan River State Forest has 105 miles (49 percent of all road miles) designated for spring closure (Table 2-3 in Appendix A, HCP). Of 363 miles of road in the Stillwater Block, 230 miles are closed year-round to motorized public access and 6 miles are closed seasonally. The West Fork Road in the Stillwater Block provides access (in combination with other roads) to Upper Whitefish Lake from U.S. Highway 93 at Stryker. The road is open to motorized public access year-round, but is typically closed by snow between November and the end of May, during which it receives moderately heavy snowmobile use.

Future management of public access on roads is guided by road management rules (ARM 36.11.421). These rules dictate that DNRC shall plan transportation systems that (1) result in the minimum number of road miles; (2) consider public access, adjacent landowners, and resource protection and management, including forestry practices, fire protection, and wildlife habitat; and (3) include implementation of BMPs. DNRC also considers the obliteration of roads that are not primary access routes during project-level analysis.

Illegal recreational use occurs on some trust lands and primarily includes motorized use of restricted roads, pioneering unauthorized roads or trails, and establishment of illegal campsites. Illegal use is greatest where urban developments are in proximity to trust lands, particularly where terrain and vegetation pose few obstacles to cross-country travel. Concerns associated with illegal recreational use include but are not limited to motorized use of restricted roads that threaten grizzly bear or other wildlife security needs, illegally pioneered roads or trails near bull trout streams, and the potential for human-caused wildfires. DNRC efforts to control such illegal uses are ongoing.

4.10.1.3 Recreational Use

Hunting, fishing, and wildlife-associated recreation are the most popular recreational activities on trust lands. Other recreational activities on trust lands include motorized recreation, bicycling, hiking, cabin leases, camping, and outfitting (leading big game hunting trips or guided rafting and fishing tours). Primary winter recreation activities include downhill skiing, snowboarding, cross-country skiing, snowmobiling, snowshoeing, and ice fishing (MFWP 2003c).

Recreation on trust lands has been increasing steadily in recent years. Although DNRC does not collect recreational use data, sales of recreational use licenses provide an indicator of general trends. All recreational activities (including hunting, fishing, hiking, camping, picnicking, etc.) on trust lands require a recreational use license from DNRC. The type of license required depends on the type of activity conducted. A general recreational use license is required for most types of non-commercial or non-concentrated activities. A special recreational use license is required for commercial use (such as outfitting) or concentrated use (e.g., large group activities). DNRC tracks the number of general use licenses sold annually, as well as the revenue generated by sales of special use licenses. Recreational use license sales showed an increasing trend between 1999 and 2006 (Table 4.10-1).

TABLE 4.10-1. STATEWIDE RECREATIONAL USE LICENSE SALES, LICENSE YEARS 1999 TO 2006[1]

License Type	1999	2000	2001	2002	2003	2004	2005	2006
General (number sold)	36,479	37,605	39,089	47,764	50,795	434,106[2]	464,432[3]	446,171
Special (revenues)	$86,170	$98,950	$104,200	$114,600	$91,200	$112,300	$109,378	$103,613

[1] The license year extends from March 1 through the last day of the following February.
[2] Includes 4,200 general licenses and 429,906 conservation licenses.
[3] Includes 6,029 general licenses and 458,403 conservation licenses.
Source: DNRC (2005c, 2005d, 2006a).

Note that the apparent sharp increase in general use license sales between 2003 and 2004 reflects the implementation of a new policy, under which the cost of a conservation license (required by MFWP as a prerequisite for purchasing a hunting, fishing, or trapping license) was increased to cover the fee for recreational use of trust lands. Note also that the values in Table 4.10-1 represent license sales statewide rather than within the planning area. Data on licenses sold or revenues from licenses sold specifically within the planning area are not available. In addition, the location of a license sale does not necessarily reflect the location of the recreation activity; a person purchasing a license in one area is not required to recreate on state land in the same area.

Hunting, Fishing, and Wildlife-associated Recreation

DNRC has estimated that 96 to 97 percent of the recreational use conducted on trust lands statewide is for hunting, fishing, or wildlife-associated recreation, with the remaining 3 to 4 percent coming from other types of uses.

In 2001, an estimated 871,000 state residents and non-residents 16 years old and older fished, hunted, or participated in wildlife-watching activities in Montana (USFWS and U.S. Census Bureau 2001) (Table 4.10-2). Approximately 40 percent of respondents fished, 26 percent hunted, and 79 percent participated in wildlife watching. The sum of these numbers exceeds 100 percent because many people participated in more than one activity. The activity levels of younger participants (Montana residents ages 6 to 15) were also estimated for the year 2000. In the separate survey of the younger age group, an estimated 66,000 (50 percent of Montana residents between 6 and 15 years old) fished, 18,000 (13 percent) hunted, and 50,000 (42 percent) watched wildlife (USFWS and U.S. Census Bureau 2001).

TABLE 4.10-2. FISHING, HUNTING, AND WILDLIFE WATCHING IN MONTANA FOR YEARS 1991, 1996, AND 2001

Activity	1991	1996	2001
Total Participants			**871,000**
Fishing	342,000	336,000	349,000
Hunting	223,000	194,000	229,000
Wildlife Watching	558,000	394,000	687,000
Total Days Engaged in Activity			
Fishing	3,156,000	2,617,000	4,068,000
Hunting	2,591,000	1,807,000	2,442,000
Wildlife Watching	4,317,000	2,697,000	4,612,000

Source: USFWS and U.S. Census Bureau (2001).

In all survey years, wildlife watching accounted for the greatest number of person-days spent in wildlife-based recreation in Montana (Table 4.10-2). Montana is reported to be a leading state in birdwatching, with a participation rate of 44 percent, double the national average and highest of any state (Lomax 2005). In 2001, the number of person-days devoted to wildlife watching was nearly double the number of days devoted to hunting. Nearly 1.6 million (65 percent) of the hunting days in Montana took place solely or partially on public land (USFWS and U.S. Census Bureau 2001). Nearly 2.7 million visitors to Montana participated in wildlife watching, ranking behind only shopping as the most popular recreational activity (MFWP 2003c). Fishing was listed as an activity by 1.2 million visitors. Of the non-resident wildlife-watching participants, approximately 94 percent visited public areas (USFWS and U.S. Census Bureau 2001). National survey data do not differentiate between federal, state, and other public land. For the three western travel regions (Glacier, Gold West, and Yellowstone), the top attractions for non-resident visitors in 2004 were mountains, open space, rivers, wildlife, and the national parks (Swanson 2004).

The amount of hunting that occurs on trust lands can be indirectly estimated by assuming that trust lands are used at a rate that is roughly proportionate to their distribution on the landscape. In other words, if 10 percent of the area of a particular hunting district consists of trust lands, then approximately 10 percent of the hunting activity in that district may be assumed to occur on those lands. This is likely an underestimate, because many private landowners do not permit hunting on their property. Statewide, approximately 52 percent of hunting days occurred wholly or partially on private land (USFWS and U.S. Census Bureau 2001). This suggests that public land is used more heavily than private land, because private land accounts for approximately 65 percent of the total area of the state.

Different hunting district boundaries are established for different game species. The total number of districts that overlap the planning area varies from 23 for black bear to 121 for deer and elk (Table 4.10-3). In most districts, HCP project area lands make up a small proportion of the area open to hunting; more than half of all hunting districts have less than 1 percent HCP project area lands. With only one exception, HCP project area lands make up no more than 20 percent of any hunting district for any species. The exception is deer and elk district 282 (the Blackfoot-Clearwater Wildlife Management Area), 26 percent of which consists of HCP project area lands.

TABLE 4.10-3. PROPORTION OF HCP PROJECT AREA LANDS IN MFWP HUNTING DISTRICTS IN THE PLANNING AREA

	Number of Hunting Districts, by Proportion of HCP Project Area Lands within District Boundaries						
Species	0%	0 - 1%	1 - 5%	5 - 10%	10 - 20%	> 20%	Maximum Percentage
Bighorn Sheep	14	8	10	2	1	0	15
Black Bear	4	8	8	2	1	0	14
Deer and Elk	54	28	31	4	3	1	26
Moose	34	23	21	4	1	0	17
Mountain Goat	26	12	9	0	1	0	10
Pronghorn	20	10	8	0	0	0	4

Source: MFWP (2005c).

Two watchable wildlife destinations are found in the HCP project area, and both were built by other organizations. These two sites are the Old Squeezer Loop and a nature trail at Point Pleasant campground. The *Montana Wildlife Viewing Guide* includes a description of the Old Squeezer Loop on the Swan River State Forest (Fischer and Fischer 1990). The site, noted for its birding opportunities, includes two loop trails and several benches for wildlife viewing. Labor for construction of the facility was provided by the Montana Department of Corrections. The site is not maintained by DNRC. The other site is an interpretive nature trail built by Friends of the Wild Swan at the Point Pleasant campground also in the Swan River State Forest. This 2-mile loop trail features an old logging site and old-growth forest, with a wide variety of labeled tree and plant species.

Other Recreation Uses

In general, DNRC does not maintain trails, winter recreation areas, or other facilities devoted to outdoor recreation. DNRC does, however, manage lands that support some of these facilities, and licenses other parties to groom and maintain snowmobile and cross-country ski trails on trust lands. Three commercial snowmobile outfitters and the Flathead Snowmobile Association have land use licenses for grooming trails in the Stillwater Unit The Stillwater has also issued land use licenses for a commercial dogsled outfitter and a commercial groomed Nordic ski track. In addition, there are several ski trail licenses on the Swan River State Forest, the Libby Unit, and the Kalispell Unit.

Recreational Trail Use

Trails on trust lands are used for non-motorized recreation (e.g., hiking, horseback riding, mountain biking) and for motorized recreation (e.g., off-road vehicle use, motocross, snowmobiling). Several trails occur in the planning area, but only a small proportion of the total trail length is on trust lands. In many cases, both the trailhead and the destination are on National Forest lands. Of 9,878 miles of trail in the planning area, only 170 miles (2 percent) are on trust lands; of these, approximately 85 percent are within the HCP project area (Table 4.10-4). Bicyclists ride on trails and on both open and closed roads in the planning area. The Great Divide bike route from Canada to New Mexico passes through the Stillwater State Forest.

TABLE 4.10-4. MILES OF RECREATIONAL TRAILS IN THE PLANNING AREA BY LAND OFFICE

	NWLO	SWLO	CLO	Planning Area Total
DNRC – HCP Project Area Lands	84	56	5	144
DNRC – Non-HCP Lands	6	18	2	26
Other Ownerships	4,478	4,412	818	9,708
Total	**4,568**	**4,486**	**824**	**9,878**

Source: DNRC (2008a).

Some non-motorized recreation takes place on roads that are closed to motorized public access. Stryker basin and Herrig Lake on the Stillwater State Forest are popular destinations that recreational users approach on horseback, bicycle, or foot. Motorized public access was curtailed in the 1990s. Herrig Lake was stocked with fish in the past, but it is likely that this practice stopped when the road was closed.

Outfitting

Outfitting is another common recreational use of trust lands. Outfitters include guides leading big game hunting trips (e.g., for mountain lion and black bear) and guides who offer guided rafting and fishing tours. Popular put-in and take-out points for rafting outfitters in the HCP project area include Cedar Creek and Point Pleasant on the Swan River State Forest, and a tract on the Blackfoot River on the Clearwater Unit.

Campgrounds

There are five campgrounds on HCP project area lands, and all are located on the Stillwater and Swan River State Forests. These are the Spring Creek and Upper Whitefish Lake campgrounds on the Stillwater (18 sites total) and the Soup Creek, Point Pleasant, and Cedar Creek campgrounds on the Swan (24 sites total). Most camping occurs between Memorial Day and Labor Day; campgrounds also receive considerable use during the hunting season. In addition to the campgrounds identified above, Camp Westana Girl Scout Camp is located at Lower Stillwater Lake. Use of the site is managed through the special recreational use license program. In addition to scouting activities, the site is used by other gatherings (e.g., family reunions and weddings).

Dispersed Uses

Dispersed camping occurs on trust lands throughout the planning area, with rivers and lakes being common destinations. In addition to the activities described above, other popular activities in the planning area include berry picking, hiking, birding, and mushroom hunting. Mushroom picking has become an annual spring activity for both recreational and commercial pickers. Mushroom and berry picking on trust land requires a general recreational use license for private gathering or a special recreational use license for commercial collection.

Cabin Leases

Other recreation facilities on trust lands include cabin sites, which are leased to private parties for a 15-year term. DNRC administers more than 750 cabin and home sites statewide, of which 668 are in the planning area. The number of leased cabin sites on HCP project area lands cannot be readily determined from available data. Many cabin lease sites adjoin stream- or lake-front property. Approximately 1,200 acres (0.07 percent) of trust lands in the planning area are leased as cabin sites.

4.10.1.4 Effects of and Trends in Climate Change

Outdoor tourism and recreation activities are expected to be affected in various ways by a changing climate. At least in the near-term, warmer temperatures and a longer season are expected to increase summer activities, such as hiking, picnicking, water-based recreation, and sightseeing, while warming winter temperatures are expected to reduce opportunities for winter activities, such as skiing and snowmobiling (Karl et al. 2009). Additionally, outdoor recreation and tourism activities that depend on the availability and quality of natural resources, including forests, wetlands, snow, and wildlife, may experience the effects on these resources from climate change (Karl et al. 2009).

Climate change is also beginning to affect hunting and fishing opportunities as habitats shift and relationships among species in natural communities are disrupted by their different responses to climate change (Karl et al. 2009). In Montana, effects of a changing climate over the last decade have impacted hunting and fishing, with hotter and drier conditions reducing opportunities in some places and times (Saunders et al. 2008). Cold- and cool-water fisheries have been declining as warmer and drier conditions reduce their habitat (Field et al. 2007; Saunders et al. 2008). Montana's sportfishing industry was directly affected from 1998 through 2007, with drought and higher temperatures during 8 of those 10 years leading to fishing closures and restrictions (Saunders et al. 2008).

4.10.2 Environmental Consequences

The environmental consequences analysis for recreation addresses the potential effects of the alternatives on recreational opportunities in the analysis area. These include effects on recreational access and effects on the quality of the recreational experience on HCP project area lands. The analyses associated with the three action alternatives address covered forest management activities, which do not include the management of recreation areas, campgrounds, or other recreational facilities. Analyses in this section focus on potential direct and indirect effects on recreation that might arise from changes in management of transportation (Section 4.4) and forest vegetation (Section 4.2) within the HCP project area.

4.10.2.1 Introduction and Evaluation Criteria

Forestland management has the potential to affect recreation resources primarily through road management and timber harvest. The relationship between roads and the recreational experience is complex. Roads can provide access for certain popular recreation activities but can permanently reduce recreation opportunities in wild, backcountry areas. Roads that are open to public motorized use provide ready access to recreation destinations. This can be particularly valuable for persons engaged in hunting, fishing, or wildlife viewing, which are the most common recreational uses of HCP project area lands. Closed roads offer opportunities for hiking, mountain biking, berry picking, and other non-motorized activities. Economic value analyses have found that hiking is more highly valued in unroaded areas, while cross-country skiing is more highly valued in roaded areas (Walsh et al. 1984). Sediment from roads can reduce fish populations and catch rates, affecting the value of some sites as tribal or sport fisheries (e.g., Hueth et al. 1988; Rice 1989). Management that degrades scenic quality or reduces the abundance and catchability of fish has been found to diminish recreation benefits (Hueth et al. 1988).

The recreational experience can be affected by the amount and location of areas where timber harvest occurs. Timber harvest can either enhance or detract from the quality of recreational experiences, affecting different users in various ways. Recreational users who seek opportunities for hunting, berry picking, or scenic views may be attracted to areas that have recently been subject to even-aged timber harvest, where little forest canopy is present. Conversely, recreational users who seek experiences in old-growth forest or wild, backcountry areas may avoid such areas; in addition, the quality of the recreational experience for these users may be diminished in areas where managed stands are a prominent feature of the visual landscape.

The potential effects of the alternatives on recreational access and quality of experience are based on the following evaluation criteria:

Recreational Access

- Miles of road by classification
- Changes in forest management policies affecting access to roads.

Quality of Experience

- Amount and location of timber harvest.

For this analysis, the potential effects of the alternatives on recreational access are addressed qualitatively, based on the quantitative analyses in Sections 4.4 (Transportation) and 4.2 (Forest Vegetation). Discussions examine anticipated changes in the location and mileage of roads that would be open or closed to motorized public access, or that would be open with seasonal restrictions. Expected changes in the amounts and location of timber harvest are also discussed. In addition, potential changes in access to popular recreation destinations are addressed.

Public and administrative access to trust lands was identified as an issue during public scoping. Many commenters expressed concern about possible road closures. They were concerned that the HCP would result in more road closures and affect their recreational access to trust lands or affect DNRC's ability to manage trust lands.

Others asked how lands would be treated under the HCP for those areas that are primarily used for recreation. None of the alternatives addressed in this EIS address the management of recreation areas. As noted in Section 4.10.1.3 (Recreational Use), DNRC does not maintain trails, winter recreation areas, or other facilities devoted to outdoor recreation. Neither the no-action alternative nor any of the three action alternatives would be expected to result in changes to special recreational use and land use licenses.

4.10.2.2 Alternative 1 (No Action)

Recreational Access

As described in the discussion of environmental consequences for transportation under Alternative 1 (Section 4.4.2.2), DNRC would continue to direct transportation management under Alternative 1 according to the existing road management rules (ARM 36.11.421). These include minimizing the extent of roads on trust lands while also considering the needs for public access.

Based on the analysis of roads needed for the Permit term, the total amount of roads in the HCP project area (excluding roads that would be abandoned or reclaimed) would increase by ~~more than 1,400~~1,121 miles by year 50 (Table 4.4-6). Nearly all of this increase would be in the form of roads that are closed to motorized public access. In all parts of the HCP project area, increases in the amount of roads open to non-motorized public access would result in expanded opportunities for hiking, mountain biking, berry picking, and other such activities. The amount of roads open to motorized public access in the project area would increase by approximately 41 miles by year 50, with all open road increases occurring in the scattered parcels of the SWLO, CLO, and NWLO. This change (4 percent above current conditions) does not represent a substantial increase over current total open road miles, and is not expected to result in any discernible differences in recreational access in these areas. No additional miles of road open to motorized public access would be expected in the Stillwater Block or the Swan River State Forest.

Opportunities for wintertime recreation (e.g., snowmobiling, cross-country skiing, snowshoeing) would not be expected to change from current conditions. Wintertime motorized access to groomed trails and other licensed facilities would continue. It is not likely that any new areas would be opened to motorized access. It is worth noting that winter recreation maps indicate areas that are open or closed to motorized use, but not all users are aware of these closures. Snowmobiles are not confined to roads; even on roads, deep snow can render closure signs and structures invisible. It is likely that a considerable amount of snowmobile use currently occurs in areas that are closed to motorized access, and would continue to occur under this and the other alternatives.

In the Stillwater Block, there would be no long-term transportation commitments. Due to existing commitments, any increase in the mileage of road open for motorized public access would likely be offset by the imposition of access restrictions (either seasonal or year-round closures) of an equal amount of open road elsewhere in the Stillwater Block. The amount of roads with year-round restrictions would increase by 17 miles, which would provide additional opportunities for non-motorized recreation. Recreational access to destinations that currently lack motorized public access (e.g., Stryker basin, Herrig Lake) would likely continue to occur on horseback, foot, or bicycle.

The road system in the Swan River State Forest would continue to be managed in accordance with the terms of the Swan Agreement. Similar to the Stillwater Block, any increases in open road mileage would likely be offset by decreases elsewhere on the forest. The amount of roads with year-round restrictions is predicted to increase by 70 miles by year 50, resulting in increased opportunities for non-motorized recreation on closed roads. If the Swan Agreement is terminated, transportation management decisions would be made on a case-by-case basis, and would be constrained by requirements to avoid or mitigate for take under the ESA. DNRC would look to the rulemaking process to identify ways of ensuring both ESA compliance and continued public access, and would look for opportunities for collaboration with the USFS. It is likely that the miles of open road on the Swan River State Forest would not change substantially if the Swan Agreement is terminated under Alternative 1.

Current road management rules require DNRC to inspect all road closures (inside grizzly bear recovery zones as well as outside) at least every 5 years (ARM 36.11.421(14)), with repairs to ineffective road closures assigned a high priority when allocating time and budget, but no schedule for completion established. On the Stillwater Block and Swan River State Forest, DNRC is required to inspect all road closures annually, and make necessary repairs within one operating season. DNRC would continue to meet this requirement for roads on the Stillwater Block and Swan River State Forest. However, DNRC currently does not meet the 5-year inspection cycle for roads on scattered parcels, and if it cannot determine a way to meet this requirement in the future, it may modify the rules. If any roads that are managed as closed to motorized public access have ineffective closure structures, they could in fact be accessible for up to 5 years – or possibly longer – depending on how long it takes to identify the problem, allocate funding, and complete the repairs. Based on this consideration, the numbers of miles of road open for motorized public access in Table 4.4-6 likely represent underestimates of the total miles of road on which motorized recreational access is possible.

Quality of Recreational Experience

Based on the output of the forest management model that was used to calculate sustainable yield (Section 4.2.2.2, Forest Vegetation – Sustainable Yield), 53.2 million board feet of timber would be harvested annually from trust lands under Alternative 1 (Table 4.2-14). Opportunities for hunting, berry picking, and other activities in young, open-canopy forest would likely increase in areas where management would occur. For some users, the quality of the recreational experience may decrease due to the increased visibility of these managed stands. Timber management increases, along with increases in the amount of roads, would likely reduce the amount of wild, backcountry areas available for recreation.

4.10.2.3 Alternative 2 (Proposed HCP)

Recreational Access

As under Alternative 1, DNRC would continue to minimize the extent of roads on trust lands while also considering the needs for public access. Based on the transportation model, the increase in total road miles (excluding abandoned and reclaimed roads) in the HCP project area at year 50 would be approximately 21 miles lower overall than Alternative 1 (Table 4.4-6). Similar to that alternative, nearly all of the new road miles would be closed to motorized public access. The most notable differences from Alternative 1 would be in the Stillwater Block and the Swan River State Forest, where the amount of road open year-round or seasonally to motorized public access would increase by 29 and up to 23 miles, respectively. These differences would stem from the implementation of transportation plans for the blocked lands in those two areas, which are addressed in greater detail below.

Under the transportation plan for the Stillwater Block, the amount of existing roads open year-round for all motorized public access would decrease by 18.3 miles (15 percent) (Table 4.4-6). In contrast, the amount of existing roads available for motorized public access with seasonal restrictions would increase nearly ten-fold, from 6.4 miles to 54 miles, of which 29.8 miles would be closed in spring (April 1 to June 30) and 24.2 miles would be closed in spring and fall (April 1 to June 30 and September 16 to November 30) (Table 2-2 in Appendix A, HCP). Compared to current conditions, the amount of roads in the Stillwater Block that would be open during the summer and autumn months (i.e., that would have no restrictions or spring restrictions only) would increase by 15.3 miles (Table 2-2 in Appendix A, HCP). This would result in increased opportunities for motorized access for hunting, fishing, berry picking, hiking, picnicking, and numerous other activities.

Increases in the amount of roads in the Stillwater Block that are seasonally available to motorized public use would occur at several popular destination points, including Stryker Basin and Herrig Lake, which would be open from July 1 through September 15 (Figure D-4B in Appendix D, EIS Figures). Recreational use of Herrig Lake would likely increase, which could include an increase in fishing (depending on whether MFWP resumed stocking the lake). Additional roads would be opened seasonally along the southern extent of Stryker Ridge and near Woods Lake in the Stillwater State Forest, and along Coal Ridge in the Coal Creek State Forest. The West Fork Road, which provides access to Upper Whitefish Lake from the north, would be closed to motorized public access from April 1 to June 30. Access to Upper Whitefish Lake during the month of June (when the road typically melts out) would be from the south only. Driving times would probably be about the same, but persons wishing to complete a scenic loop drive would have to wait until the West Fork Road opens on July 1.

The proposed HCP also includes a transportation plan for the Swan River State Forest. This plan would be implemented only if the Swan Agreement is terminated. Under the Swan Agreement in its current form, no changes are anticipated in the miles of road open to motorized public access. If the agreement is terminated and replaced by the HCP Swan River State Forest transportation plan, the amount of open or seasonally restricted road may increase from the current 43.4 miles to as much as 66.5 miles (Table 4.4-6). As a result, opportunities for motorized recreation would increase. Opportunities for non-motorized recreation on closed roads would also increase from current conditions, but not as much as under Alternative 1 (Table 4.4-6). The actual amount of additional road that would be open to motorized public access at any time in the future would depend on the status of access agreements with adjacent landowners, as well as the timing of individual landowners' decisions to pursue access across parcels of trust lands. Additional opportunities may become available for motorized recreation on the Swan River State Forest, but no specific destinations would be targeted for increased access. No new restrictions would be placed on any roads that are currently open to public motorized access under Alternative 2.

In most areas throughout the planning area, winter recreation opportunities would not be expected to differ from those anticipated under Alternative 1. Seasonal openings of additional areas to motorized use in the Stillwater Block and the Swan River State Forest (if the Swan Agreement is terminated) may create additional opportunities for snowmobile use. Several areas that are currently closed year-round would be open to motorized use between December 1 (or earlier, for roads with no autumn restrictions) and March 31. As noted in the discussion of effects under Alternative 1, a considerable amount of snowmobile use would likely continue to occur in areas that are closed to motorized access. Formally opening some areas to motorized use during winter may encourage some users to increase their activities in areas where use is authorized. The spring closure of the West Fork Road could reduce some late-season opportunities, but opportunities in that area are typically limited by patchy snow starting in April. Vehicular access to groomed trails and other licensed facilities would not be expected to differ from Alternative 1, because roads in the Stillwater Block (where the most changes would be likely to occur) are under snow through most of the winter season.

Under Alternative 2, all primary road closures in grizzly bear recovery zones would be inspected annually, and repairs would be completed within one year of identifying the problem. Compared to Alternative 1, this would be expected to lead to a decline in the mileage of roads where motorized public use occurs even though the management goal of the road includes use restrictions. For this reason, the numbers of miles of road open for motorized public access in Table 4.4-6 likely represent underestimates of the total miles of road on which motorized recreational access is possible, but to a lesser degree than under Alternative 1. Outside of the recovery zones, DNRC's inspection and repair of road closures would be expected to continue as under Alternative 1.

<u>Quality of Recreational Experience</u>

The annual sustainable yield under Alternative 2 would be ~~58~~57.6 million board feet per year (Table 4.2-14), ~~9~~8 percent more than under Alternative 1. The most noticeable difference between Alternatives 1 and 2 would be in the Stillwater Block, where increased access would allow more timber management in the Stillwater Core under Alternative 2. Under this alternative, approximately 15 million board feet would be harvested annually in the Stillwater Unit, up from approximately 10 million board feet under Alternative 1 (Table 4.2-14). Opportunities for hunting, berry picking, and other activities in young, open-canopy forest would likely increase in areas where management would occur, particularly in the Stillwater Core. For some users, the quality of the recreational experience may decrease due to the increased visibility of these managed stands, although the implementation of 50-foot no-harvest buffers along all Class 1 streams may lessen the visibility of the managed stands. Timber management increases, along with increases in the amount of roads, would likely reduce the amount of wild, backcountry areas available for recreation, particularly in the Stillwater Core.

4.10.2.4 Alternative 3 (Increased Conservation HCP)

<u>Recreational Access</u>

For scattered parcels, the effects of Alternative 3 on recreational access would be lower than those described above for Alternatives 1 and 2. Effects in the Stillwater Block would be almost identical to those described under Alternative 1, while effects in the Swan River State Forest would be the same as those described under Alternative 2. Based on the transportation model, the total amount of road miles open for motorized public access under this alternative would be slightly higher than under Alternative 1 and lower than under Alternative 2. The increase in total road miles (excluding abandoned and reclaimed roads) would be approximately ~~2~~8 percent less than Alternative 1 at year 50, resulting in slightly fewer opportunities for road-based recreation, mostly in the scattered parcels (Table 4.4-6). Effects on recreational access in all seasons would be as described for Alternative 1.

The most prominent difference between Alternatives 3 and 2 would be in the Stillwater Block, where DNRC would implement the same transportation commitments as under Alternative 1, along with additional provisions within the Stillwater Core. Similar to Alternative 1, Alternative 3 would not be expected to result in any change in the amount of roads open for motorized public access.

Under this alternative, the HCP transportation plan (described under Alternative 2) for the Swan River State Forest would be implemented if the Swan Agreement is terminated during the Permit term. Under this plan, miles of open or seasonally restricted road could increase by as much as 23 miles, providing additional opportunities for motorized recreation.

Under Alternative 3, DNRC would commit to repairing all ineffective closures in grizzly bear recovery zones during the same operating season in which they are identified, to the extent that time, workforce, and contracting funds are available. Any repairs not completed during the same season would be completed within 1 year of being identified. Compared to Alternative 1, this would be expected to reduce the miles of road on which motorized public use occurs even though the management goal for those roads already includes use restrictions. Fewer miles would be open for *de facto* motorized public access than under Alternative 2, because repairs would occur more frequently, although inspection frequency would be the same.

Quality of Recreational Experience

The annual sustainable yield under Alternative 3 would be approximately 51 million board feet per year (Table 4.2-14), 5 percent less than under Alternative 1. In the HCP project area as a whole, increases in the amount of forest harvested would be smaller than those anticipated under Alternative 1. Similar to Alternative 1, access restrictions in the Stillwater Block would limit opportunities for active forest management there; the average annual harvest from the Stillwater Unit would be approximately 10 million board feet. Similar to Alternative 1, opportunities for hunting, berry picking, and other activities in young, open-canopy forest would likely increase. However, in the Stillwater Block, these increases would not be as great as under Alternative 2. For some users, the quality of the recreational experience may decrease due to the increased visibility of these managed stands. Implementation of no-harvest buffers extending the entire width of RMZs on Class 1 streams supporting HCP fish species may lessen the visibility of some managed stands more than would occur under Alternative 2. However, unlike Alternative 2, this alternative would not apply any no-harvest buffers along Class 1 streams with non-HCP fish species. Timber management increases and increases in the amount of roads would likely reduce the amount of wild, backcountry areas available for recreation.

4.10.2.5 Alternative 4 (Increased Management Flexibility HCP)

Recreational Access

Alternative 4 would result in the same total length of ~~new~~ roads in the HCP project area and road management classification as Alternative 2 in all portions of the HCP project area.

The effects associated with Alternative 4 on recreational access would be almost identical to those described above for Alternative 2. The total amount of road miles (including roads open for motorized public access, as well as those with seasonal or year-round restrictions) would be the same as under Alternative 2, and the transportation plans for the Stillwater Block and the Swan

River State Forest would be implemented as described. Under Alternative 4, DNRC would commit to inspecting road closures on scattered parcels in grizzly bear recovery zones every 2 years, and repairing ineffective closures within 1 year of identifying the problem. Compared to Alternative 1, this would be expected to reduce the miles of road on which motorized public use occurs even though the management goal for those roads already includes use restrictions. The miles of *de facto* open road under Alternative 4 would be greater than under Alternatives 2 and 3, however, because inspections and repairs would occur less often.

Quality of Recreational Experience

The amount and location of timber harvest under Alternative 4 would be very similar to what is described above for Alternative 2. However, for some users, the quality of the recreational experience may decrease more than under Alternative 2 since narrower no-harvest buffers would be applied and only on Class 1 streams supporting HCP fish under this alternative.

4.10.2.6 Summary

Under all four alternatives, increases in the amount of roads open to non-motorized public access would result in expanded opportunities for hiking, mountain biking, berry picking, and other such activities throughout the HCP project area. Under Alternatives 2 and 4, implementation of a transportation plan in the Stillwater Block would result in increased opportunities for motorized public access as compared to Alternatives 1 and 3 due to greater access to the Stillwater Core. In the Swan River State Forest, access would remain the same for all alternatives if the Swan Agreement remains in effect; otherwise, opportunities for motorized public access could increase under the action alternatives. As a result of timber harvest under all alternatives, opportunities for hunting, berry picking, and other activities in young, open-canopy forest would likely increase. On the other hand, opportunities for recreation in unmanaged areas would be reduced, and the quality of the recreational experience for some users may decrease due to the increased visibility of managed stands, although the amount of increased visibility would vary based on the no-harvest buffers applied under each of the action alternatives. Under the action alternatives, increases in the amount of roads available for motorized public access would likely reduce the amount of wild, backcountry areas available for recreation, particularly in the Stillwater Block.

Effects of climate change are not expected to alter the amount of motorized and non-motorized public access that would be made available under any of the alternatives. However, differences among the alternatives in potential effects on the quality of the recreational experience for those accessing project area lands may become more pronounced as a result of effects from climate change on the availability and quality of natural resources.

4.11 Visual Resources

Visual resources are generally regarded as important because they enhance quality of life, influence the quality of recreational experiences, and, in some cases, affect the value of adjacent properties. Forestlands are considered to be an important visual or scenic resource by many Montana residents and visitors. For local residents, forest scenery contributes to casual and inexpensive recreation experiences near home, and to a general sense of well-being, security, and stability. In addition, the scenery in western Montana is a factor in attracting tourists and new residents to the area. For both residents and visitors, the scenic condition influences opinions concerning ecosystem health and forestland management. This section describes the affected environment and environmental consequences of the no-action and action alternatives on visual resources.

4.11.1 Affected Environment

This section first identifies the regulations governing visual resources and how DNRC incorporates visual resource considerations in timber sale planning. This discussion is followed by a description of the landscape characteristics within the planning area and a summary of visual resource concerns related to forest management activities.

4.11.1.1 Regulatory Framework

The Forest Management ARMs contain no specific provisions for the consideration of potential visual impacts. Also, standard timber sale contract language provides no such guidance. Further, the ARMs do not stipulate re-planting requirements or a maximum size for clearcut harvest areas, which would reduce the visual impacts of timber harvest.

Some commitments for other resources, however, can lessen the visual impact of forest management activities. For example, on the Stillwater Block, Swan River State Forest, and scattered parcels in grizzly bear recovery zones, DNRC is required to provide visual screening adjacent to open roads to the extent practicable (ARMs 36.11.431 through 433). Visual screening is defined as vegetation or topography (or both) providing visual obstruction that makes it difficult to see into adjacent areas from the roadbed. The distance required to provide visual screening, typically 100 feet, is dependent on the type and density of cover available.

The ARMs also contain provisions for the maintenance of forest cover along streams. Where streams occur parallel to roads, such cover would also be expected to provide some visual screening for road users. Within the grizzly bear management areas identified under ARMs 36.11.431 through 433 (see above), DNRC is required to maintain hiding cover, where available, along all riparian zones. Hiding cover is defined as vegetation that provides visual screening capable of obstructing from view 90 percent of an adult grizzly bear at 200 feet. In addition, DNRC is required to consider providing hiding cover near riparian zones on scattered parcels in the CLO within the NCDE (ARM 36.11.434).

The SMZ Law contains provisions for management standards that require the retention of trees along all streams, specific lakes, and other bodies of water in Montana. Clearcutting is prohibited within SMZs, which extend at least 50 feet from streams. On slopes greater than 35 percent, the SMZ width on Class 1 and 2 streams and lakes is extended to 100 feet. For lakes and all streams, the SMZ width must be extended to incorporate adjacent wetlands that intercept the SMZ boundary. 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 a Class 3 SMZ must retain sub-merchantable trees and shrubs. Tree densities provided by the minimum retention levels would not be expected to result in full visual screening along streams.

On fish-bearing streams, SMZs are supplemented by RMZs. The total RMZ width, including the SMZ, is equal to the average SPTH at age 100 years. Harvest conducted within the combined SMZ and RMZ must retain all bank edge trees and retain enough other trees to ensure adequate levels of shade and potential LWD recruitment to the stream. These requirements provide a greater level of visual screening for fish-bearing streams, compared to other waterbodies.

When visual resources are identified as an environmental issue for a project, DNRC may incorporate mitigations into the timber sale design to address effects on visual resources. Visual resources are more frequently addressed on scattered parcels rather than blocked lands. This is because scattered parcels often have more neighboring landowners who raise concerns about visual resources. Examples of measures that may be implemented to mitigate potential adverse effects on visual resources include the following:

- Uneven unit boundaries, to simulate a more natural appearance
- Feathering (the use of partial harvesting techniques between clearcuts and neighboring stands of trees to reduce the appearance of change between harvested and non-harvested sites)
- Retention of intermediate-sized trees in seed tree clumps
- Retention of additional canopy cover on the downslope side of roads in steep areas, to avoid eroding soils and vegetation loss
- Restrictions on skidding and site preparation.

4.11.1.2 Landscape Characteristics

The following descriptions of the landscape characteristics of the planning area are summarized from the *DNRC Real Estate Management Programmatic Plan Final EIS* (DNRC 2004f) and supplemented by information from *Ecoregions of Montana* (Woods et al. 2002).

Northwestern Land Office

Land administered by the NWLO lies within the mountainous and rugged Northern Rockies and Canadian Rockies ecoregions. Much of this region is classified as open mountains, a distinctive setting with high, detached mountain ranges separated by broad, smooth-floored valleys. The primary valley in this region is the Flathead Valley. Mountainous portions of the region are characterized by closely spaced ranges separated by narrow, restricted valleys. Elevations range from approximately 2,000 feet to more than 10,000 feet above sea level. The state’s lowest elevation of 1,800 feet above sea level occurs within this region, where the Kootenai River flows into Idaho. Manmade features are readily observable on many of the mountains surrounding the lowlands. These include roads and clearcuts resulting from logging operations on a variety of land ownerships, areas of historical mining activity, transmission lines and other utility corridors, scattered rural residences, and the effects of grazing.

Forestlands in western Montana encompass a variety of forest types. North-facing slopes and floodplain terraces along most rivers in the NWLO support mixed, relatively dense conifer forests. South-facing floodplain terraces, benches, and slopes in this land office are characterized by more open forests dominated by ponderosa pine and Douglas-fir forests.

The Stillwater State Forest, which includes approximately 39,600 acres of grizzly bear security core, is in the NWLO. The predominant forest cover types in the Stillwater Core are subalpine fir and mixed conifer. Although management activities are currently restricted, the area has been managed heavily in the past. Most of the Stillwater Core is not visible from any local towns, major highways, or main forest roads. The primary exception is the west slope of Stryker Ridge, on which some roads, skid trails, and old clearcuts are visible from U.S. Highway 93 north of Kalispell. In addition, forest roads on the east side of Stryker Ridge offer views into some areas of the Stillwater Core.

Southwestern Land Office

Most of the area of the SWLO lies within the Middle Rockies ecoregion, although the scattered parcels associated with the Sula State Forest, near Hamilton, are in the Idaho Batholith ecoregion. The landscape of the Middle Rockies ecoregion is dominated by detached mountain ranges separated by numerous broad, grass- or shrub-covered valleys. The Idaho Batholith ecoregion is typically mountainous, deeply dissected, and partially glaciated. Elevations in the SWLO range from approximately 3,000 feet in the Bitterroot Valley to more than 10,000 feet in the Anaconda and Flint Creek ranges. As with the NWLO, man-made features are readily observable on many of the surrounding mountains.

Forestlands in the SWLO are similar to those described for the NWLO, with north-facing slopes and floodplain terraces along most rivers supporting mixed, relatively dense conifer forests. South-facing floodplain terraces, benches, and slopes are characterized by more open forests dominated by ponderosa pine and Douglas-fir forests.

Central Land Office

Land administered by the CLO encompasses diverse ecoregions, ranging from the Rocky Mountain Front in the northwest, to the Northwestern Glaciated Plains and the Northwestern Great Plains in the east, to the Middle Rockies in the south and southwest. HCP project area lands are all in the Middle Rockies ecoregion, with characteristics similar to those of the SWLO. Elevations range from approximately 4,500 feet to 10,000 feet. Forestlands in the CLO include coniferous forests providing the dominant colors, with shrubs, grasses, and deciduous trees providing seasonal variations.

4.11.1.3 Visual Resource Concerns Affected by Forest Management Activities

Assessing scenic values is generally a subjective exercise; scenic quality is typically determined by evaluating the overall character and diversity of landform, vegetation, color, water, and man-made features in a landscape. Typically, more complex or diverse natural landscapes are considered to have higher scenic quality than landscapes with less complex features. Visual impacts of human activities are commonly assessed on the basis of contrast (e.g., form, line, color, and texture) to the surrounding landscape. Examples of forest management activities that may affect scenic values include road construction and intensive timber harvest, such as clearcutting or heavy thinning.

Viewers experience landscapes at different scales, depending on the distance from the observer. At close range (typically less than 1,000 feet), leaves, trunks, branches, and other features of individual trees are discernable. At distances up to 3 or 5 miles, individual trees are still visible but do not stand out distinctly from the landscape. At greater distances, the visual experience is defined by broad changes in foliage and topography. Changes that are visible from nearby (e.g., light thinning treatments) may not be readily apparent at greater distances. Conversely, an observer may find a clearcut to look unappealing when viewed from a distance, but appreciate the vistas available from within the clearcut.

Primary areas where forest-related visual concerns exist at the landscape scale include major highway corridors, cities and towns, and residential areas near managed forestlands. Areas where visual resources are experienced at a more immediate scale include trails and other recreation areas. Forested landscapes in these areas are often highly visible to the public and can be managed to reduce the visual impact of harvest and road-building activities.

Forest management practices may be particularly relevant near roadways that have been designated as scenic drives. Of 27 designated scenic byways and scenic drives in the state of Montana, 24 are wholly or partially within the planning area (Travel Montana 2005). This includes five congressionally recognized national scenic byways and two back country byways. Five scenic drives occur in the vicinity of HCP project area lands in the NWLO. These include the Lake Koocanusa and St. Regis Paradise scenic byways and the Bull River Valley, Clark Fork, and Seeley Swan scenic drives. In the SWLO, the Garnet Back Country Byway and the Bitterroot Valley scenic drive pass through areas with appreciable amounts of HCP project area lands. No designated scenic drives occur near HCP project area lands in the CLO.

4.11.1.4 Effects of and Trends in Climate Change

Visual resources within the planning area may be affected by climate change through changes in visibility and the appearance of vegetation. As discussed in Section 4.3 (Air Quality), major wildfires have increased in the western United States over the last few decades, and further increases are expected. The smoke from more and larger wildfires will likely increase the number of days when localized and landscape-scale visibility is affected. As discussed in Section 4.2 (Forest Vegetation), changes in vegetation patterns, including forest dieback, are expected as the result of increased wildfires, insect infestation, disease, and stress from changing climate conditions (e.g., increasing temperatures and decreasing water availability). Depending on the sizes of affected areas and the nature of the vegetation changes, visual effects may occur on a localized or landscape scale.

4.11.2 Environmental Consequences

The environmental consequences analysis for visual resources addresses the potential effects of the alternatives on scenic quality in the planning area. This effects analysis considers changes that are visible both at the landscape scale (i.e., apparent to residents and users of scenic drives) and at the local scale (i.e., apparent to recreational and other users of HCP project area lands).

4.11.2.1 Introduction and Evaluation Criteria

Analyses in this section focus on potential direct and indirect effects on visual resources that might arise from changes in the amount and location of timber harvest (see Section 4.2.2, Forest Vegetation – Environmental Consequences) and the amount and location of road building (see Section 4.4.2, Transportation – Environmental Consequences) under the alternatives. The analysis of effects for each alternative also addresses any changes in Forest Management Rules that may reduce the visual impacts of timber harvest.

For this analysis, comparisons of the potential effects of the alternatives on the visual landscape are based on the following evaluation criteria:

- Expected changes in the amount and location of timber harvest
- The location and magnitude of expected changes in road miles.

As noted above in Section 4.11.1.3 (Visual Resource Concerns Affected by Forest Management Activities), assessing scenic values can be a subjective exercise. It is generally accepted, however, that timber harvest affects visual resources by changing the visible characteristics (e.g., crown cover, size class) of the forested landscape. The type of timber harvest employed also influences visual impacts. Even-aged harvest techniques (e.g., clearcut harvest or heavy thinning) typically result in more dramatic changes in the crown cover, size class, and age class of the residual stand, compared to uneven-aged management (selective removal of single trees or groups of trees within a harvest unit). Notably, at the HCP project area scale, no discernable differences would be expected among the four alternatives with regard to crown cover or size class (see Section 4.2, Forest Vegetation). The alternatives do differ, however, in terms of the modeled amount and location of timber harvest that would occur (Table 4.2-14). The basis of these differences is the amount of area available for forest management, particularly in the Stillwater Core. In any given area, the effects on visual resources would be greater under alternatives with a higher annual harvest rate, compared to those with a lower rate.

Analysis of the visual effects from roads is based on changes in the total miles of road on HCP project area lands, as presented in Table 4.4-6, and whether the amount of change between alternatives would be enough to detect a visual difference.

Under any of the four alternatives, the ARMs will continue to have no specific provisions for the consideration of visual impacts associated with forest management on trust lands. DNRC will continue to seek opportunities to mitigate for the visual impacts of timber harvest at the project level, when such impacts are identified as an issue. The amount of timber harvest is not expected to vary substantially from year to year. In addition, DNRC will endeavor to minimize new road construction.

4.11.2.2 Alternative 1 (No Action)

Under Alternative 1, DNRC would continue to retain visual screening where practicable along open roads within grizzly bear recovery zones. Residual tree densities provided by SMZ requirements would provide additional visual screening for roads that parallel fish-bearing streams. These measures would continue to reduce the visibility of even-aged harvest units from adjacent roads, although recently harvested areas would be visible in mid-range and distant views.

Approximately 53.2 million board feet of timber would be harvested annually from trust lands statewide under Alternative 1 (Table 4.2-14). Over the 50-year Permit term, the amount of forest harvested would likely result in a noticeable increase in the amount of visibly modified forestland. Access restrictions in the Stillwater State Forest would limit opportunities for active forest management there; as a result, a smaller proportion of the Stillwater Block would undergo visual impacts, compared to other areas.

Based on the analysis of roads needed for the Permit term, the total amount of roads in the HCP project area would increase by more than 1,400 miles by year 50 (Table 4.4-6). Abandoned or reclaimed roads would make up approximately 20 percent of the increased mileage; as time passes, vegetation may grow on and over these roads, reducing their visual impact compared to maintained roads. In the Stillwater Block and the Swan River State Forest, limitations on the allowable amount of open roads would not prevent the construction of new roads. Although motorized public access restrictions on new and existing roads would be implemented to ensure no net increase in open road density, new roads would be visible from adjacent areas.

4.11.2.3 Alternative 2 (Proposed HCP)

Under Alternative 2, visual screening requirements would be similar to those described for Alternative 1, except that vegetation would be retained (through commitment GB-RZ2) between open roads and clearcut or seed tree harvest units within grizzly bear recovery zones (with some allowances), and not just where practicable. Within NROH and recovery zones, commitment GB-NR4 would impose an additional requirement that all portions of new clearcut and seed tree harvest units must be no more than 600 feet from visual screening. This requirement would have the effect of constraining the maximum size of such harvest units (or, for larger units, ensuring a relatively long, narrow shape) within grizzly bear NROH and recovery zones, thereby reducing their visual impact. Requirements for no-harvest buffers along ~~HCP fish-bearing~~Class 1 streams (commitment AQ-RM1) would likely provide some additional visual screening for nearby roads. Tree retention requirements along all other streams would be the same as required under Alternative 1.

The statewide annual sustainable yield under Alternative 2 would be ~~58~~57.6 million board feet per year (Table 4.2-14), ~~9~~8 percent more than under Alternative 1. Compared to Alternative 1, this larger amount of forest harvested each year would likely result in a larger increase in the amount of visibly modified forestland in the HCP project area. The most noticeable difference would be in the Stillwater Block, where increased access would allow more timber management in the Stillwater Core. Approximately 15 million board feet would be harvested annually in the Stillwater Unit, up from approximately 10 million board feet under Alternative 1 (Table 4.2-14). Changes in the amount of timber harvest in other land offices and other administrative units of the NWLO would be comparable to those anticipated under Alternative 1.

Compared to other areas, timber harvest in the Stillwater Unit would be more likely to result in visual impacts when viewed either from a distance or from nearby. This is because a greater proportion of timber management would occur as even-aged harvest in that area than in other areas. This would be particularly true in the Stillwater Core, which is mostly in the higher-elevation areas of the Stillwater Unit where the forest types are not conducive to uneven-aged management. Other logistical and operational challenges, such as the anticipated difficulty in accessing these sites and the limited options for harvesting methods (i.e., helicopter yarding in many situations), would also render even-aged management the most feasible option in many parts of the Stillwater Block. For these same reasons, many stands in the Stillwater Unit (and especially in the Stillwater Core) would have a relatively low priority for treatment because forest management at those sites would not be as cost-effective as management elsewhere.

Predicted increases in road miles under Alternative 2 would be almost identical to those anticipated for Alternative 1 (Table 4.4-6). Increases would be slightly smaller in all but two areas. In the Swan River State Forest, there would be no difference in total road miles by the end of the Permit term between Alternatives 1 and 2. Increases in the Stillwater Block would be slightly larger than those anticipated under Alternative 1.

4.11.2.4 Alternative 3 (Increased Conservation HCP)

The vegetation retention commitments described under Alternative 2 for recovery zones (GB-RZ2) and NROH and recovery zones (GB-NR4) would be the same for Alternative 3, resulting in the same effect of reducing visual impacts of clearcut and seed tree harvest units from adjacent roads in these areas. Under Alternative 3, more visual screening for nearby roads would be provided by vegetation ~~retention~~retained within a wider buffer along HCP fish-bearing streams (commitment AQ-RM1)~~ would result in more visual screening for nearby roads as compared to Alternative 2~~.

The statewide annual sustainable yield under Alternative 3 would be approximately 51 million board feet per year (Table 4.2-14), 5 percent less than under Alternative 1. In the HCP project area as a whole, increases in the amount of visibly modified forestland would likely be smaller than those expected under Alternatives 1 and 2. Access restrictions in the Stillwater Block would limit opportunities for active forest management there; the average annual harvest from the Stillwater Unit would be approximately 10 million board feet, similar to the amount anticipated under Alternative 1.

In most areas, predicted increases in road miles under Alternative 3 would be smaller than those predicted for Alternatives 1 and 2 (Table 4.4-6). The greatest difference in road increases is in the scattered parcels of the NWLO, where total road miles would increase from a current value of 826.7 to 1,412.7 under Alternative 3 (compared to 1,456.6 miles under Alternative 2 and 1,469.0 miles under Alternative 1). These represent increases of 71, 76, and 78 percent, respectively, which are not likely to translate into a discernible difference in the visual landscape.

4.11.2.5 Alternative 4 (Increased Management Flexibility HCP)

Within NROH and recovery zones (commitment GB-NR4) and along HCP fish-bearing streams (commitment AQ-RM1), visual screening requirements under Alternative 4 would be the same as under Alternative 2, resulting in the same effect of reducing visual impacts of clearcut and seed tree harvest units from adjacent roads in these areas. Within recovery zones, visual screening requirements along open roads would be the same as those described for Alternative 1, and would therefore reduce the visibility of even-aged harvest units from adjacent roads to a lesser extent than under Alternatives 2 or 3.

~~Similar to Alternative 2, t~~The statewide annual sustainable yield under Alternative 4 would be approximately 58 million board feet per year (Table 4.2-14), which is very close to the 57.6 million board feet under Alternative 2. Consequently, the increase in amount of visibly modified forest would likely be the same. Similar to Alternative 2, Alternative 4 would allow increased access for timber management in the Stillwater Block. The logistical and operational constraints, as well as the effects on visual resources, would be similar under both alternatives.

In all areas, predicted increases in road miles under Alternative 4 would be identical to those modeled for Alternative 2 (Table 4.4-6), and the visual impacts would be the same.

4.11.2.6 Summary

Under all four alternatives, increases in the amount of roaded areas and forest in the non-stocked and seedling/sapling size classes would result in decreases in the amount of natural-appearing forested landscape. Such changes would be visible from roads (including scenic drives), trails, recreation areas, and viewpoints in the planning area. Under Alternatives 2 and 4, increased access in the Stillwater Core would result in more timber management (largely even-aged harvest), resulting in greater visual impacts than under Alternatives 1 or 3. Under all three action alternatives, slightly smaller increases in total road length at year 50 were predicted for the Permit term, compared to Alternative 1, with the smallest increases expected to occur under Alternative 3. In all parts of the HCP project area, the visual impacts of roads would not be expected to differ substantially among the alternatives.

Changes to landscape-scale visual resources caused by effects of climate change are not expected to vary among the alternatives. However, localized effects would be more likely seen in areas accessed by new roads constructed under all the alternatives, including the Stillwater Block, which would be actively managed under Alternatives 2 and 4.

4.12 Archaeological, Historical, Cultural, and Tribal Trust Resources

4.12.1 Affected Environment

This section describes the regulatory framework under which cultural, paleontological, and tribal trust resources are considered. It also provides a description of the types of cultural, paleontological, and tribal trust resources in the planning area and their relative abundance or frequency of occurrence.

Cultural resources include archaeological sites, historic sites, architectural properties, traditional cultural properties (TCPs), districts, landscapes, structures, features, or objects resulting from human activity. Cultural resources are non-renewable resources that can be either prehistoric and thousands of years old, or historic dating from 1805 (for Montana). They are recognized as tangible materials or sites, at least 50 years old, resulting from human behavior. Some cultural resource sites are known for the planning area that extend back several thousand years. As one moves forward in time, the number and variety of sites increases, mainly as a result of the increase in Native populations and, after 1860, European, Euroamerican, and Asian immigration and population increase.

Paleontological resources are fossilized plant and animal remains that are rare and have scientific research value. Non-renewable paleontological and cultural resources provide invaluable information about the behavior of past plant, animal, and human populations and their environments.

Tribal trust resources include natural resources on and off Indian lands that are reserved for tribes through treaties, executive orders, statutes, or judicial decisions and protected as a trust obligation of the United States.

4.12.1.1 Regulatory Framework

Cultural and paleontological resources have been recognized as important and irreplaceable resources by both state and federal administrators and legislators, resulting in the passage of federal and state legislation and regulations (Table 4.12-1). Federal regulations relevant to cultural resources include the National Historic Preservation Act (NHPA), the Archaeological Resources Protection Act (ARPA), NEPA, the American Indian Religious Freedom Act (AIRFA), the Native American Graves Protection and Repatriation Act (NAGPRA), Executive Orders, and a DOI Secretarial Order. State of Montana regulations consist of the Montana State Antiquities Act (MSAA), MEPA, and the Montana Human Remains and Burial Site Protection Act.

In order to carry out the policy set forth in NEPA, it is the continuing responsibility of the federal government to use all practicable means, consistent with other essential considerations of national policy, to improve and coordinate federal plans, functions, programs, and resources to the end that the nation may, in part (and as is relevant to this discussion), preserve important historic, cultural, and natural aspects of our national heritage. Although rules and guidelines specific to NEPA have not been drafted that direct federal agencies in the identification, evaluation, and preservation of "important historic, cultural, and natural aspects of our national heritage," it is generally accepted, although not well articulated, that federal agency compliance with NHPA constitutes compliance with the portion of NEPA that mandates consideration of those resources defined as "historic properties" under NHPA.

TABLE 4.12-1. FEDERAL AND MONTANA STATE LEGISLATION AND REGULATIONS GOVERNING PROTECTION OF CULTURAL AND PALEONTOLOGICAL RESOURCES

Law or Order	Purpose (Summarized)
Federal Laws, Executive Orders, and Policy	
National Historic Preservation Act (NHPA)	Specifies a process by which federal agencies identify, consider project effects, and make efforts to protect existing or eligible historic properties during project planning for any federal undertaking, or federally funded or permitted activity. Affords the Advisory Council of Historic Preservation a reasonable opportunity to comment on a federal agency's conclusions. Requires federal agencies to solicit consultation from potentially affected Native American tribes.
Executive Order 11593, Protection and Enhancement of the Cultural Environment	Requires federal agencies to inventory and record cultural resources, and in consultation with the Advisory Council, ensure that plans and programs contribute to the preservation and enhancement of non-federally owned archaeological and historic sites. Requirements now subsumed under NHPA amendments and regulations.
National Environmental Policy Act (NEPA) (42 USC 4321 et seq.)	Requires federal agencies to take into consideration, prior to their decision making process, the potential environmental impacts of their proposed actions and reasonable alternatives to those actions. Federal agencies must consider potential impacts to ecological, aesthetic, historic, cultural, economic, social, and health resources.
Archaeological Resources Protection Act (ARPA)	Provides for the protection and confidentiality of archaeological resources on federal and Indian lands. Establishes a method for federal land managers to issue permits to conduct archeological work generally directed at NHPA compliance. Applies to all lands fee-owned by the federal government and Indian lands held in trust by the United States.
American Indian Religious Freedom Act (AIRFA)	Requires consultation with Native American organizations if an agency action will affect a sacred site on federal lands.
Native American Graves Protection and Repatriation Act (NAGPRA)	Requires consultation with the appropriate Native American tribes prior to the intentional excavation of human remains and funerary objects on federal lands. It also establishes procedures for repatriation of human remains found on federal land, as well as funerary items and human skeletal remains in federally funded institutions such as museums.
Executive Order 13007, Indian Sacred Sites	Requires federal agencies to accommodate access to and ceremonial use of Indian sacred sites on federal lands by Indian religious practitioners, shall avoid adversely affecting the physical integrity of such sites, and shall maintain the confidentiality of such sites.
American Indian Tribes and the Endangered Species Act (AITESA), Secretarial Order No. 3206	Provides guidelines for coordinating ESA compliance and tribal trust responsibilities.
Montana State Laws	
Montana State Antiquities Act (MSAA) (MCA 22-3-401 et seq.) with administrative procedures in ARMs 36.2.801 through 813	Defines the duties and responsibilities of the State Historic Preservation Office (SHPO). Mandates that state agencies, in consultation with the SHPO, develop procedures to be followed for identification of NRHP-eligible cultural (heritage) properties and paleontological (fossilized plant and animal remains which are rare and critical to scientific research) resources when the agency intends to authorize an undertaking on state-owned land.
Montana Environmental Policy Act (MEPA) (MCA 75-1-103:2 et seq.)	Requires the state agency involved in the action to, in part, take into consideration the impacts that the proposed action will have on important historic, cultural, and natural resources and, whenever possible, make efforts to preserve those properties. MEPA is not restricted to state lands and requires consideration regardless of land ownership status.
Montana Human Remains and Burial Site Protection Act (MCA 22-3-801 et seq.)	Provides for the protection of human remains and all associated grave goods accidentally discovered from unmarked, or marked but unprotected burial sites.

The NHPA requires federal agencies to follow a process to identify, and make efforts to protect, historic properties on federal lands, or within defined areas of potential effect for federally permitted or funded undertakings. The term “undertaking” refers to projects, activities, or programs partially or wholly funded, permitted, or otherwise authorized by a federal agency. The process of NHPA compliance commences with the federal agency examining the nature of the project to be authorized, permitted, or funded, and then determining if the manner of authorization meets the criteria of an undertaking.

The process to be followed under NHPA for identification of cultural resources, and their subsequent evaluation and consideration in the decision-making process, is outlined in regulations issued by the Advisory Council on Historic Preservation (ACHP) (Protection of Historic Properties [36 CFR Part 800]). It should be noted that NHPA also establishes the Advisory Council on Historic Preservation, State Historic Preservation Officers, and Tribal Historic Preservation Officers. These entities serve as review parties that provide recommendations and assist federal agencies in preservation law compliance.

The principles of the American Indian Tribes and the Endangered Species Act (AITESA) require federal agencies to work directly with Indian tribes on a government-to-government basis to promote healthy ecosystems; recognize that Indian lands are not subject to the same controls as federal public lands; assist tribes in promoting, developing, and expanding tribal programs for healthy ecosystems; be sensitive to Indian culture and provide tribes information related to tribal trust resources and Indian lands; and strive to protect sensitive tribal information from disclosure. Like most federal regulations, AITESA does not pertain to DNRC’s operations, but the USFWS must demonstrate compliance with this Act if it issues a Permit to DNRC. This is achieved by the ongoing outreach the USFWS and DNRC have conducted with tribes in the form of early scoping notices, seeking input on TCPs, discussion of project effects, and seeking input from tribal representatives regarding how to lessen identified impacts.

The process by which DNRC implements the mandates of MSAA consists of a series of steps largely conducted in consultation with the State Historic Preservation Office (SHPO) and fully outlined by ARMs 36.2.801 through 813. This process closely mirrors the previously outlined NHPA process found at 36 CFR Part 800, with the exception that MSAA does not recognize the Advisory Council on Historic Preservation, and the NHPA sets a higher standard for tribal consultation and involvement. While MEPA and MSAA are distinct and separate laws, the Montana SHPO concurs that compliance with MSAA will fulfill the environmental effects assessment requirements of MEPA.

DNRC’s process for complying with MSAA and MEPA while conducting forest management activities is described below. This process involves inventorying and evaluating cultural and paleontological resources, determining potential impacts to such resources, and applying measures intended to avoid or mitigate potential impacts during forest management activities. DNRC currently does not have resource guidelines for monitoring known historic properties (heritage properties), paleontological resources, and TCPs in the planning area.

During the initial scoping of proposed timber sales, DNRC contacts the tribal governments on the statewide timber sale scoping list and the DNRC archaeologist to inform them of the location of the proposed project area, the projected volume to be harvested, the number of road miles to be constructed or improved, the number of acres in the project area, as well as other activities associated with the project. Initially, the DNRC archaeologist will use existing information to determine if cultural and paleontological resources are present within a project's area of potential effect and decide if an inventory is warranted.

If an inventory takes place and cultural or paleontological resources are located, then cultural resources are evaluated in terms of the National Register of Historic Places (NRHP) criteria; paleontological resources are evaluated to determine if they are scientifically significant materials. If a cultural resource is evaluated in consultation with the SHPO and determined to be potentially eligible for listing in the NRHP, or if a paleontological resource of scientific value is identified, then DNRC and the SHPO determine if the qualities that make the resource a heritage property or paleontological resource will be diminished if a project is allowed to proceed. If a proposed project may adversely affect a heritage property or paleontological resource, DNRC then considers, in consultation with the SHPO, ways to avoid or mitigate adverse effects.

If an inventory does not take place, or if resources are not identified prior to the project, DNRC includes language in the MEPA document stating that if cultural and paleontological resources are found at any time during the project, the DNRC archaeologist will be contacted immediately. Additionally, DNRC includes the following language in all timber sale contracts: "If a cultural resource is discovered, the Purchaser shall immediately suspend all operations in the vicinity of the cultural resource and notify the Forest Officer. Operations may only resume if authorized by the Forest Officer. Cultural resources identified and protected elsewhere in this contract are exempted from this clause. Cultural resources, once discovered or identified, are not to be disturbed by the Purchaser, or their employees or sub-contractors."

The final relevant state law, the Montana Human Remains and Burial Site Protection Act (MCA 22-3-801), is typically invoked during an unanticipated discovery of human remains on state land. The law applies only to state and private lands within Montana because federal lands and interests are subject to the mandates of NAGPRA and AIRFA. In contrast to MSAA and MEPA, no methodical searches specific to human skeletal remains within a proposed project's area of potential effect prior to authorization of a project have been conducted to date.

Federal Tribal Trust Responsibility

The federal trust responsibility between Indian tribes and the federal government is not defined, in part, because of reluctance by tribes and Congress to place limits on the trust. This relationship has been consistently recognized by federal courts and has been described as special, unique, moral, and solemn. In addition, the rights reserved by the tribes in treaties and agreements, which were not expressly terminated by Congress, continue to this day. These tribal rights and authorities extend to natural resources, which may be reserved by treaties, executive orders, and federal statutes. The federal courts have developed the Canons of Construction, guiding premises, that treaties and other federal actions "should, when possible, be read as protecting Indian rights in a manner favorable to Indians" (Cohen 1982).

The courts' interpretation of tribal rights and treaty language continues to evolve and define federal legal responsibilities. The primary focus of the federal government trust responsibility is the protection of Indian-owned assets, natural resources on reservations, and the treaty rights and interests that tribes reserved on off-reservation lands. In carrying out its responsibilities, a federal agency must assess proposed actions to determine potential effects on treaty rights, treaty resources, or other tribal interests. Where potential effects exist, the agency must consult with affected tribes and explicitly address those effects in planning documents and final decisions. Consultation with the tribes is an essential step in carrying out this responsibility.

When used in the context of government-to-government relationships, the term consultation means an active, affirmative process that (1) identifies issues and seeks input from appropriate American Indian governments, and (2) considers their interests as a necessary and integral part of the USFWS decision-making process. The federal government has a legal obligation to consult with American Indian tribes. This legal obligation is based in laws, executive orders, and statutes. This legal responsibility is, through consultation, to consider Indian interests and account for those interests in the decision.

4.12.1.2 Paleontological and Archaeological Overviews

Paleontological Overview

A fossil is defined as the remains, trace, or imprint of a plant or animal that has been preserved in a geologic context. Generally, fossils occurring in Montana represent the course of geologic time from hundreds of millions of years ago until approximately 10,000 years ago. Typically, these materials reflect extinct forms of flora and fauna, or flora and fauna that are no longer present in a specific region. Paleontological resources (fossils of scientifically significant value) are rare in those portions of the HCP project area west of the Continental Divide, but fossil-rich outcrops of Cretaceous-age rocks are exposed in the northern half of the project area east of the Continental Divide. Although these exposures increase the potential presence of paleontological resources, overall, their likelihood in the planning area is considered very low. At this time there are only three known fossil localities in the HCP project area (Table 4.12-2).

Archaeological Overview

The planning area overlaps three culture areas, the Great Plains east of the Continental Divide, the Columbia Plateau to the west, and the Great Basin to the south. Throughout the twentieth century, anthropologists and archaeologists defined and refined the native culture areas of North America in which the tribes share many common cultural traits. Contemporary borders between states did not exist in aboriginal times and have little bearing on plant and animal distributions and indigenous land use patterns and resource exploitation.

Prehistoric resources are further subdivided into broad time periods. The earliest time period is generally labeled as the Early Prehistoric or Paleoindian period (believed to be the earliest ancestors of contemporary Native Americans) and is believed to begin at ca. 12,000 radiocarbon years before present (BP) and extend to ca. 8,000 BP. The earliest occupants of North America, in part, hunted now extinct forms of giant fauna including mammoth, mastodon, and long-horned bison. It is currently believed that a warming and drying trend depleted the large continental glaciers that covered much of the northern hemisphere at that time. This theorized extended period of drought, which may have commenced shortly before, or after, the arrival of the first peoples to the Americas, may have persisted until amelioration of climatic conditions around ca. 5,000 BP.

TABLE 4.12-2. ACRES OF INVENTORIED AND CULTURAL AND PALEONTOLOGICAL SITES DOCUMENTED IN THE HCP PROJECT AREA BY COUNTY

County	Total Trust Land Surface Acres	Trust Land Surface Acres within the HCP Project Area	Trust Land Surface Acres Inventoried within the HCP Project Area	Number of Prehistoric Archaeological Sites Known in the HCP Project Area	Number of Historic Sites Known in the HCP Project Area	Number of Traditional Cultural Properties Known in the HCP Project Area	Number of Paleontological Sites Known in the HCP Project Area
Beaverhead	334,478	61,788	1060	2	2	0	0
Deer Lodge	7,553	1,771	0	0	0	0	0
Flathead	129,904	109,717	3436	6	6	0	1
Gallatin	49,964	9,182	0	0	0	0	0
Granite	20,423	16,444	820	4	2	0	2
Jefferson	32,150	194	0	0	0	0	0
Lake	55,038	48,144	1328	0	10	0	0
Lewis and Clark	134,679	33,902	1920	16	22	1	0
Lincoln	65,362	61,991	2945	6	13	0	0
Madison	133,116	11,788	1920	2	2	0	0
Mineral	21,863	16,924	870	8	1	0	0
Missoula	69,262	56,354	1575	7	5	0	0
Park	33,400	4,314	0	0	0	0	0
Powell	61,324	37,152	2560	5	4	0	0
Ravalli	29,424	20,914	4280	3	3	0	0
Sanders	63,006	53,554	1205	6	15	0	0
Silver Bow	13,234	4,365	640	3	3	0	0
Total	**1,254,180**	**548,497**	**24,559**	**68**	**88**	**1**	**3**

The following period from 8,000 to 1,000 BP, known as the Middle Prehistoric period or Archaic, was a time when human populations increased (especially toward the end of the Middle Prehistoric period) and exploited a broader range of animals and plant resources to survive than did their Paleoindian counterparts. In some culture areas, the Archaic lifeway persisted until European contact.

For the study area, the Late Prehistoric period begins ca. 1,000 to BP to ca. AD 1750 and marks the transition from the atlatl and dart to the bow and arrow as the dominant weaponry system. It also marks abrupt changes in social order, which, in part, can be seen in the large-scale communal bison kills common to that period.

The Proto-historic period is marked by the arrival of horses of Spanish stock brought into the region by the Shoshone, and also the presence of metal and glass trade items (including firearms) initially distributed across the Canadian Plains from French and British traders. For the study area, the Proto-historic period gives way to the Historic Period with the presence of the Corps of Discovery in the region and the first known written records.

Cultural (and paleontological) resource sites are non-renewable in nature and can be easily disturbed or destroyed. Loss of these resources equates to a loss of the only existing records of Prehistoric and Proto-historic site types. Prehistoric and Proto-historic site types in the HCP project area include open campsites, cave or rockshelter occupation sites, human burials, vision quest sites, cairns (rock piles) and cairn lines, tipi ring sites, medicine wheels, stone effigies, animal kill and/or processing sites, hunting blinds, lithic extraction and processing sites, plant processing sites, and pictograph and petroglyph sites. The frequency of some of these site types, however, changes dramatically from the east side to the west side of the Continental Divide.

Table 4.12-2 summarizes cultural and paleontological information for trust lands within the planning area. To date, less than 5 percent of the trust lands within the planning area have been inventoried for cultural or paleontological resources. This includes four counties where no trust lands in the planning area have been inventoried. Inventories have located a total of 68 prehistoric archaeological sites, with an average density of one site for every 361 acres surveyed, although Lake County lands produced no sites. This density is somewhat lower than Montana SHPO data, which indicate that surveys on all categories of land in the counties within the planning area have produced one site for every 267 acres. Trust lands in the planning area are currently inventoried at the rate of approximately 1,500 acres per year, with five or fewer prehistoric sites located.

It is impossible to determine the exact nature or number of resources that may have been previously disturbed on trust lands in Montana. A few small-scale cultural resource inventories were conducted beginning in 1979, followed by more frequent investigations in subsequent years as required by the environmental review process and the MSAA. The implementation of updated research and survey designs based on the results of previous work and current methods and techniques, combined with various mitigation measures, can lead to the preservation of significant resources and provide data that will guide future research and management activities.

4.12.1.3 Cultural and Trust Resources of Native American Tribes

Native American Tribes in the Historic Period

Ethnographically, the planning area and HCP project area include both the southern and western territory of the Blackfeet and areas claimed by both the Flathead Salish and the Kootenai. Ethnographic sources indicate that several American Indian ethnic groups were present in the planning area before and during the time of earliest European contact. Groups known to have formally occupied, controlled, or used western Montana include the Flathead Salish, Upper Pend d'Oreille, Kootenai, Blackfeet, Crow, Northern Shoshone, Gros Ventre, and Plains Cree. The Flathead, Upper Pend d'Oreille, and Kootenai are widely accepted as the primary prehistoric occupants of Montana east and west of the Continental Divide, along with the Blackfeet to the east and Northern Shoshone in southwestern Montana. Other groups moved into the area from the north and east, with the Blackfeet controlling much of the region from the mid-1700s through the mid-1800s (Walker and Sprague 1998:138-140).

Two Indian reservations are located within the planning area, the Flathead Reservation (containing the Confederated Salish and Kootenai Tribes [Flathead, (Upper) Pend d'Oreille, and Kootenai]) west of the Continental Divide and the Blackfeet Reservation to the east containing the Blackfeet Tribe (see Figure D-3 in Appendix D, EIS Figures). The other federally recognized tribes listed in Table 4.12-3 traditionally used at least portions of the planning area, as did members of the tribes now located north of the International Boundary in Canada. The HCP project area is composed of trust lands, and a few scattered parcels are located within the Flathead Indian Reservation boundaries.

TABLE 4.12-3. FEDERALLY RECOGNIZED TRIBES OF MONTANA AND ADJACENT STATES WITH CULTURAL INTERESTS IN WESTERN MONTANA FORESTS

Country	Tribes
United States	
Montana, western	Flathead, Kootenai, (Upper) Pend d'Oreille
Montana, eastern	Blackfeet (South Piegan or Pikuni and Blood), Gros Ventre, Plains Cree, Assiniboine, Crow, Sioux
Idaho	Lower or Bonners Ferry Kootenai of Idaho, Coeur d'Alene, Nez Perce
Washington	Kalispel (Lower Pend d'Oreille)
Canada	Upper Kootenai of British Columbia; the North Piegan, Blackfeet, and Blood of Alberta

The establishment of reservations did not eliminate all Native American rights to their aboriginal territories. Treaties often included provisions for Indian people to continue to hunt and fish on open and unclaimed lands within their former territorial boundaries. Thus, although the majority of Indian people lived within the boundaries of their respective reservations, they continued to use their former territories for subsistence and ceremonial purposes. In some cases, reservation boundary revisions left individual Indian allotments outside the reservation boundary.

TCPs are sites eligible for inclusion in the NRHP because of their cultural importance to a "living community's" historically rooted beliefs, customs, and practices (Parker and King 1998:1-2). In Montana, these sites typically encompass both the historical and the continuing aspect of the traditional beliefs, customs, and practices of a federally recognized tribe or tribes. TCPs can be tangible or intangible and include individual sites or locations, such as vision quest sites or sweat lodges with their associated fire pits, or areas where plants or minerals are or were gathered. They also can be broader areas, such as river or stream valleys and/or all or portions of mountain ranges, that encompass multiple sites or locations and plants, animals, minerals, or pure water used in customary practices. However, not all cultural properties identified by an individual representing a specific living community as having cultural significance meet the definition and intent of TCP status. To be eligible for inclusion in the NRHP, TCPs must meet the NRHP criteria of significance and integrity (Parker and King 1998). In 1997, the Keeper of the NRHP drafted a letter intended to clarify some confusion that SHPOs were experiencing concerning TCPs. In this letter, the Keeper noted that

> *"It is critical that the [traditional] activities be documented... National Register guidance also requires information establishing that the property is of importance to the community... The documentation must specifically address the ways in which the property meets one or more of the criteria for eligibility and the information must also address the physical integrity of the property and its setting… A property or natural feature important to a traditional culture's religion and mythology is eligible if its importance has been ethnohistorically documented and if the site can be clearly defined... A significance ascribed to a property only in the last 50 years cannot be considered traditional ... The fact that a certain cultural tradition is over 50 years old ... is also not sufficient justification for determining a property eligible for listing, if the direct association between the particular tradition and the property being evaluated is less than 50 years old."*

TCPs are not a defined site type in the Montana SHPO Cultural Resource Inventory System; therefore, it is not possible to retrieve specific information about TCPs. Personnel at SHPO indicate that there may be 30 to 40 such sites in the counties contained in the planning area. DNRC is only aware of one TCP at least partially on HCP project area lands (Table 4.12-2).

The forests of Montana provided a significant portion of the subsistence base of the Native Americans who occupied the planning area prehistorically. Tribal members continue to hunt, fish, and gather animal, plant, and mineral resources from state and federal public lands for use in subsistence and traditional practices or to use as raw materials. Table 4.12-4 lists the various resources discussed or tabulated in the ethnographic literature on the various tribes. This list may not be exhaustive because most tribes and individual members are hesitant to openly discuss religious and spiritual practices and the materials used for such practices with those who are not enrolled tribal members. DNRC has not identified any tribal member who utilizes trust lands to hunt, fish, or gather any of the listed resources or generally exercises their subsistence rights. DNRC sent a letter and made telephone contact with the offices of the Confederated Salish and Kootenai Tribal Historic Preservation Office (THPO) and the Blackfeet THPO regarding use of trust lands by tribal members for hunting, fishing, or gathering or for traditional practices. Neither tribal office identified TCPs they were concerned about for the purpose of this project.

TABLE 4.12-4. CULTURALLY IMPORTANT ANIMAL, PLANT, AND MINERAL RESOURCES FOR NATIVE AMERICAN TRIBES IN WESTERN MONTANA

Resource Type	Specific Resource
Animals	Bison[1], grizzly bear[1], black bear, moose, elk, caribou, mule deer, white-tail deer, pronghorn antelope, big-horn sheep, mountain goat, porcupine, marmot, beaver, hare, rabbit, squirrel, wolf[1], wolverine, mountain lion, bobcat, badger, skunk, muskrat
Birds	Swan, sand hill crane, goose, duck, pelican, prairie chicken, spruce grouse (fool hen), partridge, chicken hawk, eggs (especially waterfowl)
Fish	Salmon (outside area), trout, sturgeon, grayling, char, chub, sucker, whitefish, squawfish, shiners
	Fresh water clam/mussel
Plants	Roots/bulbs – bitterroot, camas, wild carrot (yampah), false onion (several species), lomatium (biscuitroot, wild celery, several species), wild onion (several species), balsamroot, mariposa, tiger and chocolate lily, Indian potato, prairie or wild turnip, artichoke, wild garlic, wild thistle (several species), yellow bell, bugleweed, false-agoseris, western sweet-cicely, silverweed, water-parsnip, cattail, edible valerian, mule's ear
	Fruit/berries – huckleberry, serviceberry, blueberry, chokecherry, elderberry, bullberry, raspberry, strawberry, blackberry, dewberry, soapberry, cranberry, gooseberry, wild plum, wild or Oregon grape, currant, haw (hawthorn) berry, thimbleberry, thornberry, red-osier dogwood (red willow), kinnikinnick, rosehip, salal, pin cherry, bitter cherry
	Nuts/seeds – hazel, white-bark pine, balsamroot
	Greens – cow parsnip, fireweed, balsamroot, barestem lomatium (Indian celery) and other lomatium, mule's ear, cactus, wild rhubarb
	Leaves/tea – chokecherry, hackberry, Labrador tea, mint, wild bergamot, wild rose stems and flowers, barestem lomatium seeds and leaves
	Cambium (inner bark) – lodgepole pine, ponderosa pine, other evergreens, black cottonwood
	Pitch/gum – black pine, pine, spruce, larch, milkweed
	Mushrooms – pine, cottonwood, oyster
	Fungus/lichen – black tree lichen
	Cooking pit linings – Douglas-fir boughs, ponderosa pine needles, wild strawberry, fireweed, wild rose, mountain alder, shrubby penstemon, sticky geranium
	Medicinal/ritual for humans (internal or external) – mullein, willow bark, juniper, sagebrush, yarrow, stinging nettle, buttercup (several species), Indian hellebore, tree fungus (conk), cascara, kinnikinnick, Oregon grape, lomatium, willows, water hemlock, death camas, baneberry, juniper, sagebrush, Oregon grape, wild rose, Douglas-fir boughs, larch, lodgepole pine, ponderosa pine, native tobacco, red-osier dogwood, kinnikinnick, sweetgrass, subalpine fir, snowbrush, horsetail, mint, devil's club, plantain (several species), smooth sumac, soapberry, waxberry, mountain valerian, false Solomon's seal
	Medicinal for horses – sticky geranium, yellow pond lily, lomatium
Minerals, Rocks, etc.	Clay, fossils (ammonites), steatite, minerals (iron oxide)
Raw Materials	Trees – lodgepole pine, white pine, Douglas-fir, grand fir, subalpine fir, Engelmann spruce, cedar, western yew, Rocky Mountain maple, cottonwood, juniper, willow (several species), alder, cherry, oceanspray, silverberry, serviceberry, mock orange, red-osier dogwood, snowbrush, sagebrush
	Plants – tule, cattail, reed, beargrass, stinging nettle, Oregon grape, dock, grass (several species), moss, milkweed, horsetail, native tobacco
	Hides – bison[1/], elk, deer, mountain goat, bear, wolf[1/], coyote, fox, wolverine, badger, mountain lion, lynx, bobcat, badger, skunk, marten, fisher, mink, weasel/ermine, otter, marmot, raccoon, porcupine, beaver, muskrat, hare, rabbit, squirrel, gopher, mice
	Horns/antlers/teeth/bones/hooves/sinew – bison[1], big-horn sheep, mountain goat, elk, deer, beaver
	Feathers and other material – bald and golden eagle, hawk, owl, woodpecker, red-shafted flicker; porcupine quills
	Fungus/lichen – conks, wolf lichen

[1] Species no longer present or no longer as abundant as early contact levels.

Sources: Brunton (1998:226); Darnell (2001:642-643); DeMallie and Miller (2001:577-578); Dempsey (2001:605-607, 609-610); Fowler and Flannery (2001:679-680); Hunn et al. (1998:525-545); Lahren (1998:284-288); Malouf (1998:297-301); Voget (2001:698-701).

4.12.1.4 Historical Overview

The planning area, both east and west of the Continental Divide, followed a similar historical progression as other areas in the West. United States government explorers and fur traders came first, followed by missionaries, miners, ranchers, farmers, and other diversified commercial interests.

Known historic site types in the planning area include exploration and overland migration sites such as trails (likely Native American in origin), river fords, wagon roads, encampments, or geologic/geographic landmarks; inscriptions including pictographs, petroglyphs, or tree carvings; transportation sites such as late nineteenth to early twentieth century roads, railroad engineered features (bridges, trestles, ballast, track and ties), and construction camps; isolated trappers' or miners' cabins; homesteading, ranching, and farming sites such as residences (including foundations), outlying buildings, and structures; cultural landscape elements (including fences, field/pasture patterns, stock ponds and dams, stock trails and river fords), irrigation structures, and artifact scatters; mining and mine-related sites such as prospect pits and trenches, placer or hydraulic mine equipment or deposits, lode mining adits, shafts, waste rock, interior tramways, mills (various types), smelters, tailing piles, tailing ponds, flumes, power plants, bunkhouses, mess halls, kitchens, livestock shelters, trash dumps, trails, two-track roads, truck trails, rail lines, and construction debris (borrow pits, tree stumps); logging-related sites such as logging camps, stumps, skid lines, sky-line cables, lumber mills, power plants, roads, donkey engines, big wheels, rail lines, cables, livestock facilities, log decks, and flumes; abandoned town sites including foundations and trash dumps; and fire towers or lookouts and related cabins.

Inventories have located a total of 88 historic cultural resource sites on trust lands in the planning area (Table 4.12-2). There is an average density of one site for every 279 acres surveyed, suggesting a slightly higher density than prehistoric sites. However, this density of sites of historic age is somewhat lower than Montana SHPO data that indicate surveys on all categories of land in the counties in the planning area have produced one site for every 180 acres. Trust lands in the planning area are currently inventoried at the rate of approximately 1,500 acres per year, with five or fewer historic sites located.

4.12.1.5 Stillwater Core

While subjected to various management practices in the past, recently there has been limited timber harvest activity in the Stillwater Core, which is managed for grizzly bear security. Since the mid-1980s, there have been a total of 11 cultural resource inventories of roughly 3,400 acres on the Stillwater and Coal Creek State Forests within the Stillwater Core. A total of six cultural resource sites have been recorded within those areas and consist of historic fire lookouts, historic buildings, historic roads or trails, and an historic camp. Portions of the Stillwater Core not yet inventoried for cultural resources are likely to contain similar historic site types, as well as prehistoric lithic scatters, campsites, and mining sites.

4.12.1.6 Effects of and Trends in Climate Change

Cultural resources may be affected by climate change in a variety of ways. As discussed in previous resource sections, climate change may be altering the distributions, demographics, health, and potential for extinction of various plant and animal populations. Such effects on plants and animals important to Native American tribes could in turn affect their use of those plant and animals for subsistence and traditional practices and as raw materials. Additionally, the risk of disturbance or destruction of cultural and paleontological resources, including TCPs and historical sites, may increase due to erosion or blowdown caused by more frequent severe weather events, such as heavy downpours and windstorms.

4.12.2 Environmental Consequences

Cultural and paleontological resources provide information about past lifeways, and TCPs provide information about ongoing cultural activities. As a result, identification and protection of these non-renewable resources is important. This section discusses possible changes in potential direct and indirect effects on cultural and paleontological resources and TCPs from differences in forest management policies among the four alternatives. Cumulative effects on cultural and paleontological resources and TCPs are discussed in Chapter 5.

4.12.2.1 Introduction and Evaluation Criteria

Impacts from natural decay, landscape changes, and forest management activities potentially result in the loss of non-renewable cultural and paleontological resources and TCPs or cultural use areas on trust lands in Montana. Direct impacts to paleontological and cultural resources and TCPs or cultural use areas may result from activities such as road building, timber harvesting, construction or reconstruction of stream crossings, excavation of gravel pits, or prescribed burns that get out of control. Natural processes, such as wildfire or erosion and redeposition of soils, can also adversely affect historic properties (or heritage properties) and TCPs or cultural use areas. Such processes can be accelerated as a result of forest management activities. Indirect effects on cultural resources and TCPs or cultural use areas may include changes in stream flow or sediment loads, vandalism, and unwanted human disturbance.

This section addresses how and to what extent historic properties (heritage properties) or paleontological resources or TCPs would be affected by changes in DNRC forest management activities under the alternatives.

Several of DNRC's forest management activities have the potential to adversely affect historic properties (heritage properties) or paleontological resources or TCPs: timber harvesting, slash disposal, prescribed burning, site preparation, reforestation, road construction, and gravel quarrying for forest road surface materials. The following DNRC management activities have the potential to adversely affect TCPs and tribal trust resources, such as hunting, fishing, and plant gathering: weed control and fertilization, at least temporarily, and grazing and road construction or reconstruction across or near rivers or streams on a long-term basis. However, application of pesticides or fertilizers is not a covered activity under the HCP, and is not further analyzed in this section. Typically, DNRC applies fertilizer on road cuts or through direct application to individual planted trees. This level of application is not expected to affect TCPs or tribal ability to hunt, fish, or gather plants.

To describe and compare the likelihood of these effects among the no-action and action alternatives, the following evaluation criteria are used:

- Miles of road by classification
- Harvest levels and locations.

As previously inaccessible areas or areas with limited access to humans are made more accessible, there would be a greater possibility for unauthorized entry to cultural and paleontological resources and TCPs or cultural use areas likely to contain such resources. Those resources are currently protected from incompatible human activities by limiting access to backcountry areas. Increases in acres of land disturbed by timber harvest activities, including road construction, would increase the potential to adversely affect cultural and paleontological resources and TCPs.

For this analysis, total road miles, including those classified as abandoned or reclaimed, are used to compare the alternatives. While abandoned and reclaimed roads are no longer in use, construction and maintenance of those roads prior to abandonment or reclamation would have resulted in land surface disturbances that could have adversely affected cultural resources.

The only comment related to cultural resources that was received during public scoping recommended that "Executive Orders be addressed, specifically those that concern Indian tribal governments and Minority populations." Based on communications with both the Confederated Salish and Kootenai THPO and the Blackfeet THPO, there are currently no concerns regarding future access to TCPs or cultural use areas on trust lands. This would not be expected to change over the Permit term for any of the alternatives.

4.12.2.2 Alternative 1 (No Action)

Under Alternative 1, timber harvest and management activities on DNRC's forestlands would be no different than those of the past 12 years. Annual timber harvest under Alternative 1 would continue at the current level of more than 53 million board feet, based on annual sustainable yield (Table 4.2-14). By the end of the Permit term, roads on lands within the HCP project area would increase by 1,408 miles, for a total of 4,053 miles, including those abandoned or reclaimed during the Permit term. Of the total new road miles, 731 miles would be located on NWLO lands, 473 miles on SWLO lands, and 204 on CLO lands (Table 4.4-6). This increase over existing conditions would generally be evenly distributed across the planning area; however, most of the increased road miles over the Permit term would restrict year-round motorized public access. The largest increase in road miles would occur on scattered parcels in the NWLO, where nearly 400 miles of constructed roads would restrict year-round motorized public access. Miles of open or seasonally-restricted roads, which allow public access at least part of each year, would remain unchanged in the Stillwater Block and Swan River State Forest and increase by a total of 41 miles for all scattered parcels in the HCP project area.

DNRC would continue to operate under the existing SFLMP and Forest Management ARMs, which include the MSAA. Selected cultural and paleontological resource inventories would be conducted prior to timber harvests, gravel extraction, and road construction based on presence of known sites, high likelihood of a potential site, available personnel, and funding. Current DNRC management practices include harvest restrictions along streams within SMZs and RMZs (50- to 100-foot buffers) that may be protective of cultural and paleontological resources, although some timber harvest activities would continue to be allowed in these high-sensitivity zones. Such activities in these areas would increase the likelihood of indirect adverse effects, such as erosion of sediments from, or deposition of sediments on, cultural resources located in or near drainages. However, restricted harvest in these areas may also improve or encourage the growth of native plants important to tribal members who continue to gather those resources.

4.12.2.3 Alternative 2 (Proposed HCP)

While there would be a slight decrease in number of miles of roads under Alternative 2 as compared to Alternative 1, the increased harvest would likely increase the potential for adverse effects on cultural and paleontological resources and TCPs within the HCP project area. By the end of the Permit term, there would be 21 fewer miles of roads within the HCP project area as compared to Alternative 1 (see Table 4.4-6). The estimated annual timber harvest under this alternative would be nearly 5 million board feet greater than Alternative 1, primarily due to increased flexibility to manage timber in the Stillwater Core (Table 4.2-14).

By opening up the Stillwater Core to active forest management under Alternative 2, additional timber harvest would occur in this area, and the miles of road accessible for motorized use by the public at least part of the year would increase as compared to Alternative 1. This additional activity and increased access would increase the likelihood of adverse effects on cultural and paleontological resources and TCPs or cultural use areas.

Because the Stillwater Core would be ~~open to forest management activities~~actively managed under Alternative 2, the USFWS, DNRC, and SHPO have developed a process for inventorying, evaluating, and avoiding or mitigating impacts to cultural resources specific to this area. Tribal governments that may potentially have interest in this area are currently being contacted to review this process.

Under Alternative 2, DNRC would apply a 50-foot no-harvest buffer in RMZs for Class 1 streams and lakes ~~with HCP fish species~~ (commitment AQ-RM1). This would provide increased protection of cultural and paleontological resources and TCPs or cultural use areas located in those areas as compared to current practices that would be followed under Alternative 1. Harvest restrictions in RMZs for all other classes of streams and lakes would be the same as those under Alternative 1.

Under Alternative 2, DNRC would implement current cultural resource management procedures for HCP project area lands. DNRC would be required to comply with the mandates of MSAA and MEPA for future ground-disturbing undertakings. Issuance of the Permit would not change the potential for DNRC to affect historic properties. Similarly, tribal access to TCPs would not be changed.

4.12.2.4 Alternative 3 (Increased Conservation HCP)

Alternative 3 would result in a lower level of timber harvest and fewer miles of road at the end of the Permit term as compared to Alternatives 1 and 2. Consequently, this alternative would be expected to have a lower likelihood for adverse effects on cultural and paleontological resources and TCPs or cultural use areas. Under Alternative 3, timber harvest and management activities on DNRC's forestlands would be lower than Alternatives 1 and 2, as would miles of road present in the

HCP project area at the end of the Permit term. The estimated annual timber harvest under Alternative 3 would be about 3 million board feet lower than Alternative 1 and 7 million board feet lower than Alternative 2 (Table 4.2-14). Alternative 3 would result in 86 fewer miles of roads within the HCP project area than under Alternative 1 and 65 fewer miles than Alternative 2 (Table 4.4-6). While the majority of this decrease would be among the scattered parcels of the NWLO, there would also be fewer miles in the SWLO. Miles of road at the end of the Permit term and timber harvest levels within the Stillwater Block would be the same as those under Alternative 1 because the Stillwater Core would be retained. As for Alternatives 1 and 2, most of the new road miles under Alternative 3 would be restricted year-round to motorized public access, which would partially offset the potential for adverse effects on cultural resources from human activity and access.

Compared to Alternatives 1 and 2, an 80- to 120-foot no-harvest buffer for RMZs on Class 1 streams and lakes with HCP fish species would provide the greatest protection of cultural and paleontological resources and TCPs or cultural use areas located in those areas. ~~As for Alternative 2, however, harvest restrictions in RMZs for all other classes of streams and lakes would be the same as those under Alternative 1.~~

Similar to Alternative 2, DNRC would implement current cultural resource management procedures for HCP project area lands. However, since the Stillwater Core would be retained, the process of inventorying, evaluating, and mitigating for cultural resources in this area would not apply.

4.12.2.5 Alternative 4 (Increased Management Flexibility HCP)

Under Alternative 4, estimated annual timber harvest would be slightly higher than under Alternative 2 and total road miles ~~at the end of the Permit term~~ would be equivalent to those under Alternative 2 at the end of the Permit term (Tables 4.2-14 and 4.4-6). While timber harvest would vary somewhat between land offices, as compared to Alternative 2, the likelihood for adverse effects on cultural and paleontological resources and TCPs or cultural use areas would be similar. Like Alternative 2, the Stillwater Core would likely experience more timber harvest due to increased ~~flexibility for~~active management in this area. ~~As for Alternative 2, a~~The 25-foot no-harvest buffer for RMZs on Class 1 streams and lakes with HCP fish species would also provide increased protection of cultural and paleontological resources and TCPs or cultural use areas located in those areas, although not to the same degree as the 50-foot no-harvest buffers that would be applied to all Class 1 streams and lakes under Alternative 2.

Similar to Alternatives 2 and 3, DNRC would implement current cultural resource management procedures for HCP project area lands. The process for inventorying, evaluating, and mitigating impacts to cultural resources in the Stillwater Core would apply since this area would be open to management activities as it would under Alternative 2.

4.12.2.6 Effects on Tribal Trust Resources

In accordance with DOI Secretarial Order #3206, American Indian Tribal Rights, Federal-Tribal Trust Responsibilities, and the ESA, no adverse effects on Tribal Trust Resources are anticipated. As described above, all alternatives would construct more roads, thereby increasing the risk of potential effects on TCPs or cultural use areas on trust lands. However, one indirect benefit to cultural use areas and TCPs under all the alternatives would be the large amounts of road with restricted motorized public access year-round. Alternatives 2 and 4, which would also increase timber harvest, would also increase the risk of potential effects on TCPs or cultural use areas on trust lands. Some of these adverse effects may be offset by the 50-foot no-harvest buffers implemented along Class 1 streams and lakes for Alternative 2 and the 25-foot no-harvest buffers implemented on streams supporting HCP fish species for Alternative 4. Alternative 3 represents the least risk to TCPs or cultural use areas on trust lands because it proposes the least amount of annual timber harvest, the lowest amount of new roads at the end of the Permit term, the widest buffers for streams supporting HCP fish species, and retention of the Stillwater Core.

The USFWS, DNRC, SHPO, and ACHP have entered into a Programmatic Agreement (PA) to address the potential effects of increased timber harvest in the Stillwater Core. Additionally, the USFWS and DNRC have initiated government-to-government consultation with all affected tribes. The PA and ongoing tribal consultations are discussed in more detail in Chapter 6, Scoping and Public Involvement.

4.12.2.7 Summary

Within DNRC's existing forest management program, activities associated with timber harvest and road construction are the primary sources of potential adverse effects on non-renewable cultural and paleontological resources and TCPs or cultural use areas on trust lands. For the four alternatives, Table 4.2-14 indicates that annual timber harvest would range from just under 51 to 58 million board feet per year, and Table 4.4-6 indicates that there would be between 1,322 and 1,408 miles of new road constructed on HCP project area lands. The one indirect benefit to cultural and paleontological resources and TCPs under all the alternatives would be the large amounts of road with restricted motorized public access year-round.

Alternative 3 would result in the least amount of annual timber harvest, the lowest amount of new roads at the end of the Permit term, the widest buffers for stream systems supporting HCP fish species, and retention of the Stillwater Core. Thus, this alternative would be expected to have the lowest likelihood of adversely affecting cultural and paleontological resources and TCPs or cultural use areas.

Alternative 1 would be expected to have a lower likelihood of adverse effects resulting from timber harvest as compared to Alternatives 2 and 4. Conversely, Alternatives 2 and 4 would be expected to have a lower likelihood of adverse effects from road construction than Alternative 1 and lower likelihood of adverse effects from timber harvest along streams supporting HCP fish species due to the no-harvest buffers that would be implemented for those alternatives. However, within the Stillwater Block, Alternatives 2 and 4 would result in a higher likelihood of adverse effects to cultural and paleontological resources and TCPs or cultural use areas because there would be increased ~~flexibility to manage~~active management in the Stillwater Core. Additional harvest activities, as well as increased public access to the Stillwater Core, would increase risks to existing resources in the area.

Anticipated climate changes over the Permit term may increase the risk of effects from the alternatives on cultural and paleontological resources and TCPs or cultural use areas on trust lands. More extreme weather events, such as intense downpours, may increase the potential for erosion and mass movements (where soils and landforms are prone to these types of events). The larger amounts of harvested area and more miles of new roads under Alternative 4, followed by Alternative 2, may result in a larger amount of area within which there would be a risk of disturbance or destruction of cultural resources as compared to Alternatives 1 and 3. However, the additional commitments under the action alternatives to reduce risks of erosion and sediment delivery to streams and prohibit harvest in some riparian areas would likely lessen the potential risks from climate change on cultural resources in those high-sensitivity areas.

Regarding culturally important plant and animal species, discussions about potential effects of the alternatives on plant and animal species in light of anticipated climate changes are included in Section 4.7 (Plant Species of Concern, Noxious Weeds, and Wetlands), Section 4.8 (Fish and Fish Habitat), and Section 4.9 (Wildlife and Wildlife Habitat).

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4.13 Socioeconomics

Quality of life incorporates a number of factors (Center for Rural Affairs 2007), including (1) availability of good-paying jobs; (2) access to critical services, such as education and health care; (3) strong communities; and (4) a healthy natural environment. Management of the HCP project area could affect the people and communities in the overall planning area, thus the affected environment and environmental consequences of the four alternatives on social and economic values that contribute to quality of life are described in this section. An evaluation of environmental justice is also provided at the end of this section.

4.13.1 Affected Environment

While there is no specific regulatory framework under which DNRC addresses socioeconomic conditions, it does have a fiduciary responsibility to maximize revenues for its trust beneficiaries in the short and long term. Generation of revenues for the trusts affects socioeconomic conditions because these revenues support employment and operations for the trust beneficiaries.

This section describes the existing regional social and economic conditions within the planning area. FMB revenues are also summarized, as are revenues generated from recreational licenses and residential leases. Finally, this section closes with a discussion of natural amenities and non-use values because these contribute to quality of life within the planning area.

4.13.1.1 Regional Social and Economic Conditions

The State of Montana and U.S. Census Bureau primarily report socioeconomic data by county, which is the approach used for this section of the EIS. There are 25 counties in the planning area, shown in Figure D-23 in Appendix D (EIS Figures).

Flathead County has the greatest amount of HCP project area within its boundaries (109,688 acres) (Table 4.13-1). In comparison, although Broadwater, Cascade, Glacier, Liberty, Meagher, Teton, and Toole Counties are in the planning area, they have no HCP project area lands within county boundaries. Total acreage by county may fluctuate through the years based on trust land sales and acquisitions.

Population

The population of the planning area was estimated to be 644,231 people in 2006 (Table 4.13-2). Although the overall population of the counties comprising the planning area increased between 2005 and 2006 by 7,736 (1.2 percent), 10 of the 25 counties had small population declines (Table 4.13-2). Missoula County, which is located in the SWLO, had the largest population in the planning area due to the urban population in the city of Missoula.

By 2020, the planning area population is projected to increase to 762,630 people, which represents an 18.4 percent increase over the 2006 population. Over 60 percent of the population growth is projected to be concentrated in three counties: Flathead, Gallatin, and Missoula. Conversely, Cascade, Deer Lodge, Liberty, Pondera, Teton, and Toole Counties are projected to decrease in population by 2020.

TABLE 4.13-1. ACREAGE OF LAND BY COUNTY FOR THE PLANNING AREA AND HCP PROJECT AREA

County	Land Office[1]	County (Acres)	Planning Area (Acres)	Project Area (Acres)
Flathead	NWLO	3,361,229	131,252	109,688
Lake	NWLO	1,057,296	55,060	48,145
Lincoln	NWLO	2,350,959	65,852	62,020
Sanders	NWLO	1,783,681	64,105	53,558
Deer Lodge	SWLO	473,937	7,869	1,768
Granite	SWLO	1,107,788	20,639	16,426
Mineral	SWLO	782,064	22,460	16,924
Missoula	SWLO/NWLO	1,673,590	69,423	56,365
Powell	SWLO/NWLO	1,491,165	60,002	37,175
Ravalli	SWLO	1,534,902	29,486	20,915
Silver Bow	SWLO	459,500	13,486	4,369
Beaverhead	CLO	3,566,469	336,938	61,804
Broadwater	CLO	791,402	24,127	0
Cascade	CLO	1,733,226	78,408	0
Gallatin	CLO	1,620,256	49,676	9,191
Glacier	CLO	1,942,247	8,301	0
Jefferson	CLO	1,060,932	32,565	198
Lewis & Clark	CLO/SWLO	2,235,984	133,959	33,904
Liberty	CLO	925,691	86,573	0
Madison	CLO	2,305,465	134,108	11,774
Meagher	CLO	1,530,860	90,692	0
Park	CLO	1,704,924	35,429	4,305
Pondera	CLO	1,049,827	58,558	0
Teton	CLO	1,465,419	103,855	0
Toole	CLO	1,244,063	99,536	0
Yellowstone Park	CLO	159,355	0	0
Planning Area Total/Average		**39,412,231**	**1,812,358**	**548,530**

[1] Counties split by land office boundaries are listed with the land office in which they have the most area.
Source: DNRC (2008a).

Employment and Income

Income and employment data can help characterize the economy of the planning area. Historically, Montana's economy depended on natural resources (DNRC 2004f). The mountainous regions of western Montana yielded timber for wood products manufacturing and minerals for mining. However, the economy in recent years has relied less on natural resources and more on service-producing jobs, and tourism is becoming more important. Education, health, accommodations, arts, food, and other services; retail/wholesale; government; and construction/manufacturing were the industrial sectors that employed the most people in the planning area in 2005 (Table 4.13-3).

TABLE 4.13-2. 2005 AND 2006 POPULATION ESTIMATES AND DENSITIES AND 2020 POPULATION PROJECTION FOR COUNTIES IN THE PLANNING AREA

County	Land Office[1]	2005 Population Estimate	2005 Population Density (Persons per Square Mile)	2006 Population Estimate	2006 Population Density (Persons per Square Mile)	2020 Population Projection
Flathead	NWLO	83,172	15.8	85,314	16.2	108,910
Lake	NWLO	28,297	17.1	28,606	17.3	35,980
Lincoln	NWLO	19,193	5.2	19,226	5.2	20,920
Sanders	NWLO	11,057	4.0	11,138	4.0	13,170
Deer Lodge	SWLO	8,948	12.1	8,888	12.0	8,160
Granite	SWLO	2,965	1.7	2,909	1.7	3,360
Mineral	SWLO	4,014	3.3	4,057	3.3	4,700
Missoula	SWLO/NWLO	100,086	38.3	101,417	38.8	123,310
Powell	SWLO/NWLO	6,999	3.0	6,997	3.0	7,810
Ravalli	SWLO	39,940	16.7	40,582	16.9	55,500
Silver Bow	SWLO	32,982	45.9	32,801	45.7	33,010
Beaverhead	CLO	8,773	1.6	8,743	1.6	9,630
Broadwater	CLO	4,517	3.7	4,572	3.7	5,640
Cascade	CLO	79,569	29.4	79,385	29.3	75,940
Gallatin	CLO	78,210	30.9	80,921	32.0	107,100
Glacier	CLO	13,552	4.5	13,578	4.5	13,900
Jefferson	CLO	11,170	6.7	11,256	6.8	14,680
Lewis & Clark	CLO/SWLO	58,449	16.7	59,302	17.0	72,880
Liberty	CLO	2,003	1.4	1,863	1.3	1,830
Madison	CLO	7,274	2.0	7,404	2.1	8,760
Meagher	CLO	1,999	0.8	1,968	0.8	2,130
Park	CLO	15,968	6.0	16,084	6.0	18,900
Pondera	CLO	6,087	3.7	6,032	3.7	5,680
Teton	CLO	6,240	2.7	6,115	2.7	6,060
Toole	CLO	5,031	2.6	5,073	2.6	4,670
Planning Area Total/Average[2]		**636,495**	**10.4**	**644,231**	**10.5**	**762,630**
Montana		935,670	7.6	944,632	7.6	1,083,050

[1] Counties split by land office boundaries are listed with the land office in which they have the most area.
[2] Excludes 159,355 acres in Yellowstone National Park.
Sources: Montana Department of Commerce (2006a,b); U.S. Census Bureau (2000).

TABLE 4.13-3. EMPLOYMENT BY INDUSTRY FOR EACH COUNTY IN THE PLANNING AREA (2005)

Region Name	Farming/ Mining	Construction/ Manufacturing	Government	Forestry, Fishing, Related Activities	Utilities	Retail/ Wholesale	Transportation and Warehousing	Information	Finance and Insurance	Real Estate and Rental and Leasing	Professional and Technical Services & Management	Administrative and Waste Services	Education, Health, Accommodation, Arts, Food, and Other Services	Total Employment
Beaverhead	674	505	1,117	NA	NA	722	NA	44	141	303	206	84	1,005	**5,671**
Broadwater	314	535	359	NA	NA	213	73	NA	58	109	64	NA	341	**2,377**
Cascade	1,255	4,167	9,460	NA	199	8,467	1,229	NA	3,008	1,651	2,225	1,672	15,861	**50,324**
Deer Lodge	125	406	932	NA	NA	427	NA	41	130	159	163	NA	1,156	**4,420**
Flathead	1,518	10,745	4,910	817	206	8,997	1,386	832	2,229	3,005	3,045	3,907	16,544	**58,141**
Gallatin	1,342	10,895	9,164	599	95	9,745	1,172	934	1,878	3,291	4,925	2,201	16,841	**63,082**
Glacier	710	-	2,393	NA	70	744	116	38	NA	NA	-	NA	1,494	**6,370**
Granite	193	253	289	NA	NA	199	84	NA	NA	NA	-	36	-	**1,825**
Jefferson	336	791	1,011	NA	NA	435	185	30	143	386	288	201	1,156	**5,578**
Lake	1,344	2,225	2,720	214	NA	1,940	NA	177	395	463	567	NA	3,552	**14,245**
Lewis & Clark	678	3,495	9,318	NA	88	5,514	939	935	2,272	1,309	2,950	NA	12,232	**41,531**
Liberty	326	-	170	NA	-	112	NA	NA	NA	NA	22	NA	128	**1,245**
Lincoln	312	1,285	1,493	NA	NA	1,311	260	127	210	418	285	235	1,560	**9,499**
Madison	706	796	563	100	11	400	153	14	132	314	-	148	1,920	**5,660**
Meagher	232	-	176	NA	NA	105	NA	NA	NA	17	-	NA	233	**1,214**
Mineral	98	389	351	93	NA	329	NA	NA	29	80	51	46	443	**2,129**
Missoula	767	8,390	10,555	839	176	12,694	2,693	1,449	2,527	2,953	5,331	3,129	23,560	**75,063**
Park	601	1,459	860	180	43	1,192	165	147	265	426	480	NA	3,519	**9,684**
Pondera	576	384	490	NA	21	516	70	25	88	80	-	NA	369	**3,239**
Powell	350	-	1,116	NA	NA	276	69	NA	78	105	98	NA	292	**3,608**
Ravalli	1,321	3,571	2,234	NA	40	2,653	469	174	581	1,248	1,119	847	5,077	**19,768**
Sanders	597	824	759	253	47	604	200	54	126	285	174	85	827	**5,659**
Silver Bow	156	1,574	2,745	NA	572	3,149	504	391	482	562	1,201	NA	7,104	**20,041**
Teton	737	251	555	NA	49	495	132	215	145	84	93	NA	236	**3,592**
Toole	444	-	720	NA	NA	287	249	64	96	67	-	NA	459	**3,480**
Planning Area Counties[1]	**15,712**	**52,940**	**64,460**	**3,095**	**1,617**	**61,526**	**10,148**	**5,691**	**15,013**	**17,315**	**23,287**	**12,591**	**115,909**	**417,445**

[1] Employment totals for the planning area do not include employment for counties where information was not available (D and L).
Source: Bureau of Economic Analysis (2008).

In 2006, the overall unemployment rate in the planning area was 3.8 percent (Table 4.13-4). Lincoln and Glacier Counties had the highest unemployment rates, both with 6.4 percent unemployment. Beaverhead, Gallatin, Madison, Teton, and Toole Counties had the lowest unemployment rates (less than 3 percent each).

Average per capita income in the planning area was $26,261 in 2005 (Table 4.13-4). This is lower than the state per capita income of $29,015. Cascade, Flathead, Gallatin, Lewis and Clark, Missoula, and Silver Bow Counties had per capita incomes over $30,000, the highest in the planning area. Sanders County had a per capita income of $20,164, the lowest in the planning area.

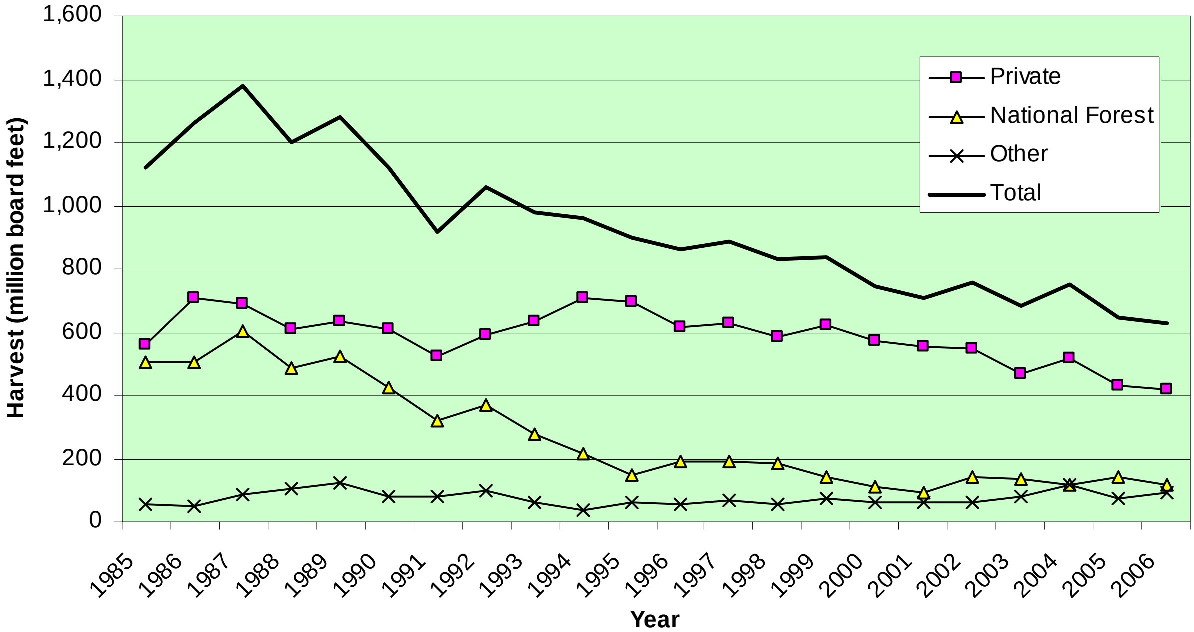
TABLE 4.13-4. UNEMPLOYMENT RATE (2006) AND PER CAPITA INCOME (2005) FOR THE PLANNING AREA

County	Land Office[1]	2006 Unemployment	2005 Per Capita Income
Flathead	NWLO	3.6	$30,008
Lake	NWLO	4.6	$21,726
Lincoln	NWLO	6.4	$21,769
Sanders	NWLO	5.0	$20,164
Deer Lodge	SWLO	4.6	$23,945
Granite	SWLO	4.2	$24,652
Mineral	SWLO	4.7	$22,057
Missoula	SWLO/NWLO	3.0	$30,608
Powell	SWLO/NWLO	4.7	$21,624
Ravalli	SWLO	4.0	$24,758
Silver Bow	SWLO	3.5	$31,324
Beaverhead	CLO	2.8	$27,382
Broadwater	CLO	3.0	$24,398
Cascade	CLO	3.2	$30,647
Gallatin	CLO	2.3	$32,434
Glacier	CLO	6.4	$22,091
Jefferson	CLO	3.4	$29,488
Lewis & Clark	CLO/SWLO	3.0	$31,151
Liberty	CLO	2.9	$26,471
Madison	CLO	2.9	$27,181
Meagher	CLO	4.1	$24,785
Park	CLO	3.1	$26,745
Pondera	CLO	3.8	$25,286
Teton	CLO	2.9	$27,679
Toole	CLO	2.6	$28,161
Planning Area Average[2]		**3.8**	**$26,261**
Montana		3.3	$29,015

[1] Counties split by land office boundaries are listed with the land office in which they have the most area.
[2] Excludes 159,355 acres in Yellowstone National Park.
Sources: Montana Department of Labor & Industry (2008); Montana Department of Commerce (2007).

<u>Historical and Current Statewide Timber Harvest Levels by Ownership</u>

Total statewide timber harvest has declined from a peak of approximately 1,400 million board feet in 1987 to 600 million board feet in 2006 (Figure 4.13-1). Harvest of timber on privately owned lands has accounted for between 66 and 77 percent of the total harvest since 1995. On USFS lands, harvest declined sharply between the late-1980s and mid-1990s. Harvest from the combined BLM, state, and tribal land base has increased from 6.6 percent of the total harvest in 1995 to 14.3 percent in 2006. Total harvest on the combined BLM, tribal, and state lands between 1995 and 2006 have fluctuated between 56.6 and 114.3 million board feet, with no clear trend. As shown in Figure 4.13-1, timber harvest from forested trust lands does not make a large contribution to forestry-related employment in the planning area.



Notes: Other includes harvest from tribal, BLM, and state lands.
2006 estimates are preliminary.
Source: Keegan (2007, personal communication).

FIGURE 4.13-1 STATEWIDE TIMBER HARVEST BY LAND OWNER

4.13.1.2 Forest Management Bureau Revenues

This section summarizes the FMB's revenues associated with managing timber resources on trust lands. The FMB oversees forested trust lands to provide income to trust beneficiaries through the sale of forest products. Table 2-3 in Chapter 2 (Environmental and Procedural Setting) shows that more than 80 percent of commercial forestlands are located within the planning area, indicating that most FMB revenues are generated from lands located within the NWLO, SWLO, or CLO.

As discussed in Section 2.2.2 (Trust Land Management Division), the FMB is one of four bureaus within the TLMD that are responsible for managing trust land resources to produce revenues for the trust beneficiaries. Table 4.13-5 summarizes the TLMD's statewide revenues by bureau for fiscal year 2006. Net revenues are those funds available for distribution to the trust beneficiaries. In fiscal year 2006, the FMB contributed 12 percent of the total net revenues generated, while the Minerals Management Bureau generated more than 60 percent. For fiscal year 2006, the three land offices in the planning area had net trust revenues of $17,349,000 (Table 4.13-6), representing about 25 percent of statewide net trust revenues. Given that most commercial forestlands are located within the planning area, however, the percentage of FMB revenues generated within the planning area is likely much higher.

TABLE 4.13-5. FISCAL YEAR 2006 STATEWIDE TRUST REVENUES FOR THE TLMD

Bureau	Gross Revenues	Net Revenues
Forest Management	$15,875,615	$8,262,120
Agriculture and Grazing Management	$16,852,496	$15,286,727
Minerals Management	$42,716,187	$41,749,704
Real Estate Management	$4,210,017	$2,878,138
Total	**$79,654,315**	**$68,176,688**

Source: DNRC (2006i).

TABLE 4.13-6. FISCAL YEAR 2006 TRUST REVENUES IN THE PLANNING AREA FOR THE TLMD

	NWLO	SWLO	CLO	Planning Area Total
Number of Employees	54	26	17	97
Gross Revenues	$9,960,000	$4,297,000	$9,446,000	$23,703,000
Net Revenues	$6,325,000	$2,741,000	$8,328,000	$17,394,000

Source: DNRC (2006i).

In the planning area in fiscal year 2006, the FMB oversaw 424,311 net forested acres (Table 4.13-7). Net forested acres exclude acres of roads, rivers, and lakes to obtain an estimate that is closer to the actual acres available for timber management. Although these acres are classified forest, revenues generated include those from timber sales, and any other uses that may be occurring on the lands, such as grazing licenses. In fiscal year 2006, the value of net classified forest acres on trust lands in the planning area was $318,156,287. The 10-year average annual net revenue from commodity sales on forested trust lands in the planning area was $3,163,427, and the average rate of return on state classified forests was 1.3 percent (Table 4.13-7).

TABLE 4.13-7. REVENUES EARNED DURING FISCAL YEAR 2006 ON CLASSIFIED FOREST LANDS IN THE PLANNING AREA

	NWLO	SWLO	CLO	Planning Area Total
Net Classified Forest Acres[1]	275,805	126,654	21,852	424,311
Value of Net Classified Forest Acres	$236,513,354	$70,640,235	$11,002,698	$318,156,287
Ten-Year Average Annual Net Revenue from Commodity Sales	$1,590,438	$1,460,370	$112,619	$3,163,427
Average Rate on Return on State Classified Forests (%)	0.8	3.2	0.7	1.3

[1] Net classified forest acres based on land records maintained in DNRC's Trust Land Management System, which do not match GIS-based calculations.

Source: DNRC (2006i).

Between 2000 and 2006, annual timber harvest statewide has fluctuated between 37.8 and 56.5 million board feet, with gross revenues of between $8.2 and $16.6 million (Table 4.13-8). After expenses, the FMB contributed between $3.1 and $9.1 million in net revenues to trust beneficiaries during this period. The FMB's expenses averaged 49 percent during this period, including costs associated with managing forested trust land resources; maintaining roads; and preparing, administering, and monitoring timber sales and permits. On average, the FMB generated $240,392 in gross revenues and $118,933 in net revenues per million board feet of harvested timber while spending $121,459 per million board feet (Table 4.13-8).

TABLE 4.13-8. STATEWIDE TIMBER VOLUMES, REVENUES, AND EXPENDITURES FROM DNRC LANDS

Year	Volume Harvested[1]	Volume Sold[1]	Gross Revenues	Total Expenditures[2]	Net Revenues	Net Revenues as a Percent of Gross Revenues
2000	53.3	44.9	$12,116,479	$4,629,921	$7,486,558	62
2001	37.8	49.1	$8,578,175	$5,046,942	$3,531,233	41
2002	41.8	44.7	$9,686,844	$4,690,832	$4,996,012	52
2003	44.5	43.0	$8,278,792	$5,140,093	$3,138,699	38
2004	46.0	50.1	$11,043,525	$6,260,251	$4,783,274	43
2005	57.3	57.8	$16,596,191	$7,521,180	$9,075,011	55
2006	56.5	53.3	$15,875,615	$7,613,495	$8,262,120	52
Average	**48.2**	**49.0**	**$11,739,374**	**$5,843,245**	**$5,896,130**	**49**
Average of Revenues and Expenditures per Million Board Feet of Volume Harvested			$240,392	$121,459	$118,933	

[1] Volumes are in million board feet.
[2] Total expenditures include revenues collected for DNRC's forest improvement program.
Sources: DNRC (2004g, 2006a, 2006i).

In addition to revenues generated to manage trust lands and for distribution to trust beneficiaries, the timber harvested from forested trust lands also generates forestry sector jobs and associated wages. Table 4.13-9 shows estimated forestry sector jobs and wages sustained by the volume of timber harvested each year from 2000 to 2006. On average, timber harvest on trust lands resulted in nearly 500 direct forestry sector jobs and $19 million in associated wages per year. Given the large proportion of DNRC's commercial forestland located within the planning area, most of these jobs and wages are likely to exist within the NWLO, SWLO, and CLO.

The amount of timber sold on trust lands is directly related to the annual sustainable yield, which is recalculated using a forest management model at least every 10 years under the direction of the legislature and the Land Board. As described in Section 4.2 (Forest Vegetation), the model used to calculate annual sustainable yield seeks to maximize harvest across the planning horizon and optimize PNV while meeting management policies and constraints. Optimization of PNV ensures that net income from timber harvested on forested trust lands is maximized for trust beneficiaries over the planning horizon. PNV can vary for the same annual sustainable yield, depending on constraints that can increase or decrease the cost of harvesting the same amount of timber volume.

TABLE 4.13-9. ESTIMATED STATEWIDE DIRECT FORESTRY SECTOR EMPLOYMENT AND WAGES BASED ON ANNUAL VOLUME HARVESTED

Year	Volume Harvested	Number of Jobs[1]	Total Wages[2]
2000	53.3	533	$20,719,842
2001	37.8	378	$14,694,372
2002	41.8	418	$16,249,332
2003	44.5	445	$17,298,930
2004	46.0	460	$17,882,040
2005	57.3	573	$22,274,802
2006	56.5	565	$21,963,810
Average	**48.2**	**482**	**$18,726,161**

[1] Calculated using 10 jobs per million board feet, which is an average of 9 jobs per million board feet for saw logs and pulp and 11 jobs per million board feet for sawtimber harvested and processed (source: Keegan 2008, personal communication).
[2] Calculated as the product of number of jobs and average forestry salary ($38,874).
Source: DNRC (2006a).

In 2004, DNRC recalculated its annual sustainable yield as 53.2 million board feet with a PNV of $146 million (Table 4.2-5). Of the total annual sustainable yield calculated, all but 2.5 million board feet was expected to come from forestlands within the planning area (Table 4.2-6). While the annual sustainable yield is a goal, actual timber harvest fluctuates from year to year based on current price, expected future price, availability of timber from other sources, and periodic events such as fires (DNRC 2006i). Using the annual sustainable yield as an average, and based on the distribution of volume by land office, Table 4.13-10 provides estimates of revenues, expenditures, and direct forestry sector employment and wages that would be expected for that volume of annual timber harvest.

TABLE 4.13-10. ESTIMATED REVENUES, EXPENDITURES, AND DIRECT FORESTRY SECTOR EMPLOYMENT AND WAGES BASED ON ANNUAL SUSTAINABLE YIELD WITHIN THE PLANNING AREA BY LAND OFFICE

	NWLO	SWLO	CLO	Total
Volume[1]	33.2	13.6	3.9	50.7
Gross Revenues[2]	$7,981,008	$3,269,329	$937,528	$12,187,865
Expenditures[3]	$4,032,449	$1,651,846	$473,691	$6,157,986
Net Revenues[4]	$3,948,559	$1,617,482	$463,837	$6,029,878
Number of Jobs[5]	332	136	39	507
Wages[6]	$12,906,168	$5,286,864	$1,516,086	$19,709,118

[1] Volumes are in million board feet from Table 4.2-6.
[2] Using an average of $240,392 per million board feet from Table 4.13-8.
[3] Using an average of $121,459 per million board feet from Table 4.13-8.
[4] Using an average of $118,933 per million board feet from Table 4.13-8.
[5] Calculated using 10 jobs per million board feet as in Table 4.13-9.
[6] Calculated using an average forestry salary of $38,874 as in Table 4.13-9.

4.13.1.3 Recreational License and Residential Lease Revenues

Recreational uses on trust lands generate revenues for the trust through license sales and residential leases. While recreational licenses and residential leases (cabin and home sites) are administered by DNRC's Real Estate Management Bureau, the availability of recreation opportunities on forested trust lands contributes to the revenues generated from these licenses and leases. This section summarizes revenues generated from recreational use licenses and residential leases.

All recreational activities (including hunting, fishing, hiking, camping, picnicking, etc.) on trust lands require a recreational use license from DNRC. The type of license required depends on the type of activity conducted and includes general licenses and special-use licenses. DNRC issues licenses for other activities not included in the general recreation category, such as cutting or gathering wood; collecting valuable rocks and minerals; and collecting or disturbing archaeological, historical, or paleontological sites (e.g., fossils, artifacts, dinosaur bones, old buildings, etc.). Information about revenues from other licenses is not available and is not discussed further.

<u>General Recreational Use Licenses</u>

A general recreational use license is required for most types of non-commercial or non-concentrated activities. People who hunt or fish on trust lands are required to have a general recreational license, as well as the appropriate hunting or fishing license issued by MFWP. From 1992 through February 28, 2004, individuals hunting or fishing on state lands were required to purchase separate licenses for their activities. Many individuals were unaware of the need for a recreational use permit, and revenues from those sales were unrealized. Since March 1, 2004, the recreational use permit fee to use state lands for licensed hunting and fishing has been included in the cost of hunting and fishing licenses. Revenues from general license sales increased by 44 percent from 2003 to 2004 as a result of this change in policy (Table 4.13-11).

TABLE 4.13-11. STATEWIDE GROSS REVENUES FROM RECREATIONAL USE LICENSE SALES, LICENSE YEARS 1998 TO 2006[1]

License Type	1998	1999	2000	2001	2002	2003	2004	2005	2006
General (number sold)	34,035	36,479	37,605	39,089	47,764	50,795	434,106[3]	464,432[4]	446,171
General (revenues)[2]	$336,840	$348,300	$381,740	$387,020	$517,730	$558,690	$801,980	$981,052	$934,035
Special (revenues)	$80,750	$86,170	$98,950	$104,200	$114,600	$91,200	$112,300	$109,378	$103,613

[1] The license year extends from March 1 through the last day of the following February.
[2] Revenues from 2004 through 2006 include those from sales of general license sales and from conservation licenses.
[3] Includes 4,200 general licenses and 429,906 conservation licenses.
[4] Includes 6,029 general licenses and 458,403 conservation licenses.
Sources: DNRC (2005c, 2005d, 2006a).

With the exception of a slight decline between 2005 and 2006, sales of general recreational use licenses increased steadily between 1998 and 2006 (Table 4.13-11). Annual increases generally ranged from 3 percent to 22 percent. The sharp increase between 2003 and 2004 reflects the effect of combining the recreational use permit and conservation license programs. Not all recreational users of trust lands are aware of the requirement for a recreational use license. Therefore, license sales data likely underestimate the actual amount of recreational use on trust lands. Note also that the values in Table 4.13-11 represent license sales statewide rather than within the planning area. Data on licenses sold or revenues from licenses sold within the planning area specifically are not available. In addition, the location of a license sale does not necessarily reflect the location of the recreation activity; a person purchasing a license in one area is not required to recreate on state land in the same area.

Special Recreational Use Licenses

A special recreational use license, which is available only from DNRC offices, is required for trapping, commercial recreational use (such as outfitting), and concentrated (group) use. Commercial outfitting, most commonly for big game hunting or river rafting trips, accounts for most special recreational use license sales. In 2000-2001, for example, more than 95 percent of the revenue from such sales came from licenses for outfitting (Frickel 2005, personal communication). Revenues from sales of special recreational use licenses are shown in Table 4.13-11 and generally exhibit an increasing trend.

Residential Leases

Statewide, DNRC administers more than 750 cabin site leases, and 668 of these are located within the planning area (DNRC 2005e). Annual lease rates are 5 percent of the appraised land value. The average annual cost for leasing a cabin site in the planning area is approximately $1,500 (DNRC 2005e). Statewide gross revenues from cabin and home site leases for the past 7 years are shown in Table 4.13-12.

TABLE 4.13-12. STATEWIDE GROSS REVENUES FROM RESIDENTIAL LEASES FROM 2000 THROUGH 2006

	2000	2001	2002	2003	2004	2005	2006
Residential Leases[1]	$718,290	$790,030	$854,626	$949,102	$929,995	$1,024,125	$1,129,768

[1] 99 percent of the revenues generated in the residential lease category are from cabin leases.
Sources: DNRC (2003c, 2006a).

4.13.1.4 Natural Amenities and Non-use Value

The presence of natural amenities is a factor that has increasingly been recognized as important in determining the economic prospects of many rural communities. While natural amenities do not directly generate income in the same sense as other factors, such as timber operations or recreation business opportunities, they often attract and retain residents. Natural amenities available on trust lands in the planning area include a variety of forest-related recreational opportunities, such as hunting, fishing, camping, hiking, and wildlife viewing.

Non-use values are assigned by individuals to resources independent of whether they use those resources. Individuals obtain value from knowing that a resource exists, would be available for future use if so desired, and would remain for future generations to inherit. Examples of resources to which individuals may assign non-use values include endangered species or large areas of unmanaged forest.

4.13.1.5 Effects of and Trends in Climate Change

By 2030, the population of the Mountain West (Montana, Idaho, Wyoming, Nevada, Utah, Colorado, Arizona, and New Mexico) is projected to increase by 65 percent over 2000 levels, which is one third of the projected United States population growth for that period (Karl et al. 2009). This increased population within the planning area may face a variety of changes in social and economic conditions due to climate change, including reduced water availability, changes in recreation and tourism, and changes in agriculture.

As discussed in Section 4.6 (Water Resources), climate change appears to be shifting the hydrologic cycle, with peak flows occurring earlier in the spring and lower streamflows occurring in the summer months. Such changes are likely to affect those areas and populations that depend on the region's mountain water resources for domestic, agricultural, energy, and industrial purposes (Beniston 2003). In water-limited mountain regions, such as western Montana, a decrease in water supply could increase competition for water to support various economic, social, and environmental uses, and this situation could be intensified by a growing population (Beniston 2003).

Anticipated future changes in climate are expected to result in a range of effects on outdoor recreational and tourism activities (Pederson et al. 2009).

- More favorable weather conditions at the beginning and end of the traditional summer tourist season may increase overall numbers of tourists and the length of the summer tourist season.

- A shortened season of available high-quantity and quality of snowpack is expected to decrease profits for the premier ski industry.

- Fishing guides are expected to experience more frequent closures of streams and rivers due to reduced flows and increased thermal stress on aquatic species.

Although the summer tourism season has increased in length, increased risk of wildfire danger has resulted in some forests and recreation areas being closed (Furniss 2007). Warming temperatures and other effects of a changing climate appear to have already reduced fishing opportunities in the West (Saunders et al. 2008). Cold- and cool-water fisheries, such as trout and salmon, have been declining as warmer and drier conditions reduce their habitat (Field et al. 2007; Saunders et al. 2008). As noted in Section 4.10 (Recreation), Montana's sportfishing industry has experienced multiple closures during 8 of the 10 years from 1998 through 2007 (Saunders et al. 2008). One way tourism-based businesses in Montana have coped with these effects is to encourage people to come to Montana earlier in the year (Furniss 2007).

Montana's agriculture industry has been affected by recent severe weather patterns. A prolonged drought that began in 1998 has impacted wheat production and cattle and sheep production (Saunders et al. 2008). In the first few years of the 21st century, western farmers and ranchers were affected by the frequent and widespread combination of above-normal heat and drought (Saunders et al. 2008). Additional effects on agriculture are also expected. With changes in timing of specific chilling periods, crop yields are expected to decline (Pederson et al. 2009). Dryer conditions are expected to reduce pasture quality and affect Montana's livestock industry (Pederson et al. 2009).

While higher elevation forests are likely to become more productive with increased temperatures, CO_2, and nitrogen deposition, as well as a longer growing season, forest productivity is expected to decrease in the western United States due to increased drought (Karl et al. 2009). The extent of this expected decrease in the region and whether it would occur on HCP project area lands is not known. Also, if such a decrease does occur, DNRC may be able to reduce this effect by altering its forest management approach to increase stand productivity (e.g., using different harvest treatments or using more drought-tolerant tree species for stand regeneration). Any changes in forest productivity could affect direct forestry sector employment, as well as non-forest jobs dependent on the forestry sector or those dependent on the forest as a resource (e.g., recreation).

4.13.2 Environmental Consequences

Quality of life incorporates a number of factors (Center for Rural Affairs 2007), including (1) availability of good-paying jobs; (2) access to critical services, such as education and health care; (3) strong communities; and (4) a healthy natural environment. This section discusses the potential effects on social and economic conditions contributing to quality of life that would occur as a result of changes to DNRC's forest management program for the four alternatives.

4.13.2.1 Introduction and Evaluation Criteria

For this analysis, quality of life is characterized by regional social and economic conditions, including forestry sector employment and contributions from FMB revenues and expenditures, revenues generated from recreational use and cabin leases, as well as the natural amenities provided by and the non-use value attributed to resources in the planning area. Changes in regional social and economic conditions based on forestry sector employment and FMB revenues and expenditures are estimated using annual sustainable yield and PNV, which are provided in Section 4.2 (Forest Vegetation) for each alternative. Changes to recreational revenues, natural amenities and non-use value are qualitatively discussed because specific changes cannot be identified due to the programmatic nature of the changes evaluated in this EIS.

Because the annual sustainable yield provides an estimate of changes in harvest levels from forested trust lands only, future harvest levels for other ownerships in the planning area will not be considered. Also, although DNRC is required to recalculate the annual sustainable yield at least once every 10 years, and thus will vary throughout the Permit term, this analysis is based only on those annual sustainable yields presented in Section 4.2 (Forest Vegetation).

Numbers of direct forestry sector jobs and associated wages have been estimated using the same factors applied in the affected environment discussion (Table 4.13-9) and the annual sustainable yield estimated for each alternative (Table 4.2-14). Non-forestry jobs are discussed qualitatively, including jobs generated by forest-related recreation activities.

Harvest levels and associated income earned by trust beneficiaries are tempered by DNRC environmental and legal commitments, which are specified in the SFLMP and ARMs, and by DNRC's participation in many working groups and cooperatives. Changes in commitments under the three action alternatives would result in changes in the annual sustainable yield, and those commitments that would increase costs to harvest timber have been captured by the PNV for each action alternative. To compare alternatives based on FMB revenues and expenditures, the same factors used in the affected environment discussion (see Table 4.13-10) have been applied to the annual sustainable yield estimated for each alternative (see Table 4.2-14). However, an additional adjustment has been made to expenditures for this analysis to incorporate the changes in PNV among the alternatives because these changes reflect increases or decreases in costs associated with managing and harvesting DNRC's timber resources based on changes to DNRC's management program. As noted above, actual timber harvest fluctuates from year to year based on current price, expected future price, availability of timber from other sources, and periodic events such as fires (DNRC 2006i). For this analysis, annual sustainable yield was used as an average to estimate revenues, expenditures, and direct forestry sector employment and wages that would be expected for that volume of annual timber harvest (Table 4.13-13).

TABLE 4.13-13. AVERAGE ANNUAL DIRECT FORESTRY SECTOR JOBS AND WAGES BY ALTERNATIVE AS ESTIMATED FROM ANNUAL SUSTAINABLE YIELD

	Alternative 1 (No Action)[1]	Alternative 2[1]	Alternative 3[1]	Alternative 4[1]
NWLO	332	387	332	386
Stillwater Unit	101	145	103	149
Swan Unit	67	68	66	68
Other NWLO Units	164	174	162	170
SWLO	136	126	113	129
CLO	39	40	37	41
Total Jobs in Planning Area	**507**	**553**	**482**	**557**
Total Wages ($1,000,000)[2]	**$19.7**	**$21.5**	**$18.7**	**$21.6**

[1] Calculated using 10 jobs per million board feet as in Table 4.13-9 and volumes provided in Table 4.2-14.
[2] Calculated using an average forestry salary of $38,874 as in Table 4.13-9.

Potential effects of the alternatives on license sales are difficult to assess. It could be argued that alternatives that lead to increased access overall, or that open new areas to motorized access, would be expected to result in concomitant increases in sales of recreational use licenses. It is not possible, however, to determine how much of the increase in recreational use would result in additional license sales. People who currently engage in recreational activities on trust lands may simply move their activities to newly opened areas. At a minimum, it is reasonable to assume that alternatives that would lead to increases in recreational use could also lead to increases in formal recreation under license by the state, for example by snowmobile clubs or Nordic skiing groups that conduct trail grooming. However, the magnitude of any such increases in license sales cannot be determined.

4.13.2.2 Alternative 1 (No Action)

Under Alternative 1, existing rules and regulations would be used to manage timber and grazing on HCP project area lands. There could be changes to these regulations but they cannot be identified at this time. DNRC would continue to strive to meet the annual sustainable yield and would not delay harvest based on market values. This management approach provides lumber market stability but can affect DNRC's ability to generate revenues on an annual basis. However, under this alternative that does not include an HCP, DNRC would be subject to increased risk of having to adhere to additional protection measures for federally listed species dictated by the federal government sometime in the future. If more strict requirements are instituted, DNRC would be less able to provide a stable supply of timber annually. Other land uses could also be curtailed, leading to reduced uses of DNRC lands for other activities, such as grazing and recreation.

Of the 53.2 million board feet in annual sustainable yield estimated statewide for Alternative 1 (Table 4.2-14), DNRC would aim to harvest 50.7 million board feet per year within the planning area. Annual direct forestry sector employment from this level of timber harvest would be expected to average 507 jobs and $19.7 million in wages (Table 4.13-13). Most of these jobs would be supported by harvest activities in the NWLO. Additionally, non-forest jobs would continue to support the forestry sector by providing services and supplies to employers and employees. The number of such jobs would be expected to vary over the Permit term based on fluctuations in forestry sector employment.

Table 4.13-14 provides estimates of FMB revenues and expenditures based on the annual sustainable harvest by land office and total PNV estimated for Alternative 1 (see Table 4.2-14). Because management and harvest of timber on trust lands would continue under the existing program for this alternative, estimated expenditures were calculated using the average shown in Table 4.13-8. For the planning area, gross revenues per year are estimated to average $12.2 million, expenditures are estimated to average $6.2 million, and net revenues are estimated to average $6.0 million. More than 65 percent of the revenues and expenditures within the planning area would be generated from forest management activities in the NWLO, reflecting the large amount of annual sustainable yield allocated to this land office.

TABLE 4.13-14. AVERAGE ANNUAL GROSS REVENUES, EXPENDITURES, AND NET REVENUES FROM TIMBER HARVEST BY ALTERNATIVE AS ESTIMATED FROM ANNUAL SUSTAINABLE YIELD

	Alternative 1 (No Action)	Alternative 2	Alternative 3	Alternative 4
Annual Sustainable Yield (million board feet)	53.2	57.6	50.6	58.0
PNV (million)	$146.1	$156.8	$124.5	$160.2
PNV per Million Board Feet (million)	$2.75	$2.72	$2.46	$2.76
Percent Change in PNV per Million Board Feet from Alternative 1	0.0	-0.1	-10.4	+0.6
Gross Revenues[1]				
NWLO	$7,981,008	$9,303,170	$7,971,392	$9,286,336
SWLO	$3,269,329	$3,028,939	$2,723,639	$3,110,670
CLO	$937,528	$961,568	$889,450	$980,799
Planning Area Total	**$12,187,865**	**$13,293,677**	**$11,584,481**	**$13,377,804**
Expenditures[2]				
NWLO	$4,032,449	$4,700,463	$4,446,690	$4,664,930
SWLO	$1,651,846	$1,530,383	$1,519,331	$1,562,625
CLO	$473,691	$485,836	$496,163	$492,698
Planning Area Total	**$6,157,986**	**$6,716,682**	**$6,462,184**	**$6,720,252**
Net Revenues[3]				
NWLO	$3,948,559	$4,602,707	$3,524,702	$4,621,406
SWLO	$1,617,482	$1,498,555	$1,204,309	$1,548,045
CLO	$463,837	$475,732	$393,287	$488,101
Planning Area Total	**$6,029,878**	**$6,576,994**	**$5,122,298**	**$6,657,552**

[1] Using an average of $240,392 per million board feet from Table 4.13-8 and volumes provided in Table 4.2-14.
[2] Using an average of $121,459 per million board feet from Table 4.13-8 and volumes provided in Table 4.2-14. Values are adjusted based on the percent change in PNV per million board feet from Alternative 1.
[3] Using an average of $118,933 per million board feet from Table 4.13-8 and volumes provided in Table 4.2-14.

Along with maintaining the relative contribution of the forestry industry to the planning area economy, Alternative 1 is also unlikely to alter the recreation, agriculture and grazing, or mining economic sectors relative to recent trends. As the population in the HCP project area increases, demand for recreational activities is increasing, as are the number of businesses that depend on recreationists, such as hunting and fishing outfitting, off-road vehicles, and snowmobiling.

There would be no additional restrictions on access to areas used by commercial outfitters or other potential purchasers of recreational use licenses under Alternative 1. Also, as described in the environmental consequences analysis for recreation under Alternative 1 (Section 4.10.2.2), opportunities for wintertime recreation would not be expected to change from current conditions. It is likely, therefore, that the number of licensed groups conducting trail grooming would not change substantially from current conditions. For these reasons, sales of recreational use licenses are likely to follow existing trends. As the population of western Montana increases, the number of people interested in these activities would also be likely to increase, potentially resulting in a gradual increase in license sales as well as job opportunities for forest-related recreation businesses.

Because the future land management activities would be very similar to those conducted under the existing program, changes to natural amenities and non-use values would likely continue in a similar pattern as they have since DNRC's current forest management program went into effect. Forest management activities would continue throughout the Permit term, with no changes in policies for managing resources that may provide natural amenities or non-use values. However, with no HCP in place during the next 50 years, unpredictability would remain in terms of the potential for additional protection measures to address federally listed species that could preserve or enhance valued species and areas.

4.13.2.3 Alternative 2 (Proposed HCP)

Implementing the HCP under Alternative 2 would provide greater assurances that a long-term, uninterrupted stream of wood products from trust lands would continue to supply small and large forestry businesses. Even in the event that the federal government institutes additional protection measures for listed species, DNRC would still be able to continue timber harvests as planned under the HCP. The HCP would also help to stabilize availability of good-paying jobs in the forestry and other sectors. Managing forests under the HCP would increase the likelihood that the natural environment aspects that are important for rural quality of life are maintained throughout the 50-year Permit term.

The annual sustainable yield for Alternative 2 is projected to be ~~58.0~~57.6 million board feet, which is an ~~9~~8 percent increase over Alternative 1. With all but 2.3 million board feet allocated to land offices within the planning area, this level of harvest would be expected to generate $~~21.6~~21.5 million in annual forestry wages in the planning area. This increased harvest level would also be expected to support ~~50~~46 more forestry sector jobs each year than Alternative 1. The greatest difference in forestry employment would occur in the NWLO, where harvest levels would increase throughout the land office, resulting in 58 more forestry jobs. Much of this increase in harvest levels would occur in the Stillwater Unit, primarily from making the Stillwater Core more available to active forest management. The SWLO would support 9 fewer forestry jobs as compared to Alternative 1, while the CLO would support 1 more forestry job (Table 4.13-13). Non-forestry jobs that support the forestry sector would also likely increase over Alternative 1.

With an ~~9~~8 percent higher annual sustainable yield versus Alternative 1, Alternative 2 would also result in 9-percent higher gross revenues generated from DNRC's forest management program (Table 4.13-14). About 70 percent of the gross revenues generated from harvest in the planning area would come from forest management activities in the NWLO. On a per-volume basis, PNV would be slightly lower than Alternative 1, which would likely be reflected in slightly higher costs associated with harvest activities. After factoring this slight difference into expenditures, Alternative 2 would be expected to require about $~~6.8~~6.7 million in expenditures, leaving about $~~6.6~~6.5 million for distribution to trust beneficiaries, which is ~~nearly 10~~about 9 percent higher than Alternative 1 (Table 4.13-14).

Similar to Alternative 1, Alternative 2 would impose no additional restrictions on access to areas used by commercial outfitters or other potential purchasers of recreational use licenses. General recreational use would be expected to increase under the HCP due to increased access in the Stillwater Block. The increase in use could lead to an increase in more formal recreation under license by the state, such as snowmobile clubs or Nordic skiing groups that conduct trail grooming. The implementation of a transportation plan in the Stillwater Block would not be expected to have any influence on sales of recreational cabin leases because no new cabin sites would likely be made available in the blocked lands that make up the Stillwater State Forest. Sales of recreational use licenses, therefore, would likely increase more rapidly under Alternative 2 than under Alternative 1. Similarly, increased access within the Stillwater Block would likely increase demand for recreation-based businesses, such as outfitting, snowmobiling, and off-road vehicles, thus increasing job opportunities within those businesses.

At the landscape level, program changes under Alternative 2 would result in a slightly lower level of effects on natural amenities and non-use value as compared to Alternative 1. Increased conservation commitments for HCP species would likely enhance the natural amenities and non-use values associated with those species and their habitat. On a local scale, however, opening the Stillwater Core to active management under Alternative 2 would affect the character of the natural amenities and non-use values provided by that area. While much of the core is within blocked trust lands and not visible from populated areas and public roads, existing natural amenities offered within the core would be affected by management activities. Additionally, non-use values associated with the area and local wildlife, such as grizzly bear, would be affected by the transition of unmanaged forest into managed forest.

The transition lands strategy proposed as part of Alternative 2 could reduce DNRC's flexibility to manage its land base for maximum revenue generation. The caps applied to the removal of lands from the HCP project area could prevent DNRC from disposing of lands that do not or no longer meet its forest management and revenue objectives. By adhering to these caps, DNRC could also forego sale of some lands within the HCP project area that would be needed to meet projected growth in residential, commercial, and industrial sectors over the Permit term. If non-trust lands are sold to meet these growth needs instead, then revenues from these sales would not be realized by the trust permanent fund.

Under Alternative 2, DNRC response to fires, insect or disease outbreaks, and wind events would trigger salvage harvest as required by MCA 77-5-207. While DNRC's response to these natural event changed circumstances would incorporate HCP commitments into the salvage harvest, the event may also require changes in other DNRC forest management activities to address adverse effects to HCP species resulting from the event. Such changes may include re-scheduling adjacent operations, modifying rest and management cycles, deferring operations in other areas with similar habitat qualities, or implementing additional mitigations to reduce erosion and sedimentation risks to affected streams. These changes may affect DNRC's ability to maximize revenues from its management activities, either by reducing the volume that can be harvested or increasing harvest costs, as well as its ability to provide a steady source of timber for harvest that supports forestry sector jobs.

Two other natural events, mass movements and flood events, may also increase expenditures by DNRC to assess and mitigate potential risks of erosion, sedimentation, and stream crossing structure failures from these events that are beyond the activities planned under the HCP commitments. Any elements of the changed circumstance processes for these two natural events that are not included in DNRC's existing program would result in increased expenditures and reduced net revenues available to trust beneficiaries.

Changed circumstances due to administrative changes may also affect DNRC's ability to maximize trust revenues. Federal listing of a non-HCP species or occupation of the BE by grizzly bears could require additional conservation commitments and reduce DNRC's ability to manage affected lands for maximum long-term revenues. Conversely, de-listing of an HCP species may remove some restrictions imposed by the conservation commitments for that species and allow DNRC to generate more trust revenues from affected lands. Listing of an HCP species, termination of the Swan Agreement, or changes in the Forest Management ARMs would not be expected to affect DNRC's ability to generate revenues for its trust beneficiaries.

4.13.2.4 Alternative 3 (Increased Conservation HCP)

Alternative 3 would implement the HCP with mitigation measures providing increased levels of conservation. While still helping to ensure a long-term stream of wood products from trust lands, it would actually reduce the statewide harvest level to 50.6 million board feet (5 percent reduction relative to Alternative 1) by increasing areas where harvest would be limited or prohibited (e.g., wider no-harvest buffers on Class 1 streams with HCP fish species). The expected decrease in harvest would reduce by 25 the number of annual forestry sector jobs supported within the three land offices (Table 4.13-13). This level of harvest would translate into $18.7 million in annual forestry wages in the HCP project area, the lowest of any of the alternatives. The greatest difference in forestry employment would occur in the SWLO, where 23 fewer forestry jobs would be generated annually as compared to Alternative 1. There would be slightly fewer forestry jobs in the CLO, while the total number for forestry jobs supported within the NWLO would be the same as Alternative 1 (Table 4.13-13). Increases in non-forestry jobs generated to support harvest activities would be similarly reduced from levels expected under Alternative 1.

Annual gross revenue from DNRC's forest management program under Alternative 3 would be $11.6 million (Table 4.13-14), which represents a 5 percent decrease relative to Alternative 1 and reflects a decrease in annual sustainable yield. About 69 percent of the gross revenues expected under this alternative would be generated from forest management activities in the NWLO, which is more than Alternative 1 and slightly less than Alternative 2. On a per-volume basis, PNV would be more than 10 percent lower than Alternative 1, which would likely be reflected in higher costs associated with harvest activities. After factoring this difference into expenditures, Alternative 2 would be expected to require about $6.4 million in expenditures, leaving about $5.1 million for distribution to trust beneficiaries, which is 15 percent lower than Alternative 1 and 23 percent lower than Alternative 2 (Table 4.13-14). Expected economic effects of DNRC's transition lands strategy and its responses to changed circumstances would be the same as Alternative 2.

The effects of Alternative 3 on recreational use license sales would be similar to those described for Alternative 1. Alternative 3 would also impose no additional restrictions on access to areas used by commercial outfitters or other potential purchasers of recreational use licenses, and this alternative would also not result in increased access in the Stillwater Core. Jobs generated from forest-related recreation activities are also expected to be similar to Alternative 1.

At the landscape level, changes to natural amenities and non-use value over the Permit term under Alternative 3 would likely be less than Alternatives 1 and 2. With additional protection and mitigation requirements for sensitive areas and wildlife species, such as wider no-harvest buffers on Class 1 streams with HCP fish species, natural amenities and non-use values associated with those areas and species would be less affected by DNRC's forest management activities. As under Alternative 1, the Stillwater Core would continue to be managed as it is under the existing program, so that no changes would be expected from DNRC's forest management activities.

4.13.2.5 Alternative 4 (Increased Management Flexibility HCP)

Alternative 4 would implement the HCP with increased levels of management flexibility. Regarding employment, wages, and gross revenues, the effects of this alternative would be very similar to those described for Alternative 2. The projected statewide annual sustainable harvest of 58.0 million board feet, as well as the amount allocated within the planning area, would be the same as Alternative 2, so the total number of direct forestry sector jobs and wages generated would be the same (Table 4.13-13). However, there would be slight variations in numbers of jobs by land office under this alternative as compared to Alternative 2.

Annual gross revenue from DNRC's forest management program under Alternative 4 would be $13.4 million, about $7,200 less than Alternative 2 (Table 4.13-14). As for Alternative 2, about 69 percent of the gross revenues expected under this alternative would be generated from forest management activities in the NWLO. On a per-volume basis, PNV would be about 0.6 percent higher than Alternative 1, which would likely be reflected in lower costs associated with harvest activities. After factoring this difference into expenditures, Alternative 2 would be expected to require about $6.7 million in expenditures, leaving about $6.7 million for distribution to trust beneficiaries, which is 10 percent higher than Alternative 1 and less than 1 percent higher than Alternative 2 (Table 4.13-14). Increases in non-forestry jobs, including jobs generated by forest-related recreation, would be similar to those under Alternative 2. Expected economic effects of DNRC's transition lands strategy and its responses to changed circumstances would be the same as Alternatives 2 and 3.

The effects of Alternative 4 on recreational use license sales would be similar to those described for Alternative 2. Alternative 4 would also impose no additional restrictions on access to areas used by commercial outfitters or other potential purchasers of recreational use licenses. Increased access in the Stillwater Block would likely result in increased recreational use and license sales, compared to Alternative 1.

Effects on natural amenities and non-use value for Alternative 4 are expected to be similar to those under Alternative 2, including changes associated with opening the Stillwater Core to active management.

4.13.2.6 Summary

Alternatives 2 and 4 would result in more forestry sector jobs and associated wages than Alternatives 1 and 3. Other jobs that support the forest industry or workers would be expected to follow the same pattern. Similarly, net revenues generated for trust beneficiaries would be highest for Alternative 4 and slightly less for Alternative 2 due to higher costs associated with more restrictive HCP commitments. Alternative 3 would generate the lowest net revenues.

Revenues from recreational licenses would likely be higher for Alternatives 2 and 4 due to increased access to the Stillwater Core after it is opened up for active management. Similarly, increases in forest-related recreation jobs would also likely be higher for these two alternatives.

Natural amenities and non-use values would likely be least affected under Alternative 3 because it provides protection to sensitive areas and species. Opening the Stillwater Core under Alternatives 2 and 4 would affect the natural amenities and non-use values in that area versus what they currently are and would be during the Permit term under Alternatives 1 and 3.

Over the Permit term, social and economic changes in response to climate change would be expected under all the alternatives. Differences among the alternatives would not likely alter changes expected in the tourism, recreation, and agriculture industries. Effects of climate change, especially increased drought and risk of wildfire, may decrease the productivity of forests in the planning area. This may lead to lower green tree harvest levels and increases in salvage harvest. Since DNRC's annual sustainable yield is recalculated at least every 10 years, effects from climate change may result in lower yields being calculated in the future. Decreases in the sustainable yield would lead to lower revenues and jobs; however, such changes are expected to be proportional to the levels discussed above based on the current sustainable yield for each alternative.

4.13.3 Environmental Justice

Environmental justice refers to the fair treatment and meaningful involvement of people of all races, cultures, and incomes with respect to the development, implementation, and enforcement of environmental laws, regulations, programs, and policies. This section describes the affected environment and environmental consequences of the no-action and three action alternatives on minority and low-income populations in the planning area.

4.13.3.1 Affected Environment

This section describes the regulatory framework regarding minority and low-income populations and summarizes existing conditions for those populations.

Regulatory Framework

Executive Order 12898 (February 11, 1994), Environmental Justice, requires that federal agencies identify and address any disproportionately high and adverse human health or environmental effects of their programs, policies, and activities on minority populations and low-income populations.

Black/African American, Hispanic, Asian and Pacific Islander, American Indian, Eskimo, Aleut, and other non-white persons are defined as minority populations by the Interagency Working Group convened under the auspices of the Executive Order. Low-income populations are defined as persons living below the poverty level based on total income of $13,359 or lower for a family household of four based on the 2000 Census.

Minority and Low Income Populations

Only 8 percent of the population in the planning area were minorities in 2000 (Table 4.13-15). After white (92 percent), the second most represented race is American Indian (4 percent), followed by Hispanic (2 percent), and multi-racial (2 percent). One percent or less were reported as being Black, Asian, Hawaiian/Pacific Islander, or some other race.

TABLE 4.13-15. RACE AND ETHNICITY IN THE PLANNING AREA IN 2000

	Hispanic[1]	White	Black	Indian	Asian	Hawaiian	Other	Multi	Total (Race)
Beaverhead	246	8,821	17	134	17	4	100	109	9,202
Broadwater	58	4,255	12	51	5	3	15	44	4,385
Cascade	1,949	72,897	900	3,394	652	67	547	1,900	80,357
Deer Lodge	155	9,028	16	167	34	1	17	154	9,417
Flathead	1,061	71,689	113	856	346	44	305	1,118	74,471
Gallatin	1,047	65,251	156	598	606	43	368	809	67,831
Glacier	159	4,693	11	8,186	9	7	24	317	13,247
Granite	36	2,724	0	36	4	1	13	52	2,830
Jefferson	149	9,654	14	127	42	7	38	167	10,049
Lake	668	18,922	31	6,306	79	11	177	981	26,507
Lewis & Clark	843	53,046	111	1,137	287	28	209	898	55,716
Liberty	4	2,141	0	2	7	0	2	6	2,158
Lincoln	271	18,100	21	226	59	7	74	350	18,837
Madison	130	6,647	3	36	18	0	52	95	6,851
Meagher	29	1,878	0	20	3	1	11	19	1,932
Mineral	61	3,673	8	75	20	1	10	97	3,884
Missoula	1,543	90,073	261	2,193	978	80	431	1,786	95,802
Park	288	15,168	63	145	56	5	74	183	15,694
Pondera	54	5,374	6	929	9	3	8	95	6,424
Powell	140	6,643	36	252	31	0	53	165	7,180
Ravalli	678	34,883	49	319	108	35	158	518	36,070
Sanders	159	9,400	13	485	31	1	27	270	10,227
Silver Bow	950	32,998	54	704	149	21	205	475	34,606
Teton	73	6,207	12	98	6	0	27	95	6,445
Toole	61	4,945	8	168	16	1	17	112	5,267
Planning Area Total	**10,812**	**559,110**	**1,915**	**26,644**	**3,572**	**371**	**2,962**	**10,815**	**605,389**
% in Planning Area	2	92	0	4	1	0	0	2	100

[1] Someone of Hispanic ethnicity can be of any race (including white); however, all Hispanics are considered minorities.
Source: U.S. Census Bureau (2000).

In 1999, 14 percent of the people in the planning area lived below the poverty level (Table 4.13-16). Jefferson County had the fewest living below the poverty level (9 percent), while Glacier County had the highest number of people living below the poverty level (27 percent).

TABLE 4.13-16. POVERTY STATUS BY COUNTY FOR THE PLANNING AREA IN 1999

County	Total Population	Population with Income below Poverty Level	Percent below Poverty
Beaverhead	8,723	1,491	17
Broadwater	4,310	466	11
Cascade	78,438	10,605	14
Deer Lodge	9,182	1,451	16
Flathead	73,241	9,489	13
Gallatin	64,752	8,319	13
Glacier	13,060	3,568	27
Granite	2,803	472	17
Jefferson	9,807	882	9
Lake	26,015	4,862	19
Lewis & Clark	54,565	5,960	11
Liberty	2,094	425	20
Lincoln	18,568	3,558	19
Madison	6,765	821	12
Meagher	1,901	359	19
Mineral	3,795	598	16
Missoula	92,656	13,691	15
Park	15,556	1,780	11
Pondera	6,347	1,194	19
Powell	5,704	719	13
Ravalli	35,576	4,927	14
Sanders	10,074	1,737	17
Silver Bow	33,577	5,005	15
Teton	6,369	1,056	17
Toole	4,839	624	13
Planning Area Average	**588,717**	**84,059**	**14**

Source: U.S. Census Bureau (2000).

Indian Reservations

The primary minority populations in the planning area are American Indians living in and near the Blackfeet and Flathead Indian Reservations (Figure D-3 in Appendix D, EIS Figures). The highest numbers of American Indians are found in Glacier and Lake Counties, where reservations are located (Table 4.13-15). These two counties are located within the planning area.

The planning area had an average unemployment rate of 3.8 percent in 2006 (Table 4.13-4). The Blackfeet and Flathead Indian Reservations had unemployment rates of 15 percent and 6 percent, respectively, in 2005 (Montana Department of Labor and Industry 2007). Glacier and Lincoln Counties had the highest unemployment rates in 2006 (both 6.4 percent). The higher unemployment rate in Glacier County is likely due to the high unemployment rate on the Blackfeet Indian Reservation, which covers a majority of Glacier County. There are no Indian reservations in Lincoln County.

Higher percentages of residents on the Blackfeet and Flathead Indian Reservations were low-income compared to the planning area in 1999. The planning area had 14 percent of the population living below the poverty level (Table 4.13-16), while the Blackfeet and Flathead Indian Reservations had 34 percent and 20 percent, respectively, living below the poverty level (U.S. Census Bureau 2000). The relatively high level of poverty coupled with the low level of unemployment on the Flathead Indian Reservation is likely due to most reservation residents having low wage and/or part-time jobs. Per capita income on the Flathead Indian Reservation in 1999 was $14,503. This is compared to a per capita income of $17,151 for Montana in 1999. Per capita income on the Blackfeet Indian Reservation in 1999 was $9,751. This figure is even lower but less surprising considering both unemployment and poverty rates are high on the Blackfeet Indian Reservation.

Blackfeet Indian Reservation

The 1.5-million-acre Blackfeet Indian Reservation, in northwestern Montana, has approximately 7,000 tribal members living on or near the reservation (Montana Indian Nations 2005). The reservation borders Canada and Glacier National Park. The reservation's resident tribe, the Blackfeet Tribe, has about 14,700 enrolled tribal members.

A pencil, pen, and marker manufacturing plant on the reservation employs many reservation residents (Montana Indian Nations 2005). Ranching and farming are major uses of the land. The principal crops are wheat, barley, and hay. Blackfeet Community College, located on the reservation, offers 2-year associate's degrees in the Arts and Sciences.

Recreational resources that contributed to income and employment in the reservation's tourist industry include the Blackfeet Heritage Gallery, Lodgepole Gallery and Tipi Village, John L. Clarke Western Art Gallery and Memorial Museum, Museum of the Plains Indians, Lewis Fight Site, and the east side of Glacier National Park (Montana Indian Nations 2005). In addition, there are four campgrounds, eight major lakes, and 175 miles of fishing streams on the reservation.

Flathead Indian Reservation

The 1.2-million-acre Flathead Indian Reservation, located north of I-90 between Missoula and Kalispell, has about 3,700 tribal members living on or near the reservation (Montana Indian Nations 2005). The reservation is home to the Confederated Salish and Kootenai Tribes, a combination of the Salish, Pend d'Oreilles, and Kootenai. These tribes have approximately 6,800 enrolled tribal members.

The timber, services, and energy industries form the reservation's economic base. Revenues are paid to the tribes from the co-license with Northwestern Energy for the Kerr Dam facility (Montana Indian Nations 2005). The tribes are partners in a full-service resort and casino in Polson. S&K

Holding, a tribal corporation, employs and offers business loans to tribal members. Salish-Kootenai Community College, in Pablo, offers 2- and 4-year degrees.

Recreational resources that contributed to income and employment in the reservation's tourist industry include the Ninepipes Museum of Early Montana, Farenhite Hotglass Studio, The People's Center, Miracle of America Museum, Polson-Flathead Historical Museum, Sandpiper Art Gallery, Garden of the Rockies Museum, Flathead Indian Museum and Trading Post, St. Ignatius Mission, Flathead Lake State Park, Mission Mountain Wilderness Area, the National Bison Range, and Ninepipe and Pablo National Wildlife Refuge and State Wildlife Management Area (Montana Indian Nations 2005).

4.13.3.2 Effects of and Trends in Climate Change

Disadvantaged people may be disproportionately affected by a changing climate. In general, these populations have fewer resources and often live in conditions that increase their vulnerability to the effects of climate change (Karl et al. 2009). For example, Native Americans who live on established reservations are restricted to reservation boundaries and therefore have limited relocation options (Karl et al. 2009). As noted in Section 4.12 (Archaeological, Historical, Cultural, and Tribal Trust Resources), effects of climate change on plants and animals may affect the ability of Native Americans to use those plant and animals for subsistence and traditional practices and as raw materials.

4.13.3.3 Environmental Consequences

This section describes the differences in potential effects on minority and low-income populations from changes in DNRC's forest management program related to the alternatives, and whether these effects would disproportionately impact low-income and minority populations in the planning area.

Introduction and Evaluation Criteria

Effects on minority or low-income populations could occur in the planning area from changes in the availability of salmonid species or other recreational, subsistence, or ceremonial plant or wildlife species; access to TCPs; or numbers of forestry jobs and associated income. These changes were considered in this analysis and are summarized below based on results presented in their respective resource sections.

The summary comparison of effects of the alternatives on fish and fish habitat (Section 4.8.4) states that all of the alternatives are generally effective at maintaining the key habitat components at a level that provides for healthy fish populations. However, the rate of improvement in individual habitat components would vary, as would monitoring and adaptive management mechanisms to ensure proper implementation and effectiveness of the conservation commitments. Overall, Alternative 3 would be most effective at maintaining and improving key fish habitat components, followed by Alternatives 2, 4, then 1.

For plant SOC (Section 4.7, Plant Species of Concern, Noxious Weeds, and Wetlands), current practices as defined in the ARMs and MCA would not change. However, some of the HCP conservation commitments would likely provide greater protection of plant SOC as well.

Conversely, the risk of disturbing populations of plant SOC would vary based on locations and amounts of harvest and new road construction.

As discussed in Section 4.4 (Transportation), most roads would generally remain restricted year-round to public access. Changes in total and open road miles would increase over the Permit term, but these changes would not differ much between the alternatives. Additional roaded access would be gained by opening the Stillwater Core to active forest management under Alternatives 2 and 4.

Regarding wildlife and wildlife habitat (Section 4.9), all alternatives would provide some level of protection to wildlife species, including those associated with recreational, subsistence, and ceremonial uses. Specifically, lynx and grizzly bear would receive varying levels of protection based on the commitments in each alternative. For other wildlife species, benefits would be realized where their needs overlap with lynx and grizzly bear. In some cases, however, wildlife species with requirements opposite of those for lynx or grizzly bear may be adversely affected by implementation of the action alternatives.

As noted in Section 4.12 (Archaeological, Historical, Cultural, and Tribal Trust Resources), neither tribe expressed any concerns regarding future access to TCPs or cultural use areas on trust lands, and this would not be expected to change over the Permit term for any of the alternatives.

Section 4.13.2 (Socioeconomics – Environmental Consequences) summarizes changes in forestry sector jobs and associated wages based on changes in the annual sustainable yield and PNV for the four alternatives. With higher annual sustainable yields, Alternatives 2 and 4 would result in higher numbers of forestry sector jobs, as well as non-forest employment supported by the forest industry or its workers. The number of direct forestry sector jobs would be lowest under Alternative 3.

Alternative 1 (No Action)

DNRC's current program does not disproportionately affect minority or low-income populations. Policies regarding management of fish, wildlife, and plant species and their habitat would not change. Native American tribes would continue to have the same level of access to traditional places and usual and accustomed use areas. Employment opportunities and wages from harvest and recreational activities on trust lands would be similar to existing conditions throughout the planning area. Alternative 1 would not be expected to affect employment or quality of life on the Blackfeet Indian Reservation or the Flathead Indian Reservation.

Alternative 2 (Proposed HCP)

Alternative 2 would not disproportionately affect minority or low-income populations in the planning area. Additional measures would be implemented to increase protection and enhancement of habitat for HCP species. Improvements to key aquatic habitat components would likely benefit all fish species. Native American tribes would continue to have the same access to traditional places and usual and accustomed use areas. Additional access would be gained in the Stillwater Block with the opening of the Stillwater Core to active management. Employment opportunities would be increased in the HCP project area, particularly in the NWLO counties with relatively high percentages of minority and low-income residents (Tables 4.13-15 and 4.13-16). Alternative 2 would not be expected to affect employment or quality of life on the Blackfeet Indian Reservation or the Flathead Indian Reservation.

Alternative 3 (Increased Conservation HCP)

Alternative 3 would not disproportionately affect minority or low-income populations in the planning area. Measures more protective than those under Alternative 2 would be implemented to increase preservation and enhancement of habitat for HCP species. Alternative 3 would result in fewer forestry sector jobs throughout the planning area, but these reductions and any indirect effects to non-forest employment are not expected to affect minority or low-income populations more than the general population within the planning area. Native American tribes would continue to have the same access to traditional places and usual and accustomed use areas. Alternative 3 would not likely affect employment or quality of life on the Blackfeet Indian Reservation or the Flathead Indian Reservation.

Alternative 4 (Increased Management Flexibility HCP)

Alternative 4 would have no disproportionate effects on minority or low-income populations in the planning area. Measures for preserving and enhancing habitat for HCP species would be more protective than Alternative 1 but less protective than Alternatives 2 and 3. Direct and indirect employment from timber harvest on trust lands would be similar to Alternative 2, as would Native American tribe access to traditional places and usual and accustomed use areas. Alternative 4 would not likely affect employment or quality of life on the Blackfeet Indian Reservation or the Flathead Indian Reservation.

Summary

DNRC's current program does not disproportionately affect minority or low-income populations. There would be differences among the alternatives regarding changes to the availability of salmonid species or other recreational, subsistence, or ceremonial plant or wildlife species; access to TCPs; or numbers of forestry jobs and associated income. However, these effects are not expected to fall disproportionately on minority or low-income populations for any of the alternatives. Any disproportionate effect that may occur as a result of climate change is not expected to vary as a result of differences between the alternatives.

4.14 Irreversible and Irretrievable Commitment of Resources

Irreversible commitments are decisions affecting non-renewable resources such as soils, wetlands, unroaded areas, and cultural resources. Such commitments are considered irreversible because the resource would be deteriorated to the point that renewal could occur only over a long period of time or at great expense, or because the resource would be destroyed or removed. Irretrievable commitment of natural resources means loss of production or use of resources because of management decisions associated with an alternative. Irretrievable commitments represent opportunities foregone for the period of time that a resource cannot be used.

The action alternatives primarily represent programmatic plans for the management of forested trust lands in western Montana. Any commitments of resources associated with programmatic elements of a particular alternative would be part of a broad general framework. Such commitments would be evaluated more specifically through project-level analyses as the alternative is implemented.

Some activities that would occur under any of the alternatives represent resource commitments that would preclude future options. For example, most road construction is considered an irreversible action because of the long time needed for a road to revert to its pre-construction condition. Roads also require the irreversible commitment of rock and gravel, which in most cases are extracted from state land. In addition to the programmatic plans presented in all the alternatives, Alternatives 2 and 4 propose a Stillwater Transportation Plan that identifies specific roads to be constructed over the Permit term; however, exact locations of these roads would not be known until they are actually engineered to site-specific conditions. With that said, the amount of anticipated ~~new~~ road construction differs only slightly among the alternatives, with the greatest increase under Alternative 1 (1,408 miles) followed by Alternatives 2 and 4 (1,387 miles each), then Alternative 3 (1,322 miles).

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4.15 Relationship Between Short-term Uses and Long-term Productivity

Short-term use usually refers to activities that occur annually, such as livestock grazing, recreational uses, or timber harvest. Long-term productivity refers to the capability of the land to provide resources, such as timber, forage, and high-quality water. Soil and water are the primary factors that determine long-term productivity. Relationships between other resource management objectives and soil and water resources represent the relationship between short-term uses and long-term productivity (USFS 1983).

All four alternatives would protect the long-term productivity of soil and water resources while providing for short-term uses. The alternatives differ in the intensity of short-term uses. Alternative 4, for example, would impose fewer restrictions on road use and timber harvest. This may result in greater impacts on soil, water, and wildlife habitat, compared to Alternatives 2 and 3. Under all alternatives, however, BMPs and other standard practices would ensure the long-term productivity of these resources. Under all four alternatives, long-term timber productivity would be assured while continuing to provide stable and predictable annual timber outputs (see Section 4.2.2.2, Forest Vegetation – Sustainable Yield).

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Chapter

Cumulative Effects

5 Cumulative Effects

5.1 Introduction

CEQ's NEPA regulations defines cumulative effects as "the impact on the environment which results from the incremental impact of the action when added to other past, present, and reasonably foreseeable future actions, regardless of what agency (federal or non-federal) or person undertakes such other actions" (40 CFR 1508.7). MEPA defines cumulative effects as "the collective impacts on the human environment of the proposed action when considered in conjunction with other past, present, and future actions related to the proposed action by location or generic type" (MCA 75-1-220 (3)).

This chapter discloses the contribution of each alternative, including the no-action alternative, to the cumulative effects (adverse or beneficial) on the HCP species and other pertinent resources analyzed in Chapter 4 (Affected Environment and Environmental Consequences). The scope of the cumulative effects analysis is based on a review of statutes, regulations, plans, and programs and other relevant information relating to federal, tribal, state, local, and private land management activities that occur in the planning area and that have been known to or may contribute to cumulative effects on the HCP species or other resources analyzed in Chapter 4. The above-mentioned statutes, regulations, plans, programs, and other relevant information will herein be collectively referred to as "regulations and plans."

Due to the large geographic scope of the analysis area, it is not feasible to conduct a quantitative analysis of all project-level activities on all above-listed ownerships that are occurring, have occurred in the past, or will occur in the future. Rather, the following cumulative effects analysis intends to qualitatively assess the overall trend of cumulative effects on the HCP species and other pertinent resources in the planning area resulting from relevant past, present, and reasonably foreseeable future regulations and plans and to qualitatively assess if and how the alternatives described in Chapter 3 (Alternatives) contribute to that trend.

Many existing relevant regulations and plans that are applicable to the cumulative effects analysis have been discussed in the Affected Environment sections for each resource in Chapter 4. Major pertinent plans and programs that affect the planning area are listed below. Effects of these plans and programs on forest land management within the planning area are discussed for individual resources in the subsections that follow.

- The *Northern Rockies Lynx Management Direction* (USFS 2007a)
- The *Grizzly Bear Management Plan for Southwestern Montana 2002-2012* (MFWP 2002c)
- The *Comprehensive Resources Plan of the Confederated Salish and Kootenai Tribes*
- The *Forest Service Manual* and associated directives, including land and resource management plans for the following National Forests: Beaverhead-Deerlodge, Bitterroot,

Flathead, Gallatin, Helena, Kootenai, Lewis and Clark, Lolo, and portions of the Idaho Panhandle National Forests

- The following resource management plans for BLM-administered lands: Headwaters (Lewistown and Butte Field Offices), Garnet (Missoula Field Office), and Dillon (Dillon Field Office)
- Montana's statewide multimodal transportation plan, TranPlan 21 (Montana Department of Transportation 2007)
- *Montana's Comprehensive Fish and Wildlife Conservation Strategy* (MFWP 2005d)
- The *Statewide Comprehensive Outdoor Recreation Plan* (MFWP 2008)
- Planning documents for the following counties: Beaverhead, Broadwater, Cascade, Deer Lodge, Flathead, Gallatin, Glacier, Granite, Jefferson, Lake, Lewis & Clark, Liberty, Lincoln, Madison, Meagher, Mineral, Missoula, Park, Pondera, Powell, Ravalli, Sanders, Silver Bow, Teton, and Toole
- The *Swan Valley Grizzly Bear Conservation Agreement* (USFWS et al. 1995)
- The *Native Fish HCP* (Plum Creek 1999)
- The Stimson Lumber Company HCP.

For all resources except socioeconomics, the cumulative effects analysis area is represented by the planning area, which encompasses approximately 39 million acres in the NWLO, SWLO, and CLO. For socioeconomics, the cumulative effects analysis area is represented by the entire state of Montana. The lands proposed for coverage under the HCP (approximately 548,500 acres of trust lands) are described in the affected environment discussions for each resource in Chapter 4 (Affected Environment and Environmental Consequences).

The present ownership and management of land in the planning area are summarized in Table 2-5. The federal government is the largest landholder, with the USFS managing the greatest area; more than 15 million acres of the 39-million-acre planning area are National Forest System lands. The BLM (1.4 million acres) and the NPS (1.1 million acres) are other major administrators of federal lands in the planning area. Tribal lands, including BIA trust lands and lands owned by the Confederated Salish and Kootenai Tribes, make up approximately 1.6 million acres of the planning area. More than 17 million acres in the planning area are owned by private entities, of which Plum Creek is the largest, with almost 1.4 million acres.

The following sections of this chapter analyze cumulative effects on individual pertinent resources in Chapter 4 (Affected Environment and Environmental Consequences). Resources analyzed include only those for which the proposed action alternatives would be expected to have adverse or beneficial effects. These are: ~~forest vegetation;~~ transportation; soil resources; water resources; plant species of concern, noxious weeds, and wetlands; fish and fish habitat; wildlife and wildlife habitat; recreation; cultural resources, and socioeconomics.

The proposed action alternatives are not expected to contribute to cumulative effects on the following resources for the reasons stated:

- **Climate.** Although the proposed alternatives would result in varying levels of harvest and new road construction in the analysis area, changes in net CO_2 emissions from these activities within the analysis area would not be appreciably different among the alternatives. At the landscape scale, forest management activities on HCP project area lands would be expected to contribute very little to cumulative changes in the net CO_2 emissions in the analysis area. By maintaining a consistent harvest rotation and forest productivity historically and throughout the Permit term, losses of carbon from newly harvested stands would be expected to be offset by increased carbon intake from regenerating stands harvested in previous years.

- **Forest vegetation.** While the proposed alternatives would result in varying levels of harvest in the analysis area, generally the associated vegetation-related differences would not likely be discernable across the landscape because of the size of the project area (greater than 500,000 acres). See Section 4.2.2 (Forest Vegetation – Environmental Consequences) for additional details on the effects of the various alternatives on forest attributes. Forested trust land management under the proposed alternatives would not be expected to result in any adverse or beneficial effects on forest vegetation in the HCP project area that would contribute to cumulative effects on a landscape scale in the analysis area.

- **Air Quality.** At the landscape scale, there would be no appreciable differences in effects on air quality due to changes in forest management activities among the four alternatives. Therefore, the alternatives would not contribute incrementally to air quality.

- **Visual Resources.** Over the analysis area as a whole, no appreciable differences would be expected in effects on visual resources. Except in the Stillwater Core, the visual landscape within the HCP project area reflects past harvest activities. Additional incremental visual changes from implementation of alternatives over the Permit term would be offset by the lessening effects of previously harvested stands as they regenerate and grow into mature stands.

~~Section 5.11 (Climate Change in Montana) identifies the anticipated effects of climate change, which can not be considered a proposed federal or non-federal action, but can reasonably be expected to contribute to effects on environmental resources in the planning area during the Permit term.~~ Additional discussion of climate change can be found in Section~~s~~ 4.1~~.1.2~~ (~~Global Climate Change~~Climate), and effects of climate change on the various resources are discussed in their respective sections of Chapter 4. Additionally, Section~~ and~~ 4.9.6 (Effects of the Changed Circumstances Process) discusses effects of climate change on the HCP species in the context of the changed circumstances process outlined in the proposed HCP (Alternative 2).

5.2 Transportation

Factors affecting transportation in the cumulative effects analysis area include management of roads on DNRC lands, access to adjacent non-DNRC lands, management of transportation on adjacent lands, increasing human population trends, the sale of private timberlands, and public use of roads. As population in the planning area continues to grow, new residential, commercial, and industrial development will be needed, and additional roads will be required to link these new areas of development. Notably, land use planning authority, including decisions about growth policy, sub-division laws, and zoning regulations, resides at the local level. In its policy paper on access management and land use planning, the Montana Department of Transportation (2007) observed that little land use planning occurs outside the urban areas and rapid growth areas. This lack of planning adversely affects the ability of state and local transportation systems to anticipate and plan for new travel demands, which can severely reduce the function of the arterial system (Montana Department of Transportation 2007).

Section 4.4.2 (Transportation – Environmental Consequences) discussed changes in the transportation network in the HCP project area under the four alternatives. The three action alternatives would all result in slightly fewer miles of new road on forested trust lands, as compared to the no-action alternative, and therefore would result in a somewhat smaller overall road network within the analysis area. Of the three action alternatives, Alternative 3 would result in the fewest new roads on forested trust lands and would not open the Stillwater Core, resulting in the smallest change in the overall road network. All action alternatives would maintain a similar level of roads open to public use at least on a seasonal basis; however, this level of public access would be lower than what would be provided under Alternative 1.

Because the transportation network in the analysis area is dominated by roads on federal and private lands, DNRC's management actions under any of the alternatives would have limited effect on the overall distribution of roads in the planning area. Private landowners and land management agencies other than DNRC will continue to develop most roads in the planning area. DNRC roads that are associated with federally managed lands would be most directly affected by ongoing USFS transportation management dictated by the *Grizzly Bear Recovery Plan* (USFWS 1993) and individual forest plans for each national forest. Conversely, ongoing and expected future changes in land use from forestry to residential development in some portions of the planning area, as well as other regional population growth, are likely to result in a greater density of roads near forested trust lands in future years. Increasing development and use of lands adjacent to HCP project area lands would also likely result in higher levels of public use of DNRC roads, as well as additional requests for roaded access across forested trust lands.

5.3 Soil Resources

Impacts on soil productivity and erosion in the cumulative effects analysis area are primarily the result of resource extraction, human development, and natural processes.

Across the planning area, soil productivity is likely decreasing due to the rate of development, which permanently displaces productive areas. Soil compaction and displacement associated with timber harvest, is likely decreasing across the planning area due to decreases in timber harvest on federal lands. Additionally, land managers address soil productivity today through the implementation of BMPs. On forested trust lands, trends in protecting soil productivity have improved since DNRC's adoption of BMPs in 1987 and the SFLMP in 1996. Prior to this, poor road construction and logging practices led to excessive levels of soil compaction and displacement, as well as accelerated rates of soil erosion on forested landscapes. Most of the sites where soils were affected by poor historical logging practices have recovered, are revegetated, and are considered relatively stable.

Similar trends are also occurring on other forestlands within the planning area. Federal agencies and private forestland managers have also adopted BMPs as a way to avoid or minimize effects of forest management activities on soil productivity. Ongoing statewide monitoring of BMP application rates and effectiveness enables DNRC and other forestland managers to evaluate how well BMPs are being implemented, whether they are functioning as intended, and whether any modifications are necessary to improve effectiveness. This statewide monitoring and adaptive management approach by private, state, and federal forestland managers helps guide each of the land management programs by identifying where improvements are and are not occurring on a statewide basis, thereby addressing the cumulative nature of impacts to soil productivity within the analysis area. The HCP alternatives would not contribute to cumulative effects on soil productivity differently from current practices ~~aside from potentially harvesting a greater area per year under an increased annual sustainable yield~~since BMPs would be applied, monitored, and adaptively modified as necessary under all alternatives. Under Alternatives 2 and 4, however, soil disturbance from forest management activities within the Stillwater Core would contribute to cumulative impacts on soil productivity within that area, because in that area harvest and road building activities are currently limited.

Erosion is a natural process that can be exacerbated by human activities and developments, including resource extraction. Today, most land management agencies (public and private) implement best practices in designing roads or other aspects of their projects to minimize site erosion and avoid ongoing erosion issues. On forested trust lands, surface erosion from roads and stream crossings constitute the majority of identified problem sites remaining from historical forest management activities. This is likely true for federal and private lands as well. However, numerous plans are in place to address problem sites resulting from historical practices, including the Plum Creek HCP, National Forest Plans, and restoration efforts related to bull trout streams (see Section 5.6, Fish and Fish Habitat). As a result of these actions, cumulatively across the planning area, erosion is likely decreasing, particularly within bull trout and other sensitive fish watersheds. The HCP action alternatives are expected to contribute to this positive trend by further reducing erosion from road problem sites and stream crossings in the project area and by implementing corrective actions on grazing licenses in a more timely manner. While human development is increasing, which has the potential to contribute to further erosion, best practices implemented by these projects are also expected to maintain or reduce erosion within the planning area.

5.4 Water Resources

As discussed in Section 4.6.2 (Water Resources – Environmental Consequences), effects of the action alternatives on water resources are related to the management changes proposed, the current conditions of the analysis area, and proportion of the analysis area influenced by those changes.

Water quality in the analysis area is affected primarily by the widths of and allowable activities within streamside buffers, management commitments concerning water quality, and the location and maintenance of forest roads. The water quality characteristics potentially affected by these management activities include water temperature, dissolved oxygen, turbidity, and sedimentation impacts to aquatic habitat. In many cases, water conservation and water quality protection requirements on federal lands are likely more stringent than those on forested trust lands. Notably, in most basins, forested trust lands play a comparatively small role in determining the total disturbance area because they are spread throughout the state and inter-mixed with numerous other land uses.

As discussed in Section 4.6.1.1 (Water Resources – Regulatory Framework), under all four alternatives, activities with the potential to affect water quality would be subject to the same federal, state, and local regulations currently used to protect the quality of United States and state waters. Existing regulations for forest management activities require management and minimization of point sources and non-point sources of pollution, in compliance with the CWA. These regulations and associated BMPs have been designed to minimize or avoid the potential occurrence of adverse effects from forestry and related activities on water quality and aquatic resources. State rules and BMPs essentially serve as mitigation measures that address forest management activities in upland as well as riparian areas with the intent of managing and minimizing non-point source pollution, in compliance with the CWA.

Streamside management rules and requirements for addressing stream modifications that have been designed to protect water resources and hydrology and that are contained in existing federal and state regulations would continue to be enforced under all four alternatives. Road maintenance required by state rules would be expected to reduce the flow-routing efficiency to drainages throughout the analysis area. These practices would not only minimize the amount of direct overland flow from road surfaces to streams, but also minimize the potential for subsurface flow interception routing to surface waters. Over the Permit term, approximately one-third of the riparian acres adjacent to HCP fish-bearing streams could be subject to harvest. However, the total acreage affected would not have the cumulative effect of adversely impacting water quality and stream habitat because (1) a small amount of acreage would be affected in any one year (32 to 64 acres), (2) the harvest units would be distributed widely in different watersheds over the entire HCP project area, and (3) riparian areas regenerate quickly following harvest so that riparian functions associated with water quality, if affected at all, would likely be affected temporarily and on a very small, localized scale.

Under the action alternatives, the CWE conservation strategy would consist primarily of a monitoring and evaluation strategy that follows the existing ARMs. In addition, projects in watersheds with a high risk of CWE would be required to include mitigation that reduces the overall watershed risk to moderate or low. This mitigation requirement would result in a lower risk of cumulative effects, compared to Alternative 1. All three action alternatives would include a process for developing project-level thresholds based on streambank stability, beneficial water uses, and watershed conditions. Alternative 3 would reduce the risk of CWE even more than Alternatives 2 and 4 by imposing more restrictive thresholds and more oversight. Under Alternative 3, if the ECA in an HCP watershed exceeds 25 percent, a Level 3 watershed analysis would be required. If that analysis indicates a moderate or high level of watershed risk, a mitigation plan would be submitted for review and approval by the USFWS.

In addition to increased requirements for CWE, timelines for identifying and correcting erosion problems would vary by alternative. Decreasing the amount of time to correct problems that deliver sediment to streams would decrease the cumulative amount of sediment delivery from these problem sites. Consequently, Alternative 3 would result in the least amount of cumulative sediment delivery over the Permit term because it would require the shortest timelines for inspecting and repairing sediment delivery problems. Alternative 2 would also place time restrictions on identification and corrective actions, but to a lesser extent than Alternative 3. Alternative 4 would be the least restrictive of the action alternatives, but would still require some timelines not required in the current program and Alternative 1.

As discussed in Section 4.6.2 (Water Resources – Environmental Consequences), under all four alternatives, improvements in water quality would be expected to occur gradually throughout the analysis area as regulations guide new road construction and maintenance, riparian area management, land use planning, and other common forestry and wood products manufacturing activities. BMPs that reduce the occurrence of channelized flows would reduce sediment loading to streams. Provisions for understory and live tree retention prescribed for various types of waterbodies could potentially reduce water temperature effects. Alternative 3, followed by Alternatives 2 and 4, would add requirements to more quickly identify and correct erosion problems affecting water quality and reduce cumulative sediment delivery to streams over the Permit term from those sites. There would be some likelihood, however, that individual management actions would induce localized changes in water quality. There are also risks that some water quality problems could go undetected.

5.5 Plant Species of Concern, Noxious Weeds, and Wetlands

All alternatives would implement current practices (ARMs and MCA) that address plant SOC, noxious weeds, and wetlands. However, under the action alternatives, some conservation commitments would result in indirect benefits to plant SOC and wetlands, as well as expanded efforts to control the spread of noxious weeds. See the discussions of environmental consequences in Section 4.7 (Plant Species of Concern, Noxious Weeds, and Wetlands) for additional information on project effects on these resources.

Increased awareness, improved outreach programs, and requirements for addressing plant SOC, noxious weeds, and wetlands in public and private projects have all contributed to greater protection of plant SOC and wetlands and greater efforts to control the spread of noxious weeds throughout the cumulative effects analysis area. However, private development, road construction, agriculture and grazing, and increased demand on remote areas for recreation all contribute to the degradation of wetlands, potential depletion of plant SOC populations, and spread of noxious weeds.

The indirect benefits of the conservation commitments implemented under the HCP on plant SOC, along with ongoing trends to identify and protect these populations, may contribute to cumulative benefits for this resource in the analysis area. Likewise, indirect benefits of the conservation commitments implemented under the HCP on controlling the spread of noxious weeds, along with ongoing trends to identify, eradicate, and contain noxious weeds, may contribute to cumulative benefits for this resource in the analysis area. However, the factors contributing to the spread of noxious weeds in the analysis area may overwhelm these beneficial effects over time.

Ongoing forest management road construction may contribute to minor wetland losses; however, direct fill of wetlands would be subject to CWA Section 404 permitting and mitigation requirements. Additionally, effects of road maintenance activities on wetlands near roads, including sedimentation and pollution, would be minimized through the ARMs, which require assessment, prioritization, and maintenance to reduce road problem sites generating sediment delivery to wetlands and streams, and the HCP aquatic conservation strategy commitments to expedite these activities at high-priority sites during the Permit term. All forest management projects on private lands would apply BMPs required by state law, and those on federally administered lands would comply with USFS and BLM regulations. These measures would further limit cumulative effects on wetlands across the analysis area.

5.6 Fish and Fish Habitat

For fisheries resources, cumulative effects are those collective impacts specifically affecting watershed resource features including water yield, flow regimes, channel stability, and in-stream and upland sedimentation due to surface erosion and mass wasting. These factors have the potential to affect all aquatic species in the cumulative effects analysis area, including the HCP fish species (bull trout, Columbia redband trout, and westslope cutthroat trout). At the scale of this analysis, all three HCP fish species would be affected similarly by plans and actions on lands managed by other entities in the planning area, except as otherwise noted.

A general sense of the overall status of one HCP species, as well as the factors that contributed to its listing, is given in the USFWS 5-year review on the status of bull trout, which was completed in 2008 (USFWS 2008). The review presented new information, including improved analyses of genetic information and telemetry and tracking, and assessed the conservation status of each bull trout core area. The review indicated that, while most population trends are unknown, there is a broad distribution of risk across the landscape. In addition, a majority of core area bull trout populations are at high risk or at risk, with the smallest core areas tending to be at a higher risk.

The 5-year status review affirmed that the use of migratory corridors is critical to the survival of bull trout; however, it acknowledged that there is no currently available method to evaluate the degree to which habitat restoration and/or degradation within core areas has had an effect on bull trout. In addition, connectivity of habitat within and among core areas is low, and non-native fish (especially lake trout and brook trout) introductions and their increasing distribution continue to threaten bull trout through predation, competition, and, in some cases, hybridization.

Adult bull trout population values for core areas within Montana varied from less than 50 to more than 10,000. Although the short-term population trend of many of these core areas is unknown, more Montana core areas were reported as stable or increasing than declining. However, threats to bull trout core areas were also assessed, and the majority of Montana core areas were at risk from substantial or moderate imminent threats.

Habitat threats that continue from the destruction, modification, or curtailment of habitat (e.g., dewatering, sedimentation, thermal modification, water quality degradation) are generally human-caused and are a consequence of specific land and water management activities. However, the status review noted that unavoidable consequences can be, and frequently are, mitigated or moderated.

The primary threat category that is clearly demonstrated to have increased significantly since the initial listing of bull trout is introduced non-native species, primarily other fish in the genus *Salvelinus* (e.g., brook trout and lake trout) and other fish species that have high potential to be competitors or predators (e.g., brown trout, northern pike, walleye), which threaten bull trout even in areas of otherwise secure habitat.

Many of the same issues discussed above (e.g., habitat degradation and invasive species) apply to the other HCP fish species. The proposed alternatives would directly or indirectly address some of the issues listed above. ~~Although~~However, even though the primary aquatic goal of the three action alternatives is to conserve and protect fish habitat within the planning area, only a relatively small portion of the planning area consists of land managed by DNRC, limiting the extent of contribution from HCP implementation. Only about 5 percent of the stream miles in the planning area (see Table E4-4 in Appendix E, EIS Tables) that support at least one of the HCP fish species occur on HCP project area lands. In addition, a substantial portion of the forested trust lands occur on somewhat dispersed parcels, thereby limiting the ultimate influence that DNRC activities have on the overall stream habitat quality.

Increased amounts of impervious surface associated with future development in the cumulative effects analysis area pose an increased risk of adverse effects on water quality, water quantity, hydrology, and habitat quality for fish and other aquatic species. In addition, forestry and road construction and operation on federally administered lands in the planning area would continue to contribute to impacts to fisheries habitat ~~to a far greater extent than DNRC actions due to the much larger land base~~. These lands constitute a significantly larger land base, which indicates a greater potential for impacts if harvest levels on these lands are increased in the future.

Although several counties in the planning area are pursuing new regulations for streamside setbacks to protect water quality for municipal uses and for conservation of fish resources, the outcome and effectiveness of these regulations is unknown. Therefore, in areas where DNRC parcels are associated with adjacent private land, future development would interact with DNRC management to affect aquatic habitat for fish. However, in many cases, DNRC's actions would serve to protect or enhance conditions.

Recent and ongoing native trout and habitat conservation monitoring programs and habitat restoration activities have occurred throughout many watersheds in western Montana. These activities are typically conducted by MFWP, but often involve other agencies, tribes, and private partners. While a majority of these activities were initiated in response to the ESA listing of bull trout, the efforts to assess and improve habitat quantity and quality; improve fish passage conditions; limit the distribution of invasive, non-native species known to hybridize, compete with, or prey upon native species; and assess fish populations will improve the overall knowledge base for all native species. This increased knowledge will lead to greater protection levels for these populations and priority-based habitat improvement efforts, similar to the proposed HCP.

Currently, restoration projects are funded by a variety of public and private sources, including EPA Superfund, Clark Fork Natural Resource Damage Program, Avista Native Salmonid Restoration Program, Kerr Dam Mitigation, other Federal Energy Regulatory Commission-related projects, Bonneville Power Administration, MFWP license revenue, Montana's Future Fisheries Improvement Program of 1995, Montana Bull Trout and Cutthroat Trout Enhancement Program of 1999, Fisheries Restoration and Irrigation Mitigation Act funds, ESA partnership and stewardship grants, USFWS Partners for Fish and Wildlife funding, Bring Back the Natives and other sources of USFS funding, and numerous other programs throughout the planning area. Among the goals of these projects are the following: (1) protecting habitat for native fish and wildlife populations; (2) reconnecting fragmented habitats; (3) restoring in-channel habitat structure, function, and complexity; (4) restoring riparian and wetland habitats and floodplain function; and (5) restoring watershed function and condition.

The Plum Creek *Native Fish HCP* (and associated Stimson HCP) is similar to DNRC's proposed HCP, with regard to the goals of conserving, protecting, and enhancing habitat for native trout species. The Plum Creek HCP covers approximately 1.6 million acres (647,500 hectares) of land, mostly within western Montana, including some of the same drainages as the proposed HCP (USFWS et al. 2000b).

In 2000, the State of Montana adopted a bull trout restoration plan, developed through the collaborative efforts of the Montana Bull Trout Restoration Team and the Bull Trout Scientific Group (MBTRT 2000). This plan coordinates voluntary state restoration efforts to complement federal recovery efforts, and emphasizes the protection and restoration of the best remaining spawning and rearing habitat, maintaining genetic diversity represented by the remaining local populations, and reestablishing and maintaining historical connectivity. As a result, substantial progress has begun to occur, particularly in the areas of habitat restoration and protection, restoration of migratory connectivity, and promotion of bull trout public education and outreach.

Additional efforts are underway to reduce the effect of dams on native fish populations. These efforts include the removal of substantial barriers to fish movement, such as on the Clark Fork River. Once Milltown Dam is removed, it will be possible for bull trout from Lake Pend Oreille to return to the headwaters of the Clark Fork River (through a combination of trap and transport as well as natural migration) for the first time in a century. Benefits of restoring fish passage throughout this system, which includes passage at three major hydroelectric dams and the removal of the Milltown Dam, are unlikely to be measured in the near term, but are expected to gradually improve the viability of native fish populations in many portions of the watershed. In addition to improving connectivity, the development of agreements at various dams throughout western Montana, allow the release of additional water during particularly sensitive periods to enhance downstream fish habitat conditions.

Substantial efforts are also underway to clean up areas affected by historical mining operations, throughout western Montana, to improve water quality and overall fish habitat. For example, approximately 6.6 million cubic yards of toxic sediments accumulated behind Milltown Dam from upstream copper mining and smelting operations at Butte and Anaconda will be removed with the Milltown Dam removal project. This dam removal project would also eliminate habitat for a predatory fish, such as northern pike (Schmetterling and Bernd-Cohen 2002). All of these factors are expected to benefit native trout populations in this watershed, and similar activities are occurring in other areas of the state to benefit these species.

When considering all land uses and current actions within the planning area, ~~no significant cumulative effects are anticipated under any of the alternatives.~~ none of the alternatives would result in appreciable adverse cumulative effects, since in all cases, HCP fish species habitat would not be substantially degraded. Current cumulative actions as discussed above should result in an overall benefit to aquatic habitat and fish species, specifically federally and state-listed native trout populations targeted by numerous recovery plans and actions. ~~Based on~~In addition, the specific commitments~~,~~ contained within the action alternatives may ~~be slightly more successful at minimizing cumulative effects of DNRC actions on the HCP project area, although in all cases, HCP fish species habitat would not be substantially degraded~~have a somewhat positive effect on overall cumulative effects when considered with other cumulative impacts on aquatic habitats and species. ~~Current actions as discussed above should result in an overall benefit to aquatic habitat and fish species, specifically federally and state-listed native trout populations, targeted by numerous recovery plans and actions. The cumulative effects of DNRC forest management activities on HCP~~

~~fish species habitat are expected to decrease to some degree for all of the alternatives~~This positive effect would have the greatest benefit to HCP fish species and would continue over the 50-year Permit term.

In the Stillwater Block, the HCP grizzly bear conservation strategy would require DNRC to schedule commercial forest management activities in a 4-year window followed by 8 years of rest from commercial forestry within four subzones totaling only 19,400 acres. Under the Swan Agreement, the entire Swan River State Forest is allocated into five subzones subject to a management/rest scenario, allowing DNRC to conduct forest management activities in a 3-year window followed by 6 years of rest from commercial forestry. The agreement covers 39,700 acres within the Swan River State Forest. If the Swan Agreement is terminated during the Permit term, these HCP project area lands would be subject to the same management/rest schedule as the Stillwater Block.

In both the Stillwater Block and the Swan River State Forest, harvest and road construction, reconstruction, and problem site corrections would increase the risk of sediment delivery and stream temperature effects in these areas during the management period and for a short time after the management period has ended. However, under the proposed HCP, each timber sale in these areas would be required to implement all the necessary sediment abatement measures to prevent and reduce the delivery of sediment generated from roads. These include a limited number of new road miles as defined by a fixed transportation plan, a limit on the amount of riparian harvest, use of CWE assessments to evaluate potential watershed-scale effects from proposed projects, implementation of BMPs, and stream temperature thresholds and monitoring requirements. Also, DNRC would follow the public review process under MEPA, which allows the public, including the USFWS, to examine all proposed timber sales and provide input. Through the MEPA process, DNRC typically conducts a detailed sediment budget analysis and prescribes mitigation measures to address sediment issues in the project.

After harvest is completed and the area is in rest, affected (harvested) riparian areas would undergo natural rehabilitation and would experience substantially less ground-disturbing activity and road traffic, thus decreasing sediment generation and transport to streams during these periods. This would likely result in a subzone-wide improvement in riparian conditions, including increased shade for stream temperature regulation. Through implementation of the HCP commitments and anticipated riparian area recovery associated with the rest period, no substantial overall decrease or increase in aquatic habitat quality or quantity is expected to result from the implementation of the management/rest schedule in the Stillwater Block and Swan River State Forest.

Compared to blocked lands ~~(i.e., Stillwater Block or Swan River State Forest),~~ there is a greater risk ~~from~~that cumulative effects on ~~small, isolated HCP project area~~fish and fish habitat could occur on scattered parcels in the HCP project area, particularly those surrounded by industrial forestland or suburban development. ~~c~~Compared to DNRC blocked or contiguous HCP ownership areas, the likely contribution of DNRC's actions to these cumulative effects would be minor, and would probably be related to road building and potential sediment delivery to streams. ~~This is due to the watershed-wide nature of cumulative effects, and because DNRC rules and regulations on CWE are limited to DNRC lands, which can represent only a fraction of the overall watershed. However, because~~ DNRC's contribution in these areas is expected to be minor due to the CWE screening process, which evaluates landscape-level conditions and considers adjacent land uses and activities~~,~~

~~no significant~~. Through this process DNRC may address potential cumulative effects through the application of additional minimization and mitigation measures to ensure its project would not contribute to adverse cumulative effects ~~are anticipated~~ on HCP fish species.

Existing laws and regulations, including MEPA and the *Montana Cumulative Watershed Effects Cooperative Memorandum of Understanding* (Young 1989) provide some guidance in assessing the potential CWE as a result of a proposed action. However, due to generally high levels of environmental variability and different interpretations of environmental risk, the no-action alternative would not necessarily establish specific standards or thresholds to define potential impact levels for all management activities. For example, although specific watershed thresholds for CWE would be established under Alternative 1, no commitment exists to include mitigation for actions in high-risk watersheds. Under Alternative 1, existing DNRC commitments would provide the underlying guidelines for the management of forested trust lands, and result in existing problem areas on forested trust lands (i.e., problem roads) being addressed over time. This is expected to result in an overall improvement in habitat conditions and a net benefit to aquatic species in the HCP project area, compared to environmental conditions resulting from activities conducted under older regulations.

While Alternative 2 is similar to Alternative 1, it provides some additional protection because the screening process includes all forest management projects, including those categorically excluded from MEPA analysis. In addition, Alternative 2 provides a mechanism for implementing mitigation measures for projects with high risks of cumulative effects. Alternative 2 also includes an adaptive management approach for minimizing cumulative effects through the monitoring activities for the individual habitat components described above. Potential cumulative effects on scattered DNRC parcels and those from other land uses and actions within the analysis area are similar to those discussed for Alternative 1. Alternative 3 would further lessen risk of cumulative effects by mitigation plans for management activities with either a moderate or high cumulative watershed risk. Alternative 4 would provide the same level of protection as Alternative 2.

5.7 Wildlife and Wildlife Habitat

Cumulative effects to wildlife species in the analysis area would be associated with the effects of expanding human presence, as well as habitat management policies on federal and private lands.

The rapidly growing human population in the planning area is one of the most prominent factors affecting wildlife populations. Effective land use controls are more difficult to implement when there are multiple owners with divergent interests rather than a single or a few large single landowners. New residential development is encroaching on previously undeveloped areas, especially those adjacent to public lands. As the number of people increases in a particular area, so does the amount of residential development, with the attendant loss of wildlife habitat. Where habitat loss occurs in areas that provide connectivity between populations or sub-populations of a particular species, the risk of isolation and diminished viability increases. Similarly, increased recreational use in forested areas poses an increased risk of disturbance or displacement of some species, as well as adverse interactions with humans.

~~An example of population growth in the planning area is provided by Flathead County, where the population increased from 39,460 in 1970 to 83,172 in 2005 (Flathead County 2007). This equates to an average annual increase of 2.1 percent. In contrast, the annual growth rate of the planning area as a whole was 1.2 percent between 2005 and 2006, and the growth rate for the state of Montana was 0.9 percent (Table 4.13-2). This population influx in the planning area has created demand for new residential development and subdivisions of larger parcels. Land uses change when portions of larger ownerships primarily managed for resource use, such as forestry or agriculture, are sold in a series of smaller transactions to buyers of property for residential or recreational development. Effective land use controls are much more difficult to establish when there are multiple owners with divergent interests as compared to large single landowners. Development for new residents is encroaching on previously undeveloped areas, especially those adjacent to public lands.~~

A large amount of land~~s~~ in the planning area is under federal ownership. In these areas, residential development is almost non-existent, which partially buffers the cumulative effects of human population growth and residential development.~~; instead,~~ On federal lands, the primary risk to wildlife populations is associated with habitat modification (e.g., changes in the distribution of forest successional stages due to timber harvest) and disturbance due to human activities (recreation, forest management, etc.). The~~se~~ potential for cumulative effects associated with these actions ~~risks~~ are ~~managed~~mitigated through the provisions in the *Grizzly Bear Recovery Plan* (USFWS 1993), the *Northern Rocky Mountain Gray Wolf Recovery Plan* (USFWS 1987), as well as the *Northern Rockies Lynx Management Direction* (USFS 2007a). These provisions are also likely to benefit other species that are sensitive to human disturbance.

Similar to federal lands, the primary risk to wildlife populations on HCP project area lands is associated with habitat modification and disturbance from human activities. While residential development would only occur on HCP project area lands consistent with DNRC's transition lands strategy, it would be more likely to occur near or adjacent to scattered parcels due to the intermixed ownership outside of the Stillwater Block and Swan River State Forest. This could lead to an increased risk of effects on wildlife and wildlife habitat on HCP project area lands that are more easily accessible to local residents. Additionally, construction of roads to access forest stands that would be actively managed under the proposed HCP~~, which~~and are currently not accessible could realize increases in access for dispersed recreation.

Plum Creek is another prominent landowner within the planning area and is currently in the process of selling a large proportion of its lands. The Trust for Public Lands and The Nature Conservancy are actively purchasing 310,000 acres of forested lands from Plum Creek through the Montana Working Forests Project. The first two phases of this project have been completed, and Phase 3 is scheduled to be purchased in December 2010. Phase 1 lands are planned to go to the state of Montana (MFWP and DNRC), and Phase 2 lands to DNRC and the USFS. TNC conveyed lands in the Swan Valley into USFS ownership in March 2010. ~~Ultimately, these lands will be sold to Federal, state, and private entities to be managed to meet the following goals: protection of wildlife habitat, sustainable harvest of timber, and maintenance of public access.~~ These transactions ensure that additional lands in the planning area continue to provide habitat for wildlife and linkages to other habitats.

Federal land management agencies such as the USFS and BLM must conduct management actions on their lands so that ESA-listed species, such as grizzly bears, are not jeopardized. Interagency grizzly bear management guidelines have been developed for these lands. In addition, the state of Montana has a grizzly bear policy (ARM 12.9.103) that outlines policy guidelines for MFWP to promote the conservation of grizzly bears in Montana. Other regionally specific management plans include the *Grizzly Bear Management Plan for Southwestern Montana 2002-2012* (MFWP 2002c), and various tribal, national forest, and national park plans and policies. Most of these management plans are centered on three major themes: (1) management of habitat to ensure grizzly bears have large expanses of suitable inter-connected lands in which to exist, (2) management of grizzly-human interactions, and (3) research to determine the population size and trends to ensure that grizzly bear populations are not being jeopardized. National Forest System lands in the planning area are managed to maintain viable populations of existing native vertebrate species, which includes providing for adequate fish and wildlife habitat. Forest supervisors have the authority to close or restrict the use of areas to minimize the risk of conflicts between humans and grizzly bears.

On National Forest System lands that are classified as occupied lynx habitat, the *Northern Rockies Lynx Management Direction* establishes standards and guidelines with the objective of conserving and promoting recovery of Canada lynx by reducing or eliminating adverse effects from land management activities, while preserving the overall direction of multiple-use land management (USFS 2007a). The management direction establishes requirements for the maintenance of suitable lynx habitat within LAUs and limits pre-commercial thinning within winter snowshoe hare habitat. The direction document also includes non-mandatory guidelines for maintaining denning habitat, limiting the expansion of compacted snow routes, and minimizing the effects of new road construction. Collectively, these standards and guidelines are expected to result in a trend toward greater consideration of the needs of lynx on National Forest System lands in the analysis area.

Some of the recovery efforts identified in Section 5.6 (Fish and Fish Habitat) are also aimed at wildlife species. For example, some road decommissioning projects on federal lands are being implemented with the goal of increasing the availability of security habitat. In addition, one of the goals of the restoration projects initiated by the Confederated Salish and Kootenai Tribes is the reduction of wildlife-human conflicts. Conversely, in areas where land use is shifting from forestry to residential and other development, grizzly bears are being displaced from traditional use areas or experiencing increased conflicts with humans. Throughout the planning area, the USFWS' strategy is to emphasize the protection of listed species on federal lands while maintaining the security of corridors and linkages through other lands. Under the action alternatives, management of HCP project area lands would address this strategy by managing large blocks of lands differently from scattered parcels and also in providing linkage habitat on trust lands adjacent to private and federal lands.

When considering all land uses and current actions within the cumulative effects analysis area, no appreciable cumulative effects are anticipated under any of the alternatives. Based on specific commitments, the action alternatives may be slightly more successful at minimizing cumulative effects of DNRC actions in the HCP project area. On federal lands, the plans and programs discussed above should result in an overall benefit to wildlife species and habitat, specifically to federally and state-listed species, which are targeted by numerous recovery plans and actions. The cumulative effects of DNRC forest management activities on terrestrial HCP species and habitat are expected to decrease to some degree for all of the alternatives over the 50-year Permit term.

Management of forested trust lands under the action alternatives would complement the direction provided by the recovery plans and the *Northern Rockies Lynx Management Direction* (USFS 2007a), particularly the Stillwater Block and the Swan River State Forest, where large blocks of forested trust lands abut areas of federal ownership. Compared to Alternative 1, HCP conservation commitments designed to reduce the risk of bear-human encounters and minimize the risk of displacement from key habitats during key periods would increase the amount of area where such considerations are a primary factor in land use decisions. This would likely reduce the risk of adverse cumulative impacts on species that are sensitive to human disturbance that use the same seasonal habitats important to grizzly bears.

Within the Stillwater State Forest, Alternatives 2 and 4 would be expected to result in an increased risk of adverse cumulative effects on species that are sensitive to disturbance or displacement, compared to Alternatives 1 and 3. This would be the result of the reduced availability of area managed as grizzly bear security core in the Stillwater Block, considered in conjunction with the growing demand for recreational opportunities on public lands. The elevated risk of disturbance would be partially offset by the provision of quiet areas, where management activities would be restricted in certain key habitats during important seasons of the year and seasonal restrictions on DNRC administrative use and public use of roads in important habitats for bears.

Compared to blocked land (i.e., Stillwater Block or Swan River State Forest), there is a greater risk of management related impacts on small, isolated HCP parcels surrounded by industrial forestland or suburban development. This is due to the potential isolation of such parcels from other areas that provide similar habitat, and because DNRC rules and regulations are limited to forested trust lands. If management of adjacent private lands results in adverse effects on wildlife habitat, remnant patches of suitable habitat on forested trust lands may not be able to support viable populations of species that depend on a particular habitat type. For HCP species and those with similar habitat requirements, HCP conservation commitments may offset such adverse cumulative effects associated with management policies and actions on adjacent private lands. Management of forested trust lands under the HCP conservation commitments may provide cumulative benefits to species (including grizzly bear and Canada lynx) for which other management agencies have established plans, policies, and efforts aimed at recovery.

5.8 Recreation

The primary factor affecting recreation in the cumulative effects analysis area is access, particularly motorized access. Under all four alternatives, the demand for recreation opportunities throughout the planning area would be expected to increase ~~with~~given the trends of increasing population and tourism in western Montana. The supply of recreational opportunities would be governed by the availability of sites where people can engage in recreational activities, and by the accessibility of such sites. As recreational demand grows, so does the demand for motorized public access, along with the demand for areas where people may participate in non-motorized activities.

Recreational access on federal lands in the planning area may be reduced by road decommissioning efforts aimed at increasing security habitat for grizzly bears and other wildlife species, or due to reductions in funding available for road maintenance. During the planning process for decommissioning projects, however, the USFS would be required to take recreation concerns into consideration. By allowing seasonal use on additional roads in the Stillwater Block, Alternatives 2 and 4 would increase the amount of area open to motorized public access in the analysis area. This increase in the availability of publicly accessible recreation sites would likely alleviate the demand for recreational opportunities elsewhere, possibly resulting in beneficial cumulative effects compared to Alternatives 1 or 3, under which the Stillwater Core would not be open to motorized public access. If federal management decisions result in a trend of reduced recreational access on federally managed lands in the analysis area, this trend could be partially offset by increased access on forested trust lands in the Stillwater Block under Alternatives 2 and 4.

5.9 Archaeological, Historical, Cultural, and Tribal Trust Resources

Prior to the 1990s, if federal agencies considered cultural resources as part of their land management plans, the resources were often referred to as "heritage resources." Generally, inventory and preservation was not a priority. Today, federal regulations governing cultural resources require federal agencies to conduct inventories of cultural resources and, where applicable, protect those resources through the NRHP.

State and federal cultural inventories and preservation are done in cooperation with the SHPO and, when applicable, THPOs. Most frequently, cultural resource inventories and mitigation developments are done on a project-by-project basis. Most state and federal agencies tend to conduct inventories to identify cultural resource sites within project areas before excavation activities, including timber harvests and road building, take place. Identified cultural resource sites are prioritized for long-term protection, and typically monitored to determine the success of protection. If cultural resources are discovered while a project is underway, the project must cease until the SHPO and, when applicable, the THPO, investigate and analyze the cultural resource.

In large part due to USFS and BLM cultural inventories, Montana has 47,000 recorded historic precontact sites, buildings, structures, and districts, 1,100 of which are listed on the NRHP. However, only 5 percent of Montana has been inventoried (SHPO 2007). According to a 2007 study prepared by the SHPO, risks to cultural resources include commercial and resource development, urban sprawl, neglect, mismanagement, changing population needs, lack of public awareness, and limited financial resources for preservation. Since most cultural surveys in Montana are conducted in response to regulatory requirements triggered by federal and state actions, including timber sales, many known properties or known areas of high probability for properties continue to remain undocumented, especially on private land and on lands where state and federal actions have not yet occurred (SHPO 2007).

Under all alternatives, land management activities on all ownerships in the planning area would be subject to the same federal, state, and local regulations currently used to document, protect, preserve, and conserve cultural and ethnographic resources. Federal, tribal, state, and local landowners and land managers would continue to consult with the SHPO and appropriate THPOs on the identification of cultural resources and their subsequent evaluation and consideration in the decision-making process. Coordination with the SHPO by private property owners would continue to be voluntary. Projects on state and federal lands would continue to trigger cultural inventories, thereby potentially leading to the future discovery and protection of such resources. Under Alternatives 2 and 4, increased management in the Stillwater Core may lead to the discovery and protection of cultural properties that have not yet been inventoried in that area. Implementation of a Programmatic Agreement to address potential adverse effects on cultural resources in the Stillwater Core would minimize the potential for cumulative effects on cultural resources in this area.

5.10 Socioeconomics

Land use in the interior western United States is undergoing a transformation (Ringholz 1992). Some communities historically developed around natural-resource-based land uses and dependent on local resource utilization industries are shifting demographically and economically to tourism, recreation, and extended suburban development. Traditional residents, primarily participants in the resource-based economy, are being displaced by a new citizenry composed of retirees, former urban residents, and other newcomers. As a result, the value basis of communities may shift from resource utilization to abstract values, such as open space and rural lifestyle. Social migration such as this can be observed to varying degrees throughout the planning area and the state of Montana. This shift generally results in the displacement of commercial forestry as a predominant land use due to changing market values; shifting to land uses that are less regulated and potentially less protective of natural resources; shifting public sentiment to favor fewer resource-industry-based land uses; and reductions in dispersed recreation availability due to increasing closures of private and public forest roads to address resource concerns, as well as closure of larger private land holdings formerly available to the public.

Quality of life, as supported by the regional economy, natural amenities, and non-use value would be affected by DNRC actions in combination with federal land management actions that are largely controlled by the *Grizzly Bear Recovery Plan* (USFWS 1993) and individual National Forest System land management plans. Although timber harvest on federal lands has decreased substantially since 1987, it is still significant and likely to continue to help support a base timber industry. In addition to timber harvest, the USFS' expanded role in providing outdoor recreation activities on federal lands will, along with DNRC management, further increase recreation-related jobs and contribute to the ongoing transition from resource-based to service-based economies. On private lands, increased development is likely to reduce timber harvest opportunities, increasing the relative importance of DNRC timber harvest in the scattered parcels.

Without the assurances of an HCP for conservation of covered species, cumulative effects of sustained instability and cycles of socioeconomic transition may occur under the no-action alternative. This instability would limit the capability of communities within the analysis area to react to problems associated with changes in the timber industry. However, if such effects occurred, they probably would affect certain resource-dependent businesses to a greater extent than whole communities, given the geographical range of the analysis area. Larger communities with more diverse economies would probably have a greater tolerance for the instability of a single company than smaller communities that depend on a single company for their economic base.

With the potential for an unstable annual harvest level, the unpredictability of trust revenues could affect economic conditions statewide. Although to a smaller degree than the other TLMD bureaus, revenues generated by DNRC from timber harvest are distributed to trust beneficiaries that support local economies across Montana. Unstable funding levels could result in trust beneficiaries maintaining lower levels of permanent employment that support local communities.

As discussed in Section 4.13.2 (Socioeconomics – Environmental Consequences), the three action alternatives would result in greater stability of timber harvest and would improve overall socioeconomic conditions relative to the no-action alternative. There would be little difference among the three action alternatives. Under Alternative 3, the Stillwater Core would not be opened for harvest, so timber harvest in that portion of the analysis area would be less than under Alternatives 2 and 4. Alternative 3 would also have the most restrictive conservation commitments, which would result in higher costs associated with harvest and, consequently, lower PNV and revenues for trust beneficiaries. Timber harvest from DNRC lands would continue to support the statewide economy at about the same level it currently does, but likely at a more consistent level over the Permit term. This would result in a long-term stable source of employment in the forestry sector. Such stability may partially offset lower and less stable levels of employment associated with private forestlands due to increasing pressures on private land owners from changing public perceptions and regulations.

<<< Draft EIS Section 5.11 was deleted in its entirety. >>>

Chapter

Scoping and Public Involvement

6 SCOPING AND PUBLIC INVOLVEMENT

This chapter describes the scoping and public involvement activities that were conducted for the Montana DNRC Forested State Trust Lands Draft EIS/HCP, including consultation with Native American Tribes, as well as third-party scientific review. It also describes internal agency scoping activities that were conducted and lists preparers of and contributors to the HCP and EIS.

6.1 Introduction

Public participation is a required part of the NEPA, MEPA, and ESA Section 10 planning processes. Public participation is the process by which public agencies inform the public of proposed agency projects and actively seek and incorporate the public's views in their decisions.

The specific public participation objectives of this EIS/HCP are to

- Ensure that interested parties receive accurate, timely information that clearly identifies the scope and purpose of the EIS/HCP.
- Promote an understanding of the technical aspects of the project and the full range of potential effects.
- Provide opportunities for interested parties to voice concerns or opinions and to ask questions.
- Provide opportunities for the HCP Planning Team to receive and understand the concerns of interested parties.
- Provide opportunities for the HCP Planning Team to receive and understand ideas or information that may improve the plan or planning process.
- Clearly communicate what type of input is requested at each stage and explain how that input will be used.
- Comply with NEPA, MEPA, and ESA.
- Develop and maintain agency credibility in the eyes of interested parties.

The major public participation activities associated with the action include

- The public scoping period for the EIS began in spring of 2003 with notices, meetings, and preparation of a scoping report. Internal DNRC and USFWS agency scoping was also initiated during this period.
- A public comment period was opened and public meetings were held for review of the draft conservation strategies during summer and fall of 2005.
- A project website was developed and has been updated periodically to provide information about the project.

- A project update was distributed in January 2009 notifying the public of the proposed timing for release of the Draft EIS/HCP and providing an update on the project.
- With the public release of the Draft EIS/HCP, there was a 90-day public comment period and public meetings.
- Public comments on the Draft EIS/HCP were used to develop this Final EIS and will be used to prepare the RODs. The USFWS' and DNRC's responses to public comments are included in this Final EIS (Appendix G, Responses to Comments on the Draft EIS/HCP).

The next section provides detailed descriptions of public participation activities that occurred prior to publication of the Draft EIS/HCP.

6.2 Public Scoping

6.2.1 Public Notice

An NOI to prepare the draft EIS/HCP was published in the Federal Register on April 28, 2003 (68 FR 81:22412-22414), and a 60-day scoping period was established from April 28 to June 27, 2003. To satisfy federal and state environmental policy act requirements (NEPA and MEPA, respectively), the USFWS and DNRC conducted a joint scoping process for preparation of the HCP and draft EIS. During this period, a project scoping brochure was sent to agencies, private businesses, non-governmental organizations, and interested members of the public. Invitations to attend public scoping meetings were also advertised in local newspapers. The NOI, scoping brochure, and newspaper articles provided information on the project background, purpose, location, and timing of the public scoping meetings.

A project website was developed for the HCP within the DNRC website (http://dnrc.mt.gov/HCP). The website has been available to the public throughout the planning and drafting of the HCP and EIS. The website contains information about the HCP process, the HCP scoping brochure, scoping dates, the project schedule, documents published to date in support of the HCP, and links to other relevant sites.

6.2.2 Scoping Meetings

Public scoping meetings were held in Helena (April 28, 2003), Bozeman (April 29, 2003), Kalispell (May 12, 2003), and Missoula (May 13, 2003). The meetings were attended by representatives from state and federal agencies, organizations, members of the public, and DNRC staff.

The meetings introduced the project to the public. Public comments were solicited at the meetings, and comments were also received in writing throughout the scoping period. Because the HCP was not yet developed at the time of scoping, the meetings were primarily focused on answering the public's questions on the overall HCP planning effort. Topics raised in the comments and questions during the initial public scoping period included the length of the Permit term, the species that were to be included in the HCP, the management activities to be covered in the HCP, and the HCP's geographic coverage. Several commenters recommended a shorter Permit term than the 50-year period selected by DNRC. The EPA supported a multi-species approach, and one individual requested that a plant species, water howellia, be included in the HCP.

6.2.3 Internal Comments

Many of DNRC's staff had questions similar to those posed by the public. Specifically, there were many questions about how the HCP process works, how monitoring would be conducted, why a 50-year Permit term was chosen, and which activities would be covered. DNRC staff also wondered if the ARMs would have to be revised; whether fire suppression, helicopters, or herbicides would be covered activities; and whether additional surveys would be needed. Some internal DNRC staff wanted to know why species that were not federally listed would be included in the HCP, and whether these species could be added later when listed, rather than in the initial HCP. Most importantly, several staff asked how they would be informed as the project proceeded and encouraged ongoing solicitation of input from the staff. A complete summary of the internal scoping comments is included in the scoping report (DNRC 2003a), which is posted on the project website (http://dnrc.mt.gov/HCP/).

6.2.4 External Comments

Regarding land management activities, questions brought forth during scoping included the following:

- How may the HCP affect road closures and recreational access?
- Will new road management plans developed under the HCP reduce environmental effects?
- How will noxious weeds and other unwanted vegetation be treated in the HCP?
- Will fire suppression and fuel loads and fire risk be included in the HCP?
- What conservation activities will be components of the HCP?
- How will miscellaneous forest product sales, special use permitting and licensing, land purchases, sales, exchanges, and leases be considered in the HCP?
- Will the HCP include wildland/urban interface management?

EPA stated that the HCP project area should be appropriate to the planning effort, and that HCP planning should consider the specific species ranges when developing conservation measures. The agency also identified the need to coordinate management with other landowners across the landscape. A complete summary of scoping comments is included in the scoping report (DNRC 2003a).

6.3 External Review of Draft Conservation Strategies

Following completion of negotiations between DNRC and the USFWS, DNRC completed the *Draft Aquatic Conservation Strategies for Bull Trout, Westslope Cutthroat Trout, and Columbia Redband Trout*, the *Draft Canada Lynx Conservation Strategy*, and the *Draft Grizzly Bear Conservation*

Strategy. These strategies contain the specific project-level commitments DNRC would implement to conserve the HCP species. This section summarizes how DNRC solicited comments on the draft strategies and used this input to revise the strategies, which now form HCP Chapter 2 (Conservation Strategies) in Appendix A (HCP), and how they began developing alternatives for analysis in this EIS.

6.3.1 Public Review of Draft Conservation Strategies

DNRC published the draft conservation strategies for internal and public review and comment in October 2005 and initiated a 45-day comment period, which closed on November 20, 2005. The strategies were also posted on the project website. A mailer was sent to everyone on the project mailing list offering copies of the strategies and inviting interested parties to meet with the HCP Planning Team to discuss the strategies and provide input. Approximately 30 parties requested copies, and approximately 20 requested a meeting with the planning team. Meetings were scheduled in Missoula and Kalispell on November 9, 15, 16, and 18, 2005. The 10 public comment letters received and minutes from the four meetings are posted on the project website. Those sending letters and/or attending meetings included private individuals and representatives of conservation groups, the timber industry, and public agencies.

The HCP Planning Team reviewed all of the public comments, focusing on those comments that, once addressed, would help to improve or clarify the strategies or the intent behind the strategies. The following is a selection of comments that were either frequently mentioned during public review, or are of substantive relevance to the public interest. Accompanying each of these comments is DNRC's response and, where applicable, directives regarding where corresponding revisions to the strategies can be found in the HCP. Commitments identified in the responses below are included in HCP Chapter 2 (Conservation Strategies) in Appendix A (HCP). For this Final EIS, revisions to commitments and commitment numbers in the responses below reflect those made in the Final HCP.

6.3.1.1 Comments and Responses for Terrestrial Species

The following comments were received for the grizzly bear and/or lynx conservation strategies.

Comment 1. Some commitments are weak or vague and need clarification. For example, limits for exceptions to spring management restrictions must be defined. Also, the use of phrases that soften the commitments such as "where practicable" and "when economically feasible" in commitment leaves room for interpretation.

Response 1. Many of the commitments intentionally use phrases such as "where practicable." DNRC's intent is not to provide opportunities to work around commitments when they are not convenient. Rather, these statements acknowledge that challenges will arise due to the DNRC's trust mandate, limited funding, or operability constraints when additional flexibility is necessary. The USFWS and DNRC cooperatively incorporated flexibility in the commitments where they agreed it could be added without compromising the integrity of the commitments. In the Final HCP, DNRC has eliminated or constrained many of the allowances within individual commitments (see commitments GB-PR4 and GB-RZ1), as well as clarified the process and requirements associated with salvage (see commitments GB-ST3, GB-SW4, GB-SC3, and GB-CY2). Further, DNRC and the USFWS have developed a monitoring and adaptive management program that requires DNRC to report when these allowances are invoked so that both parties can ensure they are being used appropriately without compromising the intent of the commitments.

Comment 2. There should be a cap on total road densities.

Response 2. Because DNRC must retain the ability to issue easements across trust lands where their ownership is intermingled with other ownerships, the agency is not able to establish a cap on total road densities within scattered parcels.

Within NROH, DNRC addresses risks to bears associated with roads through limits on open roads (see commitment GB-NR1) and through restrictions on DNRC activities during spring, which would ultimately lower road usage in spring in spring habitat (see commitment GB-NR3).

DNRC addresses risks to bears from roads on scattered parcels in recovery zones through limits on total miles of open roads (see commitment GB-SC1), a more rigorous inspection and repair process for road closure structures (see commitment GB-RZ3), restrictions on DNRC activities during spring (see commitment GB-NR3), and required rest periods (see commitment GB-SC2) which, like spring management restrictions, would lower road usage in these areas.

To address the effects of roads on grizzly bears in the Stillwater Block and Swan River State Forest, DNRC has committed to a defined road system implemented through a transportation plan for each of these two blocked areas (see commitments GB-ST1 and GB-SW1). These plans are expected to reduce the amount of activity on total roads for the Permit term. In the Stillwater Block, an area of approximately 90,700 acres, approximately 19 additional miles of permanent road would be constructed over the 50-year Permit term. For the Stillwater Block, DNRC also established subzones, (areas of DNRC land adjacent to USFS lands) that would be on a schedule of 4 years management and 8 years rest. New permanent roads are prohibited in these areas, which is intended to provide seasonal security for bears.

In the Swan River State Forest, an area of approximately 40,000 acres, approximately 70 miles of additional permanent roads would be constructed over the 50-year Permit term, which is the same amount provided for in the current Swan Agreement. Under the HCP, however, 41 miles of these new roads would be subject to greater restrictions than they are under the Swan Agreement, which would provide bears greater protection during spring. Additionally, DNRC would also manage subzones in the Swan River State Forest on a schedule of 4 years management and 8 years rest.

Comment 3. Why has the security core been eliminated in the Stillwater State Forest?

Response 3. Currently, DNRC manages a portion of the Stillwater State Forest as secure habitat for grizzly bears as defined by the IGBC (1998). Secure habitat is defined by the IGBC as areas that are a minimum distance of 0.31 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. It is recommended that secure habitat be established to encompass lands that meet the seasonal habitat needs of bears (IGBC 1998). Within this area, referred to as the Stillwater Core, administrative or commercial activities are restricted to the denning period, and there is no salvage allowance unless activities are conducted during the denning period or through helicopter harvest.

Under the HCP, DNRC would no longer provide secure habitat for grizzly bears in the Stillwater Block through security core areas as defined by the IGBC (1998). Rather, it would implement a rotational schedule similar to that used under the Swan Agreement, which entails providing an area with a period relatively free from commercial activity following a period of active management. Under this scenario, the concept of secure habitat for bears evolves from habitat being located in fixed areas on the landscape to one of providing seasonal security on the forest through 8-year rest periods that move across the landscape.

The primary reason for this change is that by implementing the IGBC definition of secure habitat for grizzly bears in the Stillwater, DNRC was impeded in its ability to meet its trust mandate to generate revenue for the trust beneficiaries from those lands.

The proposed changes under the HCP would improve DNRC's ability to access and manage those lands to generate revenues for the trust beneficiaries and still provide seasonal security for bears as demonstrated through the Swan Agreement.

Comment 4. What is the scientific basis for changing the 3 year/7 year rest rotation for grizzly bears? What is the rationale for 4 year/8 year rest rotation timeframes?

Response 4. The revised timeframes would provide grizzly bears a longer period free from the disturbance of major commercial activity and would provide DNRC greater flexibility to concentrate and complete projects. The Swan Agreement currently requires a 3/3 rest rotation; however in practice, the scenario on DNRC lands is typically a 3/6 rest rotation. Therefore, the 4/8 rest rotation would maintain the same management-to-rest ratio implemented under the Swan Agreement. See commitments GB-ST2, GB-SW3, and GB-SC2. These commitments have been clarified, and the rationale is discussed in the conservation strategy.

Comment 5. Restrictions ending June 30 leave NCDE bears without seasonal secure areas for one month. Restrictions should extend to July 15 or July 30.

Response 5. The spring management restrictions vary by location:

- Stillwater Block – April 1 through June 15 for non-spring habitat and April 1 through June 30 in spring habitat
- Swan River State Forest – April 1 through June 15
- Scattered Parcels – April 1 through June 15.

While Waller and Mace (1997a) defined the spring period as the period from den exit to July 15 based on apparent changes in food habitats and behavior, DNRC selected the proposed dates to balance their operational needs with the security needs of bears. This change is consistent with the Swan Agreement, which identifies the spring period in the Swan River State Forest as April 1 through June 15, as well as the approach to managing access in grizzly bear habitat proposed through the Flathead National Forest's Forest Plan Amendment 19 (USFS 1995a). In the responses to comments on that proposal, it states the USFS felt justified in modifying the date to June 15 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 elevation by bears after mid-June. See the rationale for commitment GB-NR3 in HCP Chapter 2 (Conservation Strategies) in Appendix A (HCP).

Comment 6. Consider bear mortality rates relative to road density.

Response 6. The type of analysis suggested in this comment requires considerable amounts of information that is very expensive and difficult to collect, such as estimates of bear numbers, multi-ownership road data, bear demographic data, and telemetry location data for an adequate sample of female bears. Some of this type of information is currently being collected for the multi-agency NCDE trend monitoring study lead by MFWP; however, it is beyond the scope of this analysis. The concern about road effects on grizzly bears is valid, and it is addressed by analyzing various road density parameters in the EIS.

Comment 7. The conservation strategy does not address old growth or biodiversity conservation.

Response 7. The commitments contained in the HCP are designed to meet the specific conservation needs of the species covered for incidental take protection. While there are no specific commitments for old growth in the HCP, DNRC and the USFWS believe that the lynx conservation strategy commitments reflect the range of forest conditions required by lynx as described in the scientific literature.

Comment 8. Commitments in the lynx conservation strategy incorporate untested assumptions. There is a general lack of knowledge regarding lynx ecology, and commitments must be cautious and take into account the possibility of new science regarding lynx management.

Response 8. DNRC and the USFWS used the best available science to develop the HCP commitments (see HCP Section 1.3.3.3, Use of Best Available Information, in Appendix A, HCP). Additionally, HCP Chapter 4 (Monitoring and Adaptive Management) in Appendix A (HCP) includes a section on incorporating new information through adaptive management. Adaptive management provides a process for changing management practices or commitments to incorporate new information regarding species ecology and new science as it becomes available.

Comment 9. Who will determine vacancy of lynx den sites, and what monitoring will be done?

> ***Response 9.*** See commitment LY-HB3. DNRC will verify the active lynx den sites where this commitment would apply. Both DNRC and the USFWS are confident that DNRC wildlife biologists are capable of making this determination due to (1) the knowledge and skills required to serve as wildlife biologists for DNRC and (2) their familiarity with the specific lands they help manage.

Comment 10. Monitoring should include a requirement to map lynx habitat, including denning and foraging habitat and connectivity.

> ***Response 10.*** Conservation commitment LY-HB1 requires DNRC to maintain a lynx habitat map. Within the NWLO and SWLO, the lynx habitat map would be capable of identifying lynx denning and foraging habitat. The potential den sites conserved by DNRC would not be mapped, but verified active den sites would be mapped. HCP Chapter 4 (Monitoring and Adaptive Management) in Appendix A (HCP), outlines the monitoring requirements for the conservation commitments, including a program to evaluate the accuracy of its SLI database for characterizing stand conditions as they actually exist on the ground to provide confidence to both parties that the SLI and lynx habitat map would adequately track lynx habitat in the project area. There are currently no requirements to map connectivity habitat under commitment LY-HB5 (i.e., along ridge tops and saddles), although DNRC's SLI database is capable of mapping connectivity provided through riparian corridors.

Comment 11. Modify lynx monitoring to incorporate a greater habitat-based effectiveness component.

> ***Response 11.*** DNRC and the USFWS believe the proposed monitoring approach is adequate. New research will be considered by both parties at annual meetings, and any necessary changes will be addressed through the process described in HCP Section 4.2.3 (Adjusting for New Research) in Appendix A (HCP). For more information, see the discussion in HCP Section 4.5.2 (Effectiveness Monitoring and Adaptive Management) in Appendix A (HCP).

Comment 12. Is 1 percent blowdown retention adequate for lynx?

> ***Response 12.*** DNRC and the USFWS believe that, when considered in conjunction with other CWD and snag commitments~~ and den site commitments~~, 1 percent blowdown retention is adequate. See commitment LY-HB2 and associated rationale in HCP Chapter 2 (Conservation Strategies) Appendix A (HCP).

Comment 13. Timber permits and salvage limits are too liberal, and disagree with LCAS recommendations. Consider limiting or banning commercial salvage in inactive subunits during non-denning season.

> ***Response 13.*** The LCAS standard requires federal agencies not to salvage harvest when the affected area is smaller than 5 acres, with some exceptions. While the commitments in the DNRC HCP are different, they are still aimed at providing ample levels of CWD and

denning structure to contribute to the conservation of lynx. State law (MCA 77-5-207) requires DNRC to harvest dead and dying timber before there is substantial wood decay and value loss. Therefore, DNRC cannot ban commercial salvage, but the agency does not consider banning commercial salvage activities necessary to protect listed species.

Comment 14. The CWD commitment is vague, and not related to lynx habitat needs.

Response 14. The USFWS and DNRC recognize that Graham et al. (1994) does not specifically prescribe woody debris amounts or distributions for the purpose of creating potential den sites. However, by providing woody debris using these guidelines, DNRC would ensure that legacy material important for escape cover for lynx, structure important for snowshoe hares, possible future den sites, and other ecological purposes and functions would be retained. DNRC anticipates that the measures to provide for ~~(1) two den sites per square mile, (2)~~ snags, snag recruits, and CWD~~,~~ and ~~(3)~~ many other naturally occurring concentrations at the landscape scale would more than offset any minor losses of woody material due to the allowances described in the conservation strategy. This is now reflected in the rationale for commitment LY-HB2 in HCP Chapter 2 (Conservation Strategies) in Appendix A (HCP). To validate that the commitments for snags, snag recruits, and CWD combined with naturally occurring concentrations of woody material will provide adequate den sites for lynx, DNRC will monitor post-harvest stand conditions to determine the prevalence of potential future den sites (large logs, small log piles, root wads, etc.) as described in HCP Chapter 4 (Monitoring and Adaptive Management) in Appendix A (HCP).

Comment 15. Identify and protect key linkages and corridors in lynx habitat.

Response 15. DNRC's commitments for linkages and corridors in lynx habitat are contained in commitment LY-HB5 in HCP Chapter 2 (Conservation Strategies) in Appendix A (HCP). DNRC and the USFWS believe that the rationale and measures included in this commitment are sufficient and provide for adequate linkages and corridors in lynx habitat.

Comment 16. Graham et al. (1994) is inappropriate for lynx.

Response 16. DNRC and the USFWS acknowledge that Graham et al. (1994) is not a prescription for lynx den sites or denning habitat, but rather presents ranges of CWD to support biological processes. The rationale for using Graham et al. (1994) to support CWD prescriptions is contained in the rationale for commitment LY-HB2. Additionally, refer to Comment 14 for a description of the proposed monitoring for lynx den site material.

Comment 17. There is insufficient protection of winter foraging habitat for lynx.

Response 17. DNRC and the USFWS feel the provision for foraging habitat in mapped lynx habitat is sufficient (see commitment LY-HB4) given the proportion of trust lands within lynx habitat. Within designated LMAs, DNRC would be required to maintain 20 percent of the total potential habitat within the LMA as winter foraging habitat (see commitment LY-LM3). ~~Again, DNRC and the USFWS feel DNRC's commitment to foraging habitat is commensurate with its landownership in lynx habitat.~~

6.3.1.2 Comments and Responses for Aquatic Species

The following comments were received for the conservation strategies for bull trout, westslope cutthroat trout, and Columbia redband trout.

Comment 1. Implementation of the aquatic strategy could undermine the TMDLs that have been developed for impaired waterbodies, or cause new impairments.

Response 1. See commitment and rationale for AQ-SD2 item (13), AQ-SD3 item (7), and AQ-SD4 item (7). Discussion has been added to include TMDLs for impaired waterbodies. DNRC has incorporated those standards and prescriptions contained within approved TMDLs that apply to covered forest management activities where DNRC has actively participated in the development of the TMDL and those TMDL planning areas are located in watersheds supporting HCP fish species.

Comment 2. What stream temperatures are being maintained? What happens if there is a 1° C (1.8° F) increase, considering there is no adaptive management trigger? And why will temperature monitoring only be conducted for 10 years?

Response 2. See commitment AQ-RM1 item (5). Standards and rationale have been clarified. The definition of "adequate" is now addressed in HCP Chapter 4 (Monitoring and Adaptive Management) in Appendix A (HCP). An RMZ harvest prescription has been established to meet minimum post-harvest shade levels needed to meet stream temperature requirements. DNRC has changed the commitment and would monitor up to year 25 of the Permit term. The commitment has also been revised to ensure that the metric used in the proposed stream temperature monitoring strategy utilizes mean weekly maximum temperature.

Comment 3. The conservation strategy does not disclose the large amount of new roads DNRC plans to build.

Response 3. See the rationale for commitment AQ-SD1 item (6). Information on proposed roads has been disclosed for blocked lands. The EIS provides a prediction of future roads on scattered parcels, although these numbers are an estimate and do not represent a cap on total road miles.

Comment 4. There is concern that DNRC will be harvesting timber within wetlands.

Response 4. See rationale and commitment~~s~~ AQ-RM1 item (6)~~ and AQ-RM2(2)~~. DNRC does harvest timber in wetlands, although conditions are applied to both ground-based skidding and cable yarding. Additionally, the ARMs specify tree retention requirements in wetlands. Where an SMZ boundary intercepts adjacent wetlands, the SMZ is extended to include those wetlands. Under the HCP for Class 1 streams, tree retention requirements for the adjacent wetland are the same as the requirements for the first 50 feet of the SMZ under the current regulations. For Class 2 and 3 streams, tree retention requirements for the adjacent wetland are the same as the requirements for the normal SMZ under the current regulations.

Comment 5. Without a standard, how will DNRC know if bull trout habitat is being affected by sediment?

Response 5. DNRC has ~~not~~ adopted a net sediment reduction target as described in HCP Chapter 4 (Monitoring and Adaptive Management) in Appendix A (HCP). ~~However, roads would be brought up to BMP specifications. For further information on sediment monitoring and bull trout, please see the EIS.~~

Comment 6. It would be beneficial to develop a watershed-level sediment budget.

Response 6. DNRC has not adopted a net watershed-level sediment budget, but is committed to conducting road management activities to meet current BMPs.

6.3.2 Third-party Scientific Review of Draft Conservation Strategies

Concurrent with the public review, DNRC and the USFWS sought independent third-party scientific review of the draft conservation strategies. MFWP was identified as a third party that could provide an objective scientific review of the conservation commitments for HCP species provided in the strategies. During the public review period, DNRC provided the draft strategies to MFWP species experts for review and comment. DNRC and the USFWS considered the comments from MFWP, in conjunction with internal and public comments, to revise the conservation strategies and begin developing the alternatives to be analyzed in the draft EIS.

MFWP reviewers generally affirmed that the planning team identified the most important habitat components for conserving HCP species. There were many questions related to clarifying commitment language and explaining monitoring methods. Many of the comments were similar to public comments. Some reviewers suggested that DNRC minimize soft language and include firm sideboards on any allowances within the strategies of the HCP. Reviewers also identified real estate development as a primary threat to wildlife habitat and suggested that the plan minimize development of HCP project area lands.

MFWP also reviewed the Draft HCP, provided comments, and met with the USFWS and DNRC to discuss its comments on November 3, 2009. During the November meeting, MFWP brought to light its awareness of the submission for peer review and publication of the latest research results on habitat selection by lynx within the HCP project area. The USFWS and DNRC subsequently contacted the lead author, Dr. John Squires, to obtain the research paper, and biologists from both agencies met with Dr. Squires to review his findings and evaluate the lynx commitments in the Draft HCP. As a result of this meeting, several lynx commitments were revised in the Final HCP.

6.4 Consultation and Coordination with Native American Tribes and Other Agencies

At the initiation of the scoping process, the USFWS and DNRC contacted 10 Native American tribes in Montana to inform them of the proposed project and to invite their participation in the scoping process. The only tribe to respond was the Confederated Salish and Kootenai Tribes. The HCP planning team subsequently held a meeting with the Confederated Salish and Kootenai Tribes on April 4, 2004, to inform them of the project and solicit their input and concerns. Tribal representatives asked questions of the team and requested future correspondence through the project mailing list, but they expressed no concerns to be addressed in the draft EIS. In May 2007, during preparation of the draft EIS, the USFWS and DNRC contacted the Confederated Salish and Kootenai Tribes and the Blackfeet Indian Tribe to determine if any of the HCP project area contained traditional cultural properties or traditional use areas, or were accessed for collection of plants or hunting of animals. During this coordination effort, the USFWS and DNRC also considered additional general comments on the HCP.

In January 2009, the USFWS and DNRC contacted all 10 tribes on the original scoping list and 11 additional tribes via a mailing to notify them of the release of the draft EIS/HCP and to solicit government-to-government consultation. The tribes were identified based on overlap of their aboriginal lands with the HCP project area.

The USFWS is required to engage in government-to-government consultation to identify concerns tribes may have with the HCP and its potential impacts on historic, cultural, ecological, and other resources of value. As part of the consultation process, participating tribes were invited to identify traditional use areas within the HCP project area so that such areas can be avoided during forest management activities. Tribes were also invited to become signatories to a PA during the 50-year Permit term. The PA identifies how cultural resources will be inventoried and protected on approximately 39,600 acres of the Stillwater State Forest currently identified as grizzly bear security core (Stillwater Core). This area will be open to increased management should the HCP be selected and approved and the Permit issued by the USFWS. Other signatories to the PA will include the USFWS, DNRC, the SHPO, and the Advisory Council on Historic Preservation.

A draft copy of the PA was included in the January 2009 mailing sent to the tribes and specified the following: (1) how DNRC would comply with cultural resource requirements when conducting forest management activities in the Stillwater Core, (2) how DNRC would communicate with the PA signatories and affected tribes regarding cultural resource-related actions in the Stillwater Core, (3) how DNRC would consult with PA signatories and affected tribes should any amendments to the HCP occur that involve the Stillwater Core, (4) that DNRC would survey up to 640 acres annually and report findings to the participating tribes and SHPO, and (5) how PA signatories would periodically review the adequacy of the PA in identifying historic and traditional cultural properties in the Stillwater Core.

The USFWS received requests from both the Confederated Salish and Kootenai Tribes and the Blackfeet Tribe for individual meetings to discuss the proposed HCP and PA. These meetings were held on May 12, 2009, for the Confederated Salish and Kootenai Tribes and on August 26, 2009, for the Blackfeet Tribe. After the two separate meetings, each tribe individually declined the opportunity to become PA signatories.

DNRC also met with the USFS and MFWP ~~on two separate occasions~~. On January 9, 2004, the HCP planning team met with staff of the USFS Region 1 Watershed, Wildlife, Fisheries, and Rare Plants Unit in Missoula and provided an update on the status, process, and issues concerning the HCP. On May 6, 2005, DNRC met with the Helena staff of MFWP to provide a project update and answer questions about the HCP process and conservation strategies. On August 6 and 7, 2009, DNRC displayed the open-house public meeting exhibits at the MFWP Missoula office for MFWP staff to learn more about the proposed HCP commitments and the anticipated effects associated with each alternative analyzed in the Draft EIS. Following the close of the public comment period, DNRC and MFWP met on two separate occasions (October 22 and November 3, 2009) to discuss MFWP's comments on the Draft EIS/HCP.

6.5 Public Review of the EIS/HCP

6.5.1 Draft EIS/HCP Updates

In January 2009, DNRC and the USFWS sent a project update to all agencies, organizations, and individuals included in the original project scoping mailing list, as well as all those who have been added to the scoping list over time. The update provided information on the status of the project and upcoming events, including the expected dates for distribution of the Draft EIS/HCP, public meetings, and comment period. DNRC and the USFWS included information in the update on accessing the Draft EIS via the project website, as well as a postcard that recipients could return to DNRC to ensure they would be included on the distribution list to receive either a hard copy or electronic copy of the Draft EIS/HCP. ~~Those parties returning cards are listed below, as well as other parties who were provided a copy of the draft EIS/HCP. It is likely that additional agencies, organizations, and individuals will access the draft EIS/HCP on the project website to review the document.~~

~~The following agencies, organizations, and individuals were sent a copy of the draft EIS/HCP.~~

6.5.2 Distribution of the Draft EIS/HCP

On June 26, 2009, DNRC and the USFWS distributed the Draft EIS/HCP for a 90-day public comment period, which ended October 9, 2009. Several opportunities to obtain a copy of the Draft EIS/HCP were made available to the public:

- Copies of the Draft EIS/HCP were mailed to the agencies, organizations, businesses, and citizens listed in the subsections below.
- A notice and request for comment was published in the Federal Register (74 FR 122 30617-30619) on June 26, 2009.
- Notices of availability were mailed and emailed to persons on the original scoping list who did not request a copy of the Draft EIS/HCP.
- A news release announcing the availability of the Draft EIS/HCP was posted on the project website (http://dnrc.mt.gov/HCP/) and distributed to the Associated Press, major daily newspapers (Billings, Bozeman, Butte, Great Falls, Helena, Kalispell, Missoula), and selected weekly newspapers in Montana, major television and radio outlets (via the Associated Press), and Montana Public Radio.
- A notification was posted on the public participation page of the project website (http://dnrc.mt.gov/HCP/public.asp).

Those parties who were provided a copy of the Draft EIS/HCP on June 26, 2009, are listed in Table 6-1 at the end of this chapter.

<<< The distribution list in the Draft EIS was deleted from this section and incorporated into Table 6-1 at the end of this chapter. >>>

6.5.3 Open-house Public Meetings for the Draft EIS/HCP

After the Draft EIS/HCP was published, four open-house public meetings were held to inform the public about and receive comments on the Draft EIS/HCP. The open-house meetings featured exhibits summarizing the HCP process, the proposed HCP commitments, and the anticipated effects associated with each alternative analyzed in the Draft EIS. HCP planning team members from DNRC and the USFWS were present to answer questions. Notifications for these meetings were distributed to the public via the same outlets used to announce the release of the Draft EIS/HCP (see Section 6.5.2, Distribution of the Draft EIS/HCP). Citizens attending the open-house meetings were encouraged to submit comments while at the meeting, obtain a copy of the Draft EIS/HCP, and submit comments any time during the 90-day public comment period.

The open-house meeting dates, locations, times, and numbers of attendees are listed below.~~:~~

Kalispell, MT Open House
- Date: Monday, July 20, 2009
- Location: Flathead Valley Community College
- Hours: 2:00 to 8:00 pm
- Number of Attendees: 15

Helena, MT Open House I
- Date: Wednesday, July 22, 2009
- Location: Great Northern Best Western Hotel
- Hours: 2:00 to 8:00 pm
- Number of Attendees: 11

Missoula, MT Open House
- Date: Thursday, July 23, 2009
- Location: Doubletree Hotel Edgewater
- Hours: 2:00 to 8:00 pm
- Number of Attendees: 7

Helena, MT Open House II
- Date: Monday, August 10, 2009
- Location: Capitol Building
- Hours: 9:00 am to 2:00 pm
- Number of Attendees: 7

In addition to the open-house meetings listed above, DNRC and the USFWS accommodated a request by a group in Great Falls to display the open house exhibits on July 28 and 29, 2009. Meeting materials were made available to attendees, as were invitations to submit comments during the public comment period.

6.5.4 Public Comments on the Draft EIS/HCP

During the 90-day public comment period (June 26 through October 9, 2009), DNRC and the USFWS received 523 individual comment letters and emails on the Draft HCP/EIS: 168 unique letters, 229 Natural Resources Defense Council (NRDC) form letters, and 126 Defenders of Wildlife (DOW) form letters. The two form letters (including slight variations of the form letters) represent 68 percent of the letters received. Substantive variations of these two form letters were received from 39 other individuals (7 percent) and were counted as unique letters since they each contained one or more additional comments not found in the original form letters. Additionally, 54 letters received (10 percent) included one or more comments based on a brochure published by the Montana Environmental Information Center (MEIC). While these letters were counted as individual letters, any comments based on the MEIC brochure were counted once for the purpose of summarizing comments and preparing responses. Two groups of county commissioners from Lincoln and Mineral Counties sent identical letters, and these were counted as one unique letter for responding to the comments included in those letters. In addition, the Town of Lima and the Meagher County commissioners sent identical letters; as with the Lincoln and Mineral County letters, these were counted as a single letter. The remaining 73 letters received (14 percent) were unique. A summary of the nature of the comments received, as well as responses to comments on the Draft EIS/HCP, can be found in Appendix G, Responses to Comments on the Draft EIS/HCP.

6.5.5 Distribution of the Final EIS/HCP

Table 6-1 at the end of this chapter lists those agencies, organizations, and individuals that received a copy of the Draft EIS/HCP, submitted comments on the Draft EIS/HCP, and received a copy of the Final EIS/HCP or the Notice of Availability for the Final EIS/HCP. All agencies, organizations, and individuals that provided an email address and either received a copy of the Draft EIS/HCP or submitted comments on the Draft EIS/HCP received the Notice of Availability for the Final EIS/HCP, as well as a link to the documents on DNRC's HCP website (http://dnrc.mt.gov/HCP/), via email. All agencies, organizations, and individuals that did not provide an email address and either received a copy of the Draft EIS/HCP or submitted comments on the Draft EIS/HCP received the Final EIS/HCP on CDROM. Those agencies, organizations, and individuals that did not provide an email address and neither received a copy of the Draft EIS/HCP nor submitted comments on the Draft EIS/HCP received the Notice of Availability for the Final EIS/HCP via the United States Postal Service. Individuals that submitted the NRDC or DOW form letters are listed in Tables 1-2 and 1-3 in Appendix G (Responses to Comments on the Draft EIS/HCP) and received the Notice of Availability for the Final EIS/HCP, as well as a link to the documents on DNRC's HCP website (http://dnrc.mt.gov/HCP/), via email.

6.6 List of Preparers and Contributors

Contributions of the DNRC and the USFWS planning team members included providing technical assistance in the design of analyses, contributing to the writing of various sections and chapters, reviewing draft documents, assisting with data management, and performing GIS analyses.

6.6.1 DNRC Contributors

Ross Baty, Wildlife Biologist, FMB

Jim Bower, Fisheries Biologist, FMB

Gary Frank, Forest Hydrologist, FMB

Sonya Germann, Environmental Planner, FMB

Jordan Larson, Economist, FMB

Brian Long, Inventory Specialist, FMB

John Hogland, GIS Analyst, FMB

Mike O'Herron, EIS/HCP Project Manager, FMB

Donna Riebe, GIS Analyst, FMB

Jeff Schmalenberg, Soils Scientist, FMB

Tim Spoelma, Silviculturist, FMB

Shawn Thomas, Interim Bureau Chief, FMB

6.6.2 USFWS Contributors

Tim Bodurtha, Supervisory Fish and Wildlife Biologist, Ecological Services

Ben Conard, Wildlife Biologist, Ecological Services

Brant Loflin, Archaeologist

Kathleen Ports, EIS/HCP Project Manager

6.6.3 Parametrix Contributors

The following contractor staff also contributed to preparation of this EIS.

Kate Engel, Parametrix: Project Manager, Climate

Margaret Spence, Parametrix: Assistant Project Manager, Climate, Transportation, Socioeconomics

Mark Rasmussen, Mason, Bruce & Girard: Forest Vegetation

Ken Fellows, Parametrix: Air Quality

Bruce Stoker, Earth Systems: Geology and Soils, Water Resources

Jim Good, Parametrix: Water Resources

Todd Caplan, Parametrix: Plant SOC, Noxious Weeds, and Wetlands

Bob Sullivan, Parametrix: Fish and Fish Habitat

Pete Lawson, Parametrix: Fish and Fish Habitat

Mariann Brown, Parametrix: Wildlife and Wildlife Habitat

Mike Hall, Parametrix: Wildlife and Wildlife Habitat, Recreation, Visual Resources

T. Weber Greiser, Historical Research Associates: Archaeological, Historical, Cultural, and Tribal Trust Resources

Marcy Rand, Parametrix: Technical Editing

TABLE 6-1. DISTRIBUTION LIST FOR THE DRAFT AND FINAL MONTANA DNRC FORESTED STATE TRUST LANDS EIS/HCP.

Name[1]	Title	Company/Organization	City[2]	State[2]	Received Draft EIS/HCP	Commented on Draft EIS/HCP	Distribution of Final EIS/HCP[3]
Local and County Government							
Alec N. Hansen	Executive Director	Montana League of Cities and Towns	Helena	MT	X		Email
Bernie Lucas	Meagher County Commissioner		Ringling	MT			Email
Bill Bischoff		Lincoln County Commissioners	Libby	MT			NoA
Bret Smelser	President	Montana League of Cities and Towns	Helena	MT			NoA
Carly Walker		Missoula County Rural Initiatives	Missoula	MT			Email
Charlotte Mills	Clerk and Recorder	Gallatin County	Bozeman	MT			NoA
Clark Conrow, B. J. McComb, Duane Simons		Mineral County Commissioners	Superior	MT		X	Email
David Olsen		Town of Lima	Lima	MT		X	CD
Debbe Merseal	Clerk and Recorder	Missoula County Courthouse	Missoula	MT			Email
Herb Townsend, Bernie Lucas, Ben Hurwitz		Meagher County Commissioners	White Sulpher Springs	MT		X	CD
John Konzen, Marianne Roose, Anthony Berget		Lincoln County Commissioners	Libby	MT		X	CD
Katherine Jasper	Clerk and Recorder	Mineral County	Superior	MT			Email
Marnie McClain		Missoula County Attorney's Office	Missoula	MT			Email
Mary M. McMahon	Clerk and Recorder	Butte-Silverbow County	Butte	MT			NoA
Patti T. Odasz		Beaverhead County Commissioners	Dillon	MT			Email
Regina Plettenberg	Clerk and Recorder	Ravalli County	Hamilton	MT			Email
Rocky Schauer		Lincoln County Weed Control	Libby	MT			NoA
Ruth E. Hodges	Clerk and Recorder	Lake County	Polson	MT	X		Email
		Anaconda-Deer Lodge County Commissioners	Anaconda	MT	X		Email
		Beaverhead County Commissioners	Dillon	MT			NoA
		Broadwater County Commissioners	Townsend	MT			Email
		Butte/Silver Bow County Commissioners	Butte	MT			NoA
		Flathead County Commissioners	Kalispell	MT	X		CD
		Gallatin County Commissioners	Bozeman	MT	X		CD
		Gallatin County Democrats	Bozeman	MT			NoA
		Granite County Commissioners	Philipsburg	MT			NoA
		Jefferson County Commissioners	Boulder	MT			NoA
		Lake County Commissioners	Polson	MT			NoA

TABLE 6-1. DISTRIBUTION LIST FOR THE DRAFT AND FINAL MONTANA DNRC FORESTED STATE TRUST LANDS EIS/HCP (CONTINUED)

Name[1]	Title	Company/Organization	City[2]	State[2]	Received Draft EIS/HCP	Commented on Draft EIS/HCP	Distribution of Final EIS/HCP[3]
		Lewis and Clark County Commissioners	Helena	MT			NoA
	Clerk and Recorder	Lewis and Clark County	Helena	MT			NoA
		Meagher County Commissioners	White Sulphur Springs	MT			NoA
		Mineral County Commissioners	Superior	MT			NoA
		Missoula County Commissioners	Missoula	MT	X		Email
		Park County Commissioners	Livingston	MT	X		CD
		Powell County Commissioners	Deer Lodge	MT			Email
		Ravalli County Commissioners	Hamilton	MT			NoA
		Sanders County Commissioners	Thompson Falls	MT	X		CD
State Government							
		Associate Commissioner for Fiscal Affairs	Helena	MT	X		Email
Rishara Finsel		Kalispell Public Library	Kalispell	MT	X		CD
Ann Gilkey	Staffer	Land Board	Helena	MT	X		Email
Dave VanNice	Staffer	Land Board					Email
Jennifer Anders	Staffer	Land Board					Email
Mike Volesky	Staffer	Land Board					Email
John Heldt		Lewis and Clark Library	Helena	MT	X		CD
Christine Hadlow		Missoula Public Library	Missoula	MT	X		CD
Brian Schweitzer	Governor	Montana	Helena	MT			NoA
Linda McCulloch	Secretary of State	Montana	Helena	MT			NoA
Cathy Swift	Chief Legal Counsel	Montana Board of Regents	Helena	MT			NoA
Anders Blewett	Representative	Montana House of Representatives	Great Falls	MT			Email
Art Noonan	Representative	Montana House of Representatives	Helena	MT			NoA
Betsy Hands	Representative	Montana House of Representatives	Missoula	MT			Email
Bill Beck	Representative	Montana House of Representatives	Whitefish	MT			Email
Bill Nooney	Representative	Montana House of Representatives	Missoula	MT			Email
Bill Wilson	Representative	Montana House of Representatives	Great Falls	MT			Email
Bob Ebinger	Representative	Montana House of Representatives	Livingston	MT			Email
Bob Lake	Representative	Montana House of Representatives	Hamilton	MT			Email
Bob Wagner	Representative	Montana House of Representatives	Harrison	MT			NoA

TABLE 6-1. DISTRIBUTION LIST FOR THE DRAFT AND FINAL MONTANA DNRC FORESTED STATE TRUST LANDS EIS/HCP (CONTINUED)

Name[1]	Title	Company/Organization	City[2]	State[2]	Received Draft EIS/HCP	Commented on Draft EIS/HCP	Distribution of Final EIS/HCP[3]
Brady Wiseman	Representative	Montana House of Representatives	Bozeman	MT			Email
Brian Hoven	Representative	Montana House of Representatives	Great Falls	MT			NoA
Carlie Boland	Representative	Montana House of Representatives	Great Falls	MT			Email
Chas Vincent	Representative	Montana House of Representatives	Libby	MT	X		Email
Cheryl Steenson	Representative	Montana House of Representatives	Kalispell	MT			Email
Chuck Hunter	Representative	Montana House of Representatives	Helena	MT			NoA
Cynthia Hiner	Representative	Montana House of Representatives	Deer Lodge	MT			Email
Dan Villa	Representative	Montana House of Representatives	Anaconda	MT			Email
Dave McAlpin	Representative	Montana House of Representatives	Missoula	MT			Email
Deborah Kottel	Representative	Montana House of Representatives	Great Falls	MT			Email
Dee Brown	Representative	Montana House of Representatives	Hungry Horse	MT			Email
Diane Sands	Representative	Montana House of Representatives	Missoula	MT			Email
Dick Barrett	Representative	Montana House of Representatives	Missoula	MT			Email
Edith Clark	Representative	Montana House of Representatives	Sweetgrass	MT			Email
Edith McClafferty	Representative	Montana House of Representatives	Butte	MT			NoA
Eve Franklin	Representative	Montana House of Representatives	Great Falls	MT			NoA
Franke Wilmer	Representative	Montana House of Representatives	Bozeman	MT			Email
Frosty Calf Boss Ribs	Representative	Montana House of Representatives	Heart Butte	MT			Email
Galen Hollenbaugh	Representative	Montana House of Representatives	Helena	MT			Email
Gary MacLaren	Representative	Montana House of Representatives	Victor	MT			Email
George Groesbeck	Representative	Montana House of Representatives	Butte	MT			Email
Gerald Bennett	Representative	Montana House of Representatives	Libby	MT			Email
Gordon Hendrick	Representative	Montana House of Representatives	Superior	MT			Email
Gordon Vance	Representative	Montana House of Representatives	Bozeman	MT	X		Email
Harry Klock	Representative	Montana House of Representatives	Harlowton	MT			Email
Janna Taylor	Representative	Montana House of Representatives	Dayton	MT			Email
Jeffrey Welborn	Representative	Montana House of Representatives	Dillon	MT			NoA
Jennifer Pomnichowski	Representative	Montana House of Representatives	Bozeman	MT			Email
Jesse O'Hara	Representative	Montana House of Representatives	Great Falls	MT			NoA
Jill Cohenour	Representative	Montana House of Representatives	East Helena	MT			Email
Joel Boniek	Representative	Montana House of Representatives	Livingston	MT	X		Email
John Fleming	Representative	Montana House of Representatives	Saint Ignatius	MT			Email
Jon Sesso	Representative	Montana House of Representatives	Butte	MT			Email
Jon Sonju	Representative	Montana House of Representatives	Kalispell	MT			Email

TABLE 6-1. DISTRIBUTION LIST FOR THE DRAFT AND FINAL MONTANA DNRC FORESTED STATE TRUST LANDS EIS/HCP (CONTINUED)

Name[1]	Title	Company/Organization	City[2]	State[2]	Received Draft EIS/HCP	Commented on Draft EIS/HCP	Distribution of Final EIS/HCP[3]
Keith Regier	Representative	Montana House of Representatives	Kalispell	MT			Email
Llew Jones	Representative	Montana House of Representatives	Conrad	MT			Email
Mark Blasdel	Representative	Montana House of Representatives	Somers	MT			Email
Mary Caferro	Representative	Montana House of Representatives	Helena	MT			Email
Michael More	Representative	Montana House of Representatives	Gallatin Gateway	MT			NoA
Michele Reinhart	Representative	Montana House of Representatives	Missoula	MT			Email
Mike Jopek	Representative	Montana House of Representatives	Whitefish	MT			Email
Mike Menahan	Representative	Montana House of Representatives	Helena	MT			NoA
Mike Milburn	Representative	Montana House of Representatives	Cascade	MT			Email
Mike Miller	Representative	Montana House of Representatives	Helmville	MT	X		Email
Mike Phillips	Representative	Montana House of Representatives	Bozeman	MT			Email
Pat Ingraham	Representative	Montana House of Representatives	Thompson Falls	MT			Email
Pat Noonan	Representative	Montana House of Representatives	Ramsay	MT			Email
Ray Hawk	Representative	Montana House of Representatives	Florence	MT			Email
Robert Mehlhoff	Representative	Montana House of Representatives	Great Falls	MT			Email
Robin Hamilton	Representative	Montana House of Representatives	Missoula	MT			Email
Ron Stoker	Representative	Montana House of Representatives	Darby	MT			Email
Russell Bean	Representative	Montana House of Representatives	Augusta	MT			Email
Scott Mendenhall	Representative	Montana House of Representatives	Clancy	MT			Email
Scott Reichner	Representative	Montana House of Representatives	Bigfork	MT			Email
Scott Sales	Representative	Montana House of Representatives	Bozeman	MT			NoA
Shannon Augare	Representative	Montana House of Representatives	Browning	MT			Email
Sue Dickenson	Representative	Montana House of Representatives	Great Falls	MT			Email
Sue Malek	Representative	Montana House of Representatives	Missoula	MT			NoA
Ted Washburn	Representative	Montana House of Representatives	Bozeman	MT			Email
Teresa Henry	Representative	Montana House of Representatives	Missoula	MT			Email
Timothy Furey	Representative	Montana House of Representatives	Milltown	MT			Email
Aubyn Curtiss	Senator	Montana State Senate	Fortine	MT			Email
Bill Tash	Senator	Montana State Senate	Dillon	MT			Email
Bob Hawks	Senator	Montana State Senate	Bozeman	MT			Email
Bradley Hamlett	Senator	Montana State Senate	Cascade	MT			Email
Bruce Tutvedt	Senator	Montana State Senate	Kalispell	MT			Email

TABLE 6-1. DISTRIBUTION LIST FOR THE DRAFT AND FINAL MONTANA DNRC FORESTED STATE TRUST LANDS EIS/HCP (CONTINUED)

Name[1]	Title	Company/Organization	City[2]	State[2]	Received Draft EIS/HCP	Commented on Draft EIS/HCP	Distribution of Final EIS/HCP[3]
Carol Juneau	Senator	Montana State Senate	Browning	MT			Email
Carol Williams	Senator	Montana State Senate	Missoula	MT			Email
Carolyn Squires	Senator	Montana State Senate	Missoula	MT			Email
Christine Kaufmann	Senator	Montana State Senate	Helena	MT			Email
Cliff Larsen	Senator	Montana State Senate	Missoula	MT			NoA
Dan Harrington	Senator	Montana State Senate	Butte	MT			Email
Dave Lewis	Senator	Montana State Senate	Helena	MT			Email
David Wanzenried	Senator	Montana State Senate	Missoula	MT			Email
Debby Barrett	Senator	Montana State Senate	Dillon	MT			Email
Gary Perry	Senator	Montana State Senate	Manhattan	MT			Email
Greg Hinkle	Senator	Montana State Senate	Thompson Falls	MT			NoA
Gregory Barkus	Senator	Montana State Senate	Kalispell	MT			Email
Jerry Black	Senator	Montana State Senate	Shelby	MT			Email
Jesse Laslovich	Senator	Montana State Senate	Anaconda	MT			Email
Jim Keane	Senator	Montana State Senate	Butte	MT			NoA
Jim Shockley	Senator	Montana State Senate	Victor	MT	X		NoA
Joe Balyeat	Senator	Montana State Senate	Bozeman	MT			Email
John Brueggeman	Senator	Montana State Senate	Polson	MT			Email
John Cobb	Senator	Montana State Senate	Augusta	MT			Email
John Esp	Senator	Montana State Senate	Big Timber	MT			Email
Joseph Tropila	Senator	Montana State Senate	Great Falls	MT	X		Email
Larry Jent	Senator	Montana State Senate	Bozeman	MT			Email
Mike Cooney	Senator	Montana State Senate	Helena	MT			Email
Mitch Tropila	Senator	Montana State Senate	Great Falls	MT			Email
Rick Laible	Senator	Montana State Senate	Victor	MT			Email
Rick Ripley	Senator	Montana State Senate	Wolf Creek	MT			NoA
Ron Erickson	Senator	Montana State Senate	Missoula	MT			Email
Ryan Zinke	Senator	Montana State Senate	Whitefish	MT			Email
Steve Gallus	Senator	Montana State Senate	Butte	MT			Email
Terry Murphy	Senator	Montana State Senate	Cardwell	MT			NoA
Trudi Schmidt	Senator	Montana State Senate	Great Falls	MT			Email
Verdell Jackson	Senator	Montana State Senate	Kalispell	MT			Email
Vicki Cochiarella	Senator	Montana State Senate	Missoula	MT			NoA

TABLE 6-1. DISTRIBUTION LIST FOR THE DRAFT AND FINAL MONTANA DNRC FORESTED STATE TRUST LANDS EIS/HCP (CONTINUED)

Name[1]	Title	Company/Organization	City[2]	State[2]	Received Draft EIS/HCP	Commented on Draft EIS/HCP	Distribution of Final EIS/HCP[3]
Lesa Evers	Office of Indian Affairs	Office of the Governor	Helena	MT			NoA
Canon Luerkens	Staffer	Secretary of State	Helena	MT			Email
Jeff Garrard		Secretary of State	Helena	MT			NoA
Rusty Harper	Staffer	Secretary of State	Helena	MT	X		Email
Joey Kositzky		Whitefish Public Library	Whitefish	MT	X		CD
Denise Juneau	Superintendent of Public Schools		Seeley Lake	MT			NoA
	State Historic Preservation Office		Helena	MT			NoA
State Agencies							
Jim Domino	Water Resources	DNRC	Helena	MT			Email
Mary Sexton	Director	DNRC	Helena	MT	X		Email
Patrick Rennie	Archaeologist/Environmental Impact Specialist	DNRC Ag. And Grazing Mgmt.	Helena	MT			NoA
John Grassy		DNRC Centralized Services Division	Helena	MT			NoA
Kevin Chappell	Ag and Grazing Mgmt. Bureau	DNRC Trust Land Mgmt. Division	Helena	MT			NoA
David Groeschl	Forestry and Fire Div. Admin.	Idaho Department of Lands					Email
Gretchen Lech		Idaho Department of Lands	Coeur D'Alene	ID			Email
Patrick Seymour	Executive Director	Idaho Department of Lands	Coeur D'Alene	ID	X		Email
Rich Furman		Idaho Department of Lands	Coeur D'Alene	ID			Email
Robert Helmer	Forest Management Bureau	Idaho Department of Lands	Coeur D'Alene	ID			NoA
Ron Litz	Assistant Director for Forestry and Fire	Idaho Department of Lands	Coeur D'Alene	ID			NoA
Tony Furman	St. Joe Area Officer	Idaho Department of Lands	St. Mariks	ID			Email
Emily Corsi		Montana Dept. of Environmental Quality	Helena	MT			Email
Tom Ellenhoff		Montana Dept. of Environmental Quality	Helena	MT	X		CD
		Montana Dept. of Environmental Quality	Ronan	MT			NoA
		Montana Dept. of Environmental Quality	Helena	MT			NoA
Adam Brooks		Montana Dept. of Fish, Wildlife & Parks	Helena	MT			NoA
Alan Wood	Regional Supervisor	Montana Dept. of Fish, Wildlife & Parks	Kalispell	MT	X		Email
Arnie Dood		Montana Dept. of Fish, Wildlife & Parks	Bozeman	MT	X		Email
Dave Risley	Fish and Wildlife Administrator	Montana Dept. of Fish, Wildlife & Parks	Helena	MT		X	Email
Gary Bertellotti	Regional Supervisor	Montana Dept. of Fish, Wildlife & Parks	Great Falls	MT	X		Email

TABLE 6-1. DISTRIBUTION LIST FOR THE DRAFT AND FINAL MONTANA DNRC FORESTED STATE TRUST LANDS EIS/HCP (CONTINUED)

Name[1]	Title	Company/Organization	City[2]	State[2]	Received Draft EIS/HCP	Commented on Draft EIS/HCP	Distribution of Final EIS/HCP[3]
Hugh Zackheim		Montana Dept. of Fish, Wildlife & Parks					Email
Kristi DuBois	Region 2 Headquarters	Montana Dept. of Fish, Wildlife & Parks	Missoula	MT			Email
Ladel Knotek	Region 2 Headquarters	Montana Dept. of Fish, Wildlife & Parks	Missoula	MT			Email
Mack Long	Regional Supervisor	Montana Dept. of Fish, Wildlife & Parks	Missoula	MT	X		Email
Mike Thompson	Regional Wildlife Manager	Montana Dept. of Fish, Wildlife & Parks	Missoula	MT	X		Email
Pat Saffel		Montana Dept. of Fish, Wildlife & Parks	Missoula	MT			NoA
Patrick Flowers	Regional Supervisor	Montana Dept. of Fish, Wildlife & Parks	Bozeman	MT	X		CD
Sharon Rose		Montana Dept. of Fish, Wildlife & Parks	Missoula	MT			Email
T.O. Smith		Montana Dept. of Fish, Wildlife & Parks	Helena	MT		X	CD
Bryce Christensen	Regional Supervisor	Dept. of Fish, Wildlife & Parks	Miles City	MT			NoA
Craig Fager	Wildlife Biologist	Dept. of Fish, Wildlife & Parks	Dillon	MT			Email
Garry Hammond	Regional Supervisor	Dept. of Fish, Wildlife & Parks	Billings	MT			Email
Jerry Brown		Dept. of Fish, Wildlife & Parks	Libby	MT			NoA
Jim Williams	Regional Wildlife Manager	Dept. of Fish, Wildlife & Parks	Kalispell	MT			Email
Mike Hensler		Dept. of Fish, Wildlife & Parks	Libby	MT			NoA
Patrick Gunderson	Regional Supervisor	Dept. of Fish, Wildlife & Parks	Glasgow	MT			NoA
Tom Carlsen	Wildlife Biologist	Dept. of Fish, Wildlife & Parks	Townsend	MT			Email
Tom Lemke	Wildlife Biologist	Dept. of Fish, Wildlife & Parks	Livingston	MT			Email
Charlie Cortelyou		Washington DNR	Olympia	WA			NoA
George Shelton		Washington DNR	Ellensburg	WA			NoA
Roy Henderson		Washington DNR	Colville	WA	X		Email
Scott McLeod		Washington DNR	Olympia	WA	X		Email
Robert Ray		Watershed Protection, MT Department of Environmental Quality	Helena	MT		X	CD
Federal Government							
John Sloan		ICBEMP Office	Boise	ID			NoA
		Natural Resources Conservation Service	Bozeman	MT			NoA
Mark Novak		NRCS	Helena	MT			Email
The Honorable Dennis Rehberg	Representative	United States Congress	Washington	DC			NoA
The Honorable Jon Tester	Senator	United States Senate	Washington	DC	X		Email
The Honorable Max Baucus	Senator	United States Senate	Missoula	MT			NoA

TABLE 6-1. DISTRIBUTION LIST FOR THE DRAFT AND FINAL MONTANA DNRC FORESTED STATE TRUST LANDS EIS/HCP (CONTINUED)

Name[1]	Title	Company/Organization	City[2]	State[2]	Received Draft EIS/HCP	Commented on Draft EIS/HCP	Distribution of Final EIS/HCP[3]
Federal Agencies							
	District Ranger	Ashland Ranger District	Ashland	MT			NoA
	Custer National Forest	Beartooth Ranger District	Red Lodge	MT			NoA
	Forest Supervisor	Beaverhead/Deer Lodge National Forest	Dillon	MT			NoA
	District Ranger	Belt Creek Ranger District	Niehart	MT			NoA
		Benton Lake National Wildlife Refuge	Great Falls	MT			Email
		Benton Lake Wetland Management District	Great Falls	MT			Email
Bill Avey	District Ranger	Big Timber Ranger District	Big Timber	MT			NoA
Dave Bull	Forest Supervisor	Bitterroot National Forest	Hamilton	MT			NoA
Linda Cardenas		BLM					Email
		BLM Billings Field Office	Billings	MT			NoA
		BLM Butte Field Office	Butte	MT			NoA
Tim Bozorth		BLM Dillon Field Office	Dillon	MT			NoA
Nancy Anderson		BLM Missoula Field Office	Missoula	MT	X		Email
Sandy Brooks	Branch Chief, Planning and Biological Resources	BLM Montana State Office	Billings	MT	X		Email
Gene Terland	State Director	BLM Montana/Dakotas State Office	Billings	MT	X		CD
Jose Castro	District Ranger	Bozeman Ranger District	Bozeman	MT			NoA
James Sparks		Bureau of Land Management	Missoula	MT			Email
Janet Krivacek	District Ranger	Butte Ranger District	Butte	MT	X		Email
Mike Herrin	District Ranger	Cabinet Ranger District	Trout Creek	MT	X		NoA
Chuck Oliver	District Ranger	Darby Ranger District	Darby	MT	X		Email
Tom Osen	District Ranger	Dillon Ranger District	Dillon	MT	X		CD
Steve Anderson	Forest Supervisor	Flathead National Forest	Kalispell	MT	X	X	Email
Betty Holder	District Ranger	Fortine Ranger District, Murphy Lake Ranger Station	Fortine	MT	X	X	CD
	Forest Supervisor	Gallatin National Forest	Bozeman	MT			NoA
Ken Britton	District Ranger	Gardiner Ranger District	Gardiner	MT			NoA
Park Headquarters		Glacier National Park	West Glacier	MT			NoA
		Hebgen Lake Ranger District	West Yellowstone	MT			NoA
Len Walch		Helena National Forest	Helena	MT			Email
	Forest Supervisor	Helena National Forest	Helena	MT			NoA

TABLE 6-1. DISTRIBUTION LIST FOR THE DRAFT AND FINAL MONTANA DNRC FORESTED STATE TRUST LANDS EIS/HCP (CONTINUED)

Name[1]	Title	Company/Organization	City[2]	State[2]	Received Draft EIS/HCP	Commented on Draft EIS/HCP	Distribution of Final EIS/HCP[3]
Duane Harp	District Ranger	Helena Ranger District	Helena	MT			NoA
Jimmy DeHerrera	District Ranger	Hungry Horse & Glacier View Ranger Districts	Hungry Horse	MT	X		CD
Annie Dueker		Kootenai National Forest	Eureka	MT			Email
Paul Bradford	Forest Supervisor	Kootenai National Forest	Libby	MT			NoA
Lesley Thompson	Forest Supervisor	Lewis and Clark National Forest	Great Falls	MT	X		CD
Malcolm Edwards	District Ranger	Libby Ranger District	Libby	MT	X		Email
Amber Kamps	District Ranger	Lincoln Ranger District	Lincoln	MT			NoA
Ron Archuleta	District Ranger	Livingston Ranger District	Livingston	MT			NoA
		Livingston Ranger District	Livingston	MT			NoA
	Forest Supervisor	Lolo National Forest	Missoula	MT	X		Email
		Lost Trail National Wildlife Refuge	Marion	MT			Email
Sue Heald	District Ranger	Madison Ranger District	Ennis	MT			NoA
		Medicine Lake National Wildlife Refuge	Medicine Lake	MT			Email
Chad Benson	District Ranger	Missoula Ranger District	Missoula	MT	X		Email
	District Ranger	Musselshell Ranger District	Harlowton	MT			NoA
		National Bison Range	Moiese	MT			Email
Gary Edson	District Ranger	Ninemile Ranger District	Huson	MT	X		Email
		Northwest Montana Wetland Management District	Moiese	MT			Email
Brian J. Bellgraph	Montana Cooperative Fishery Research Unit	Pacific Northwest National Laboratory	Richland	WA			Email
Charlene Bucha Gentry	District Ranger	Pintler Ranger District	Philipsburg	MT	X		Email
David Wrobleski	District Ranger	Plains/Thompson Falls Ranger District	Plains	MT			NoA
		Red Rock Lakes National Wildlife Refuge	Lima	MT			Email
Glenn McNitt	District Ranger	Rexford Ranger District	Eureka	MT	X		CD
	District Ranger	Rocky Mountain Ranger District	Choteau	MT			NoA
Tim Love	District Ranger	Seeley Lake Ranger District	Seeley Lake	MT	X		CD
Debbie Mucklow	District Ranger	Spotted Bear Ranger District	Hungry Horse	MT	X		NoA
Dan Ritter	District Ranger	Stevensville Ranger District	Stevensville	MT			NoA
Ruth Wooding	District Ranger	Sula Ranger District	Sula	MT			NoA
	District Ranger	Superior Ranger District	Superior	MT			NoA
Steve Brady	District Ranger	Swan Lake Ranger District	Bigfork	MT	X		Email

TABLE 6-1. DISTRIBUTION LIST FOR THE DRAFT AND FINAL MONTANA DNRC FORESTED STATE TRUST LANDS EIS/HCP (CONTINUED)

Name[1]	Title	Company/Organization	City[2]	State[2]	Received Draft EIS/HCP	Commented on Draft EIS/HCP	Distribution of Final EIS/HCP[3]
Angela Daenzer	R1 Wildlife	Tally Lake Ranger District	Whitefish	MT			Email
Lisa Timchak	District Ranger	Tally Lake Ranger District	Kalispell	MT			NoA
A. Jacobs		Tally Lake Ranger District, USFS	Kalispell	MT	X		Email
Mike Herrin	District Ranger	Three Rivers Ranger District/Troy Ranger Station	Troy	MT			NoA
Mike Cole	District Ranger	Townsend Ranger District	Townsend	MT			NoA
Julie A. DalSoglio		U.S. EPA Region 8	Helena	MT		X	CD
Wayne Kasworm		U.S. Fish and Wildlife Service	Libby	MT	X		Email
Barry Bollenbacher		USDA Forest Service R-1	Missoula	MT	X		Email
Dave Atkins		USDA Forest Service R-1	Missoula	MT			NoA
Beth Haun		USFS Northern Region	Missoula	MT			Email
Jon Haber		USFS R-1	Missoula	MT			Email
Kristi Swisher		USFS, Northern Region One	Missoula	MT			Email
Dave Campbell	District Ranger	West Fork Ranger District	Darby	MT			NoA
Lauren Turner	District Ranger	West Yellowstone Ranger District	West Yellowstone	MT	X		Email
	District Ranger	White Sulphur Spring Ranger District	White Sulphur Springs	MT			NoA
Russ Riebe	District Ranger	Wisdom Ranger District	Wisdom	MT	X		Email
Darren Olsen	District Ranger	Wise River Ranger District	Wise River	MT			NoA
		Yellowstone National Park	Yellowstone National Park	WY			NoA
Educational Institutions							
Chuck Keegan	Forest Industry Research, Emeritus	Bureau of Business and Economic Research	Missoula	MT	X		Email
Frank Gilmore	Chancellor	Montana Tech.	Butte	MT	X		Email
Sheila Stearns	Commissioner of Higher Education	Montana University System	Helena	MT			NoA
Paul Friesema		Northwestern University	Evanston	IL			NoA
Bob Pfister		U of M School of Forestry	Bonner	MT	X		Email
Carl Fiedler		U of M School of Forestry	Missoula	MT			NoA
Dan Pletscher		U of M School of Forestry	Missoula	MT			Email
Don Potts		U of M School of Forestry	Missoula	MT	X		Email
Dr. Jack Ward Thomas	Professor Emeritus	U of M School of Forestry	Missoula	MT			NoA
Rosie Keller		University of Montana	Missoula	MT			NoA

TABLE 6-1. DISTRIBUTION LIST FOR THE DRAFT AND FINAL MONTANA DNRC FORESTED STATE TRUST LANDS EIS/HCP (CONTINUED)

Name[1]	Title	Company/Organization	City[2]	State[2]	Received Draft EIS/HCP	Commented on Draft EIS/HCP	Distribution of Final EIS/HCP[3]
Sisam Briggs	Vice Chancellor, Fiscal Affairs	University of Montana, Dillon Campus	Dillon	MT			Email
Mike Mortimer	Dept. of Forestry (Mail Code: 0324)	Virginia Tech.	Blacksburg	VA			NoA
Claudia Denker	Associate Legal Counsel		Missoula	MT	X		Email
Tribal Government and Agencies							
Harvey Spoonhunter	Chairperson	Arapaho Business Committee	Fort Washakie	WY	X		Letter
Willie Sharp, Jr.	Chairperson	Blackfeet Tribal Business Council	Browning	MT	X		Letter
John Murray	THPO	Blackfeet Tribe	Browning	MT	X		Letter
Gayle Skunkcap, Jr.	Director	Blackfeet Tribe Fish And Wildlife Department	Browning	MT	X		Letter
Dana Q Dupris	THPO	Cheyenne River Sioux Tribe	Eagle Butte	SD	X		Letter
Joseph Brings Plenty	Chairperson	Cheyenne River Sioux Tribe	Eagle Butte	SD	X		Letter
Narcisse Rousseau	Game, Fish, And Parks	Cheyenne River Sioux Tribe	Eagle Butte	SD	X		Letter
John SunChild	Chairperson	Chippewa Cree Tribal Business Committee	Box Elder	MT	X		Letter
Leland Topsky	Natural Resources Department	Chippewa-Cree Tribal Council	Box Elder	MT	X		Letter
Robert Belcourt	Natural Resources Department	Chippewa-Cree Tribal Council	Box Elder	MT	X		Letter
Alfred Nomee	Chair, Natural Resources	Coeur D’Alene Tribe	Plummer	ID	X		Letter
Chief J. Allen	Chairperson	Coeur D’Alene Tribe	Plummer	ID	X		Letter
Jill Wagner	THPO	Coeur D’Alene Tribe	Plummer	ID	X		Letter
E.T. Bud Moran	Chairperson	Confederated Salish & Kootenai Tribes	Pablo	MT	X		Letter
Marcia Pablo	THPO	Confederated Salish & Kootenai Tribes	Pablo	MT	X		Letter
Rich Janssen	Natural Resources	Confederated Salish & Kootenai Tribes	Pablo	MT	X		Letter
Tom McDonald	Division Manager: Fish, Wildlife, Recreation, and Conservation	Confederated Salish & Kootenai Tribes	Pablo	MT	X		Letter
Duane Big Eagle	Chairperson	Crow Creek Sioux Tribal Council	Fort Thompson	SD	X		Letter
Norman Thompson, Jr.	Wildlife Director	Crow Creek Sioux Tribe	Fort Thompson	SD	X		Letter
William Bid Day	THPO	Crow Nation Cultural Committee	Crow Agency	MT	X		Letter
Bill Eastman	Director	Crow Nation Fish And Game	Crow Agency	MT	X		Letter
Clara Nomee	Acting Chairperson	Crow Nation Tribal Council	Crow Agency	MT	X		Letter
Benito Morrison	Acting Director	Crow Nation Wildlife Office	Crow Agency	MT	X		Letter
Dale Becker	Wildlife Manager	CSKT			X		Letter
Les Everts	Fisheries Manager	CSKT			X		Letter
Glenda Trosper	Director, Shoshone Tribe Cultural Center	Eastern Shoshone Tribe	Fort Washakie	WY	X		Letter

TABLE 6-1. DISTRIBUTION LIST FOR THE DRAFT AND FINAL MONTANA DNRC FORESTED STATE TRUST LANDS EIS/HCP (CONTINUED)

Name[1]	Title	Company/Organization	City[2]	State[2]	Received Draft EIS/HCP	Commented on Draft EIS/HCP	Distribution of Final EIS/HCP[3]
Ivan Posey	Chairperson	Eastern Shoshone Tribe	Fort Washakie	WY	X		Letter
Robert St. Clair	Fish, Wildlife, And Parks	Eastern Shoshone Tribe, Northern Arapaho Tribe	Fort Washakie	WY	X		Letter
Tracy King	President	Fort Belknap Community Council	Harlem	MT	X		Letter
Jeff Stiffarm	Fish And Wildlife	Fort Belknap Indian Community	Harlem	MT	X		Letter
John Allen	Councilman	Fort Belknap Indian Community	Harlem	MT	X		Letter
A. T. Rusty Stafne	Chair	Fort Peck Tribal Executive Board	Poplar	MT	X		Letter
Curley Youpee	THPO	Fort Peck Tribes	Poplar	MT	X		Letter
Robert Magnan	Director	Fort Peck Tribes Fish And Game Department	Poplar	MT	X		Letter
Glen Nenema	Chairperson	Kalispel Tribe of Indians	Usk	WA	X		Letter
Jennifer Porter	Chairperson	Kootenai Tribe of Idaho	Bonners Ferry	ID	X		Letter
Scott Soults		Kootenai Tribe of Idaho	Bonners Ferry	ID	X		Letter
Ben Janis	Director, Fish And Wildlife	Lower Brule Sioux Tribe	Lower Brule	SD	X		Letter
Michael Jandreau	Chairperson	Lower Brule Sioux Tribe	Lower Brule	SD	X		Letter
McCoy Oatman	Chairperson	Nez Perce Tribal Executive Committee	Lapwai	ID	X		Letter
Darlene Conrad	THPO Director	Northern Arapaho Tribe	Fort Washakie	WY	X		Letter
Leroy Spang	President	Northern Cheyenne Tribal Council	Lame Deer	MT	X		Letter
Allen Clubfoot	Director, Natural Resources	Northern Cheyenne Tribe	Lame Deer	MT	X		Letter
Linwood Tallbull	THPO	Northern Cheyenne Tribe	Lame Deer	MT	X		Letter
Bruce Parry	Chairperson	NW Band of the Shoshone Nation	Brigham City	UT	X		Letter
Patty Madsen	**THPO**	NW Band of the Shoshone Nation	Brigham City	UT	X		Letter
Michael Catches Enemy	THPO	Oglala Sioux Tribe	Pine Ridge	SD	X		Letter
Michael Catches Enemy	Director, MRRIC	Oglala Sioux Tribe	Pine Ridge	SD	X		Letter
Theresa Two Bulls	President	Oglala Sioux Tribe	Pine Ridge	SD	X		Letter
Joseph Cordier	Director, Natural Resources	Rosebud Sioux Tribe	Rosebud	SD	X		Letter
Kathy Arcoren	THPO	Rosebud Sioux Tribe	Rosebud	SD	X		Letter
Rodney Bordeaux	President	Rosebud Sioux Tribe	Rosebud	SD	X		Letter
Russell Eagle Bear	THPO	Rosebud Sioux Tribe	Rosebud	SD	X		Letter
Terry Gray	NAGPRA	Rosebud Sioux Tribe	Mission	SD	X		Letter
Angelo Gonzales	Executive Director	Shoshone And Bannock Tribes	Fort Hall	ID	X		Letter
Nathan Small	Chairman	Shoshone And Bannock Tribes	Fort Hall	ID	X		Letter
Charles Murphy	Chairperson	Standing Rock Sioux Tribe	Fort Yates	ND	X		Letter
Jeff Kelly	Game Director	Standing Rock Sioux Tribe	Fort Yates	ND	X		Letter

TABLE 6-1. DISTRIBUTION LIST FOR THE DRAFT AND FINAL MONTANA DNRC FORESTED STATE TRUST LANDS EIS/HCP (CONTINUED)

Name[1]	Title	Company/Organization	City[2]	State[2]	Received Draft EIS/HCP	Commented on Draft EIS/HCP	Distribution of Final EIS/HCP[3]
Tim Mentz	Cultural Resource Planner	Standing Rock Sioux Tribe	Fort Yates	ND	X		Letter
Kenneth Timbana	Environmental Director	NW Band of Shoshone	Pocatello	ID	X		Letter
Organizations							
Liz Sedler		Alliance for the Wild Rockies	Helena	MT		X	Email
		Alliance For The Wild Rockies	Missoula	MT			NoA
David Schmetterling	President	American Fisheries Society, MT Chapter	Missoula	MT			Email
Kim Davitt	Corridors of Life Program Coordinator	American Wildlands	Missoula	MT	X		Email
Tom Skeele	Executive Director	American Wildlands	Bozeman	MT			NoA
	Chairperson	Backcountry Horsemen of Montana	Butte	MT			NoA
Ali Duvall		BCCA Council/Blackfoot Challenge	Ovando	MT			NoA
Ben Deeble	President	Big Sky Upland Bird Association	Missoula	MT			Email
		Blackfoot Challenge Grant	Ovando	MT			NoA
		Canyon Coalition	Hungry Horse	MT			NoA
Mayre Flowers	Executive Director	Citizens for a Better Flathead	Kalispell	MT	X		Email
Brianna Randall		Clark Fork Coalition	Missoula	MT	X	X	Email
David Gaillard	Rocky Mountain Region Representative	Defenders of Wildlife	Bozeman	MT	X	X	Email
Jonathan Proctor	Rocky Mountain Region Representative	Defenders of Wildlife	Missoula	MT	X		Email
Minette Johnson		Defenders of Wildlife	Missoula	MT	X		Email
Jenny K. Harbine		EarthJustice	Bozeman	MT		X	Email
Grant Kier	Executive Director	Five Valleys Land Trust	Missoula	MT			NoA
Lewis Young	Conservation Chair	Flathead Audubon Society	Eureka	MT		X	Email
		Flathead Basin Commission	Kalispell	MT			NoA
	President	Flathead Wildlife Inc.	Kalispell	MT	X		Email
Jim Miller	President	Friends of The Bitterroot	Hamilton	MT			NoA
Larry Campbell		Friends of The Bitterroot	Darby	MT			NoA
Mary Jones	Coordinator	Friends of the Missouri Breaks Monument	Lewistown	MT	X		Email
Arlene Montgomery	Program Director	Friends of the Wild Swan	Swan Lake	MT	X	X	Email
Steve Kelly		Friends of the Wild Swan	Bozeman	MT	X		CD
Stuart and Hilary Lewin		Great Falls Conservation Council	Great Falls	MT	X		Email
		Greater Yellowstone Coalition	Bozeman	MT	X		Email

TABLE 6-1. DISTRIBUTION LIST FOR THE DRAFT AND FINAL MONTANA DNRC FORESTED STATE TRUST LANDS EIS/HCP (CONTINUED)

Name[1]	Title	Company/Organization	City[2]	State[2]	Received Draft EIS/HCP	Commented on Draft EIS/HCP	Distribution of Final EIS/HCP[3]
Brian Shovers	Conservation Chair	Last Chance Audubon Society	Helena	MT			NoA
		Lee Metcalf National Wildlife Refuge	Stevensville	MT			Email
Ron Spoon	Land Mgmt. Chair	MCAFS	Townsend	MT			NoA
Tony Schoonen		Montana Action for Access	Ramsay	MT	X		NoA
Harold Blattie		Montana Association of Counties	Helena	MT			Email
Janet H. Ellis		Montana Audubon	Helena	MT	X	X	Email
Jack Atcheson		Montana Coalition for Appropriate Mgmt. of State Land	Butte	MT	X	X	CD
Theresa Keaveny		Montana Conservation Voters	Billings	MT			Email
		Montana Ecosystems Defense Council	Kalispell	MT			NoA
Anne Hedges	Program Director	Montana Environmental Information Center	Helena	MT	X		Email
Anne Hedges and Kyla Wiens		Montana Environmental Information Center	Helena	MT		X	Email
Graden Oeherich		Montana Environmental Information Center	Missoula	MT			NoA
Kyla Wiens	Energy Policy Advocate	Montana Environmental Information Center					Email
		Montana Farm Bureau	Bozeman	MT			NoA
Thorn Liechty		Montana Forest Owners Association	Missoula	MT	X		CD
Richard Briskin		Montana Forest Stewardship Foundation	Ovando	MT			NoA
Sam Gilbert		Montana Forest Stewardship Foundation	Helena	MT			NoA
Keith Olson	Executive Director	Montana Logging Association					Email
		Montana Logging Association	Kalispell	MT			NoA
Jason Todhunter		Montana Logging Association	Harlowton	MT		X	Email
Peter Lesica	Conservation Chair	Montana Native Plant Society	Missoula	MT	X	X	Email
		Montana Natural Heritage Program	Helena	MT			NoA
Jane Adams		Montana Old Growth Project	Kalispell	MT		X[4]	Email
Steve Barrett		Montana Old Growth Project	Kalispell	MT			NoA
Malcolm Thompson		Montana Old Growth Project, R.B.M. Lumber	Columbia Falls	MT			NoA
		Montana Outfitters and Guides Association	Helena	MT			NoA
David Galt		Montana Petroleum Association	Helena	MT			Email

TABLE 6-1. DISTRIBUTION LIST FOR THE DRAFT AND FINAL MONTANA DNRC FORESTED STATE TRUST LANDS EIS/HCP (CONTINUED)

Name[1]	Title	Company/Organization	City[2]	State[2]	Received Draft EIS/HCP	Commented on Draft EIS/HCP	Distribution of Final EIS/HCP[3]
Joe Gutkoski		Montana River Action	Bozeman	MT		X	CD
		Montana River Action	Bozeman	MT	X		Email
John Camden		Montana Rural Water Systems	Great Falls	MT			Email
Carol Lingard	President	Montana Snowmobile Association	Bozeman	MT			NoA
Beth Dodson	Chair, Missoula Chapter	Montana Society of American Foresters	Missoula	MT			Email
		Montana State Leaseholders Association	Seeley Lake	MT	X		Email
		Montana Stockgrowers Association	Helena	MT			NoA
Bruce Farling	Executive Director	Montana Trout Unlimited	Missoula	MT	X	X	Email
		Montana Trout Unlimited, Bozeman Office	Bozeman	MT	X		Email
		Montana Trout Unlimited, Helena Office	Helena	MT			NoA
Cesar Hernandez		Montana Wilderness Association	Kalispell	MT			NoA
		Montana Wilderness Association	Helena	MT			NoA
		Montana Wilderness Association	Bozeman	MT			NoA
Dr. Jim Olson		Montana Wildlife Federation	Hamilton	MT			NoA
Jim Olson and Craig Sharpe		Montana Wildlife Federation	Helena	MT		X	CD
Stan Frasier	NWF Representative	Montana Wildlife Federation	Helena	MT			NoA
Tom Maguire		Montana Wildlife Federation	Great Falls	MT		X	Email
Ellen Simpson		Montana Wood Products Association	Helena	MT	X		CD
Ellen Simpson		Montana Wood Products Association	Helena	MT	X		CD
		Montanans for Multiple Use	Missoula	MT			Email
Roger E. Bergmeier		Montrust	Missoula	MT	X		Email
Sterling Miller	Senior Wildlife Biologist	National Wildlife Federation	Missoula	MT	X		Email
Louisa Wilcox		Natural Resources Defense Council	Livingston	MT		X	Email
Bonny Ogle		North Fork Improvement Association	Kalispell	MT	X		CD
		Northern Plains Resource Council	Billings	MT			Email
Tom and Melanie Parker		Northwest Connections	Swan Valley	MT			Email
		Northwest Power Planning Council	Boise	ID	X		Email
		Northwest Power Planning Council	Lacey	WA			NoA
		Northwest Power Planning Council	Portland	OR			NoA

TABLE 6-1. DISTRIBUTION LIST FOR THE DRAFT AND FINAL MONTANA DNRC FORESTED STATE TRUST LANDS EIS/HCP (CONTINUED)

Name[1]	Title	Company/Organization	City[2]	State[2]	Received Draft EIS/HCP	Commented on Draft EIS/HCP	Distribution of Final EIS/HCP[3]
Brian J. Bellgraph	Montana Cooperative Fishery Research Unit	Pacific Northwest National Laboratory	Richland	WA	X		Email
Bronwen Wright	Policy Analyst	Pacific Rivers Council	Portland	OR	X		Email
Chris Frissell		Pacific Rivers Council	Eugene	OR			Email
Gary Carnefix		Pacific Rivers Council	Missoula	MT			Email
Mary Scurlock	Senior Policy Analyst	Pacific Rivers Council	Portland	OR			Email
		People for Elk	Hungry Horse	MT			NoA
C. M. Hauptman		People for the West	Billings	MT	X		CD
Al Christophersen		Rocky Mountain Elk Foundation	Missoula	MT			Email
		Selkirk Conservation Alliance	Priest River	ID			Email
		Sonoran Institute, Northern Rockies Office	Bozeman	MT			Email
Neil Meyer		Swan Ecosystem Center	Condon	MT	X		Email
Keith Hammer		Swan View Coalition	Kalispell	MT	X	X	Email
David Skinner		The Hydra Project	Whitefish	MT			NoA
Jeff Juel	Forest Policy Director	The Lands Council	Spokane	WA	X		Email
Kat Imhoff	State Director	The Nature Conservancy	Helena	MT	X		Email
Nathan Korb		The Nature Conservancy	Helena	MT			NoA
Anne Carlson		The Wilderness Society	Bozeman	MT		X	Email
		Thompson Falls Land Alliance	Thompson Falls	MT			NoA
Robert Rasmussen		Trust for Public Lands	Helena	MT	X		Email
		Wilderness Society	Bozeman	MT			NoA
Cameron Naficy	Staff Ecologist	Wildwest Institute	Missoula	MT			NoA
Businesses							
Craig and Jackie Mathews		Blue Ribbon Flies	Cameron	MT		X	Email
Brian Pilcher		Brian Pilcher Consulting	Dillon	MT			NoA
		Eagle Stud Mill	Missoula	MT			NoA
Chuck Roady	Lands and Resource Mgr.	F.H. Stoltze Land and Lumber	Columbia Falls	MT	X		Email
Mark Boardman		F.H. Stoltze Land and Lumber	Columbia Falls	MT			NoA
Paul McKenzie	Lands and Resource Mgr.	F.H. Stoltze Land and Lumber	Columbia Falls	MT	X	X	Email
Ronald Buentemeier		F.H. Stoltze Land and Lumber	Columbia Falls	MT	X	X	Email
Josh Letcher		Kootenai Sand and Gravel	Rexford	MT	X		Email
Wayne Finch		Owens & Hurst Lumber Co.	Eureka	MT	X		CD

TABLE 6-1. DISTRIBUTION LIST FOR THE DRAFT AND FINAL MONTANA DNRC FORESTED STATE TRUST LANDS EIS/HCP (CONTINUED)

Name[1]	Title	Company/Organization	City[2]	State[2]	Received Draft EIS/HCP	Commented on Draft EIS/HCP	Distribution of Final EIS/HCP[3]
Henning Stabins		Plum Creek	Fairfield	MT	X		Email
	Log Resources Mgr.	Plum Creek Marketing, Inc.	Columbia Falls	MT			NoA
Denny Sigars		Plum Creek Timber Co.	Missoula	MT			NoA
Jim Kranz		Plum Creek Timber Co.	Columbia Falls	MT	X		Email
Ron Steiner	Senior Wildlife Biologist	Plum Creek Timber Co.					Email
	Flathead Unit Manager	Plum Creek Timber Co.	Kalispell	MT			NoA
Brian Sugden		Plum Creek Timber Company	Columbia Falls	MT			Email
Lorin Hicks	Land Use Planner	Plum Creek Timberlands	Columbia Falls	MT	X	X	Email
Gordy Sanders		Pyramid Mountain Lumber	Seeley Lake	MT	X		Email
Jack Rich		Rich Ranch, LLC	Seeley Lake	MT	X		CD
Bob Blanford		Riley Creek Lumber Co.	Moyie Springs	ID			NoA
		Rocky Mountain Log Homes	Hamilton	MT	X		Email
		Roseburg Forest Products	Missoula	MT			NoA
		R-Y Timber, Inc.	Livingston	MT			NoA
Sid Jenson		Shipley Group	Woods Croos	UT			NoA
Steve Antonioli		Skyline Sportsmen	Butte	MT			NoA
Craig Blubaugh		Smurfit-Stone	Missoula	MT	X		Email
Jim Mountjoy		Smurfit-Stone	Frenchtown	MT			NoA
		Stimson Lumber Company	Bonner	MT	X		CD
Steve Flynn		Sun Mountain Lumber Inc.	Deer Lodge	MT	X		Email
Keith Engebretson		Thompson River Lumber	Kalispell	MT			NoA
		Thompson River Lumber	Thompson Falls	MT	X		Email
		Tricon Timber	St. Regis	MT			NoA
Private Citizens							
Adrian Romero							Email
Alan McNeil			Kalispell	MT		X	Email
Albert Banwart			Bozeman	MT		X	Email
Alex Hasson			Columbia Falls	MT		X	Email
Amy F. Davis			Gallatin Gateway	MT		X	Email
Amy Monteith			Corvallis	MT		X	Email
Andrew Pierce			Missoula	MT		X	Email

TABLE 6-1. DISTRIBUTION LIST FOR THE DRAFT AND FINAL MONTANA DNRC FORESTED STATE TRUST LANDS EIS/HCP (CONTINUED)

Name[1]	Title	Company/Organization	City[2]	State[2]	Received Draft EIS/HCP	Commented on Draft EIS/HCP	Distribution of Final EIS/HCP[3]
Andy Brummond							Email
Arlo Skari			Chester	MT		X	Email
Art Campbell							Email
Arvin Eyre			Cascade	MT		X	Email
Ashea Mills			Gardiner	MT		X	Email
Barbara OGrady			Gardiner	MT		X	Email
Benet Art							Email
Berma Saxton			Helena	MT		X	Email
Bernie Olson			Lakeside	MT			NoA
Bill Baum			Kalispell	MT			Email
Bill Jaynes			Bigfork	MT		X	Email
Bill McLaughlin			Polson	MT		X	Email
Bill Thomas			Great Falls	MT			Email
Bill Warden			Bozeman	MT			NoA
Bob Keenan			Bigfork	MT			NoA
Bruce Hunner			Hamilton	MT		X	Email
Bruce Malcolm			Emigrant	MT			NoA
Bruce Spring						X	Email
Carl Clark			Great Falls	MT		X	Email
Carla Augustad			Kalispell	MT		X	Email
Carol S. and Lawrence R. McEvoy			Clancy	MT		X	Email
Carole Reeves			Kalispell	MT		X	Email
Caroline Adams			Bozeman	MT		X	Email
Cathy Ream			Missoula	MT			NoA
Cedron Jones			Helena	MT		X	Email
Chad Bowers							Email
Charlene O'Neil			Kalispell	MT	X		Email
Chris Burley			Bozeman	MT		X	Email

TABLE 6-1. DISTRIBUTION LIST FOR THE DRAFT AND FINAL MONTANA DNRC FORESTED STATE TRUST LANDS EIS/HCP (CONTINUED)

Name[1]	Title	Company/Organization	City[2]	State[2]	Received Draft EIS/HCP	Commented on Draft EIS/HCP	Distribution of Final EIS/HCP[3]
Chris Freytag							Email
Christopher Harris			Bozeman	MT			NoA
Collette Brooks-Hops and Larry Hops						X	Email
Craig Witte			Kalispell	MT			Email
Curtis and Stephanie Kruer			Sheridan	MT		X	Email
Dan Weinberg			Whitefish	MT			NoA
Dana Huschle			Bozeman	MT		X	Email
Daniel Smith			Fortine	MT	X		CD
Darlene Jump-Rauthe			Kalispell	MT	X		Email
Dave Gallik			Helena	MT			Email
David Lehnherr			Billings	MT		X	Email
Deborah Schultz			Columbia Falls	MT	X		Email
Denise Hayman			Bozeman	MT		X	Email
Denlay Loga			St. Regis	MT			NoA
Diana Anthony			Bozeman	MT		X	Email
Diane Rice			Harrison	MT	X		Email
Don Ryan			Great Falls	MT			Email
Don Snow						X	Email
Doreen Jenness			Missoula	MT			NoA
Doris Fischer			Sheridan	MT		X	Email
Dorothy Keeler			Emigrant	MT		X	Email
Douglas Cordier			Columbia Falls	MT			Email
Dr. Charles Umhen			Milltown	MT	X		Email
Dr. Jim Habeck			Missoula	MT	X		Email
Dr. O. Alan Weltzien						X	Email
Dr. Richard Harris			Missoula	MT	X		Email
Ed Levert			Libby	MT			NoA
Edd Blackler			Bigfork	MT	X		Email
Edwin F. Prach			Whitefish	MT		X	CD

TABLE 6-1. DISTRIBUTION LIST FOR THE DRAFT AND FINAL MONTANA DNRC FORESTED STATE TRUST LANDS EIS/HCP (CONTINUED)

Name[1]	Title	Company/Organization	City[2]	State[2]	Received Draft EIS/HCP	Commented on Draft EIS/HCP	Distribution of Final EIS/HCP[3]
Edwin Fields			Whitefish	MT		X	Email
Eileen Schmidt			Martin City	MT		X	Email
Eldora Landman			Missoula	MT		X	Email
Elizabeth A. Taylor			Frenchtown	MT		X	Email
Elizabeth Lee							Email
Eric Bindseil			Gardiner	MT		X	Email
Eric Saalborn			Belgrade	MT		X	CD
Ernest Scherzer			Trout Creek	MT		X	Email
Erryl Eyster			Polebridge	MT		X	Email
Francis Auld			Elmo	MT			NoA
Fred Longhart			Kalispell	MT		X	Email
Fred Samson			Missoula	MT			NoA
Gail Gutsche			Missoula	MT	X		Email
Gail Richardson			Bozeman	MT		X	Email
Gary Aitken			Ovando	MT		X	Email
Gary Hall			Olney	MT	X		CD
George Everett			Kalispell	MT			Email
George Holton			Helena	MT		X	CD
Gerald Mueller			Missoula	MT			NoA
Gerry Jennings			Great Falls	MT		X	Email
Glenn Roush			Cut Bank	MT			NoA
Gonnie Siebel			Bozeman	MT		X	Email
Grace Hodges			Helena	MT		X	Email
Greg Lind			Missoula	MT			Email
Guenter Heinz			Eureka	MT		X	Email
Hal Jacobson			Helena	MT			Email
Heidi Barrett			Livingston	MT		X	Email
Ingrid Akerblom			Butte	MT		X	Email
Jack Losensky			Hamilton	MT	X		CD
Jack Wells			Bozeman	MT			Email

TABLE 6-1. DISTRIBUTION LIST FOR THE DRAFT AND FINAL MONTANA DNRC FORESTED STATE TRUST LANDS EIS/HCP (CONTINUED)

Name[1]	Title	Company/Organization	City[2]	State[2]	Received Draft EIS/HCP	Commented on Draft EIS/HCP	Distribution of Final EIS/HCP[3]
Jackie Foster			Dillon	MT		X	Email
Jaime Schiller						X	Email
Jamie Lennox			Missoula	MT			NoA
Jeanne O'Neill			Stevensville	MT		X	Email
Jeanne Windham			Polson	MT			NoA
Jeff Smith			Missoula	MT		X	Email
Jenni Cho							Email
Jennifer Abbott			Manhattan	MT		X	Email
Jennifer Ferenstein			Missoula	MT			NoA
Jennifer Nitz			Missoula	MT		X	Email
Jerry O'Neil			Columbia Falls	MT			Email
Jim Elliott			Trout Creek	MT			Email
Jim Moore			Florence	MT		X	Email
Joan Ryshavy			Manhattan	MT		X	CD
Joey Jayne			Arlee	MT			Email
John and Sharene Menson			Clinton	MT		X	Email
John Balyeat			Missoula	MT			NoA
John Boehmke			Billings	MT		X	Email
John D. and Darlene L. Grove			Stevensville	MT		X	Email
John E. Dunkum			Missoula	MT		X	CD
John Host			Baudette	MN			NoA
John Parker			Great Falls	MT			Email
John Ross			Absarokee	MT			NoA
John Sinrud			Bozeman	MT			Email
John Ward			Helena	MT			Email
Jon Ellingson			Missoula	MT			NoA
Jonathan Ruthchild			Missoula	MT		X	Email
Joyce W. Brown						X	Email
Julia Burwell							Email

TABLE 6-1. DISTRIBUTION LIST FOR THE DRAFT AND FINAL MONTANA DNRC FORESTED STATE TRUST LANDS EIS/HCP (CONTINUED)

Name[1]	Title	Company/Organization	City[2]	State[2]	Received Draft EIS/HCP	Commented on Draft EIS/HCP	Distribution of Final EIS/HCP[3]
Julie Wood			Fairfield	MT		X	Email
Karen, Eric, and Anni Shores			Cameron	MT		X	Email
Kate McMahon				MT		X	Email
Kathleen Stachowski			Lolo	MT		X	Email
Keith Erickson							Email
Ken and Carol Kunz			Billings	MT		X	CD
Ken McLean			Helena	MT		X	Email
Ken Toole			Helena	MT			NoA
Ken Wallace			Helena	MT		X	Email
Kent Watson			Missoula	MT		X	Email
Kerrie Byrne			Whitefish	MT		X	Email
Kim Furey			Missoula	MT			Email
Kristen Baker			Missoula	MT			NoA
L. Scott Mills			Missoula	MT			NoA
Lara Adams			Bozeman	MT		X	Email
Larry Ficks			Missoula	MT		X	Email
Linda Christensen			Kalispell	MT		X	Email
Linda Helding Schure			Arlee	MT		X	Email
Linda Smith			Missoula	MT		X	Email
Lindsey Lampe			Billings	MT		X	Email
Lorraine Masters							Email
Lowell Whitey			Kalispell	MT			NoA
Lowry Bass			Troy	MT		X	Email
Lydia Garvey			Clinton	OK		X	Email
Lyle Myers			Helena	MT			NoA
Margaret Adam			Bozeman	MT		X	Email
Margaret Jarrett			Gallatin Gateway	MT		X	Email
Marilyn Guggenheim			Bozeman	MT		X	Email

TABLE 6-1. DISTRIBUTION LIST FOR THE DRAFT AND FINAL MONTANA DNRC FORESTED STATE TRUST LANDS EIS/HCP (CONTINUED)

Name[1]	Title	Company/Organization	City[2]	State[2]	Received Draft EIS/HCP	Commented on Draft EIS/HCP	Distribution of Final EIS/HCP[3]
Mark Johnstad			Emigrant	MT		X	Email
Mark S. Connell			Missoula	MT		X	CD
Marty Howe			Missoula	MT		X	Email
Marvin Smith			Missoula	MT		X	Email
Mary Fay			Helena	MT		X	Email
Michael Ford			Deer Lodge	MT		X	Email
Michael Jamison			Columbia Falls	MT			NoA
Michael Wheat			Bozeman	MT	X		NoA
Mike Crapo			Washington	DC			NoA
Mollie Kieran			Libby	MT		X	Email
Mrs. Leo Keeler			Emigrant	MT		X	Email
Noel Williams			Eureka	MT			Email
Norma Hamilton				FL		X	Email
Orville Bach			Bozeman	MT		X	Email
Pam Hillery			Havre	MT		X	Email
Pam Knowles			Townsend	MT		X	Email
Pam Thompson							Email
Pat Helvey			East Helena	MT		X	CD
Pat Mackinder			Livingston	MT		X	Email
Pat Simmons			Bozeman	MT		X	Email
Pat Wagman			Livingston	MT			NoA
Paul Clark			Trout Creek	MT	X		Email
Paul Kerman			Missoula	MT		X	Email
Paul Klug			Kalispell	MT	X		Email
Paul Richards			Boulder	MT		X	Email
Paulina Sjardal			Kalispell	MT			NoA
Peggy Miller			Missoula	MT		X	Email
Pete Rorvik			Ronan	MT		X	Email
Phyllis Leslie			Whitefish	MT		X	Email
Rae Marie Fauley				MT		X	Email

TABLE 6-1. DISTRIBUTION LIST FOR THE DRAFT AND FINAL MONTANA DNRC FORESTED STATE TRUST LANDS EIS/HCP (CONTINUED)

Name[1]	Title	Company/Organization	City[2]	State[2]	Received Draft EIS/HCP	Commented on Draft EIS/HCP	Distribution of Final EIS/HCP[3]
Ralph Heinert			Libby	MT			Email
Rebecca Norton			Whitefish	MT			NoA
Rena Martin			White Sulphur Springs	MT		X	Email
Rhoda Cargill			Troy	MT			Email
Rich Landini						X	Email
Richard Fisher			Great Falls	MT		X	Email
Richard Mousel			Great Falls	MT		X	CD
Rick Jore			Ronan	MT			Email
Riley McClelland			West Glacier	MT			NoA
Rita Barol							Email
Robert Oset			Hamilton	MT		X	CD
Ron Mathsen			Great Falls	MT	X		Email
Ronda Lee Gagnon			Kalispell	MT		X	Email
Rosalie Buzzas			Missoula	MT			NoA
Rosalind Yanishevsky, PhD.			Colrain	MA			NoA
Roy O'Connor			Clinton	MT		X	Email
Russ Kluesner			Lima	MT	X		Email
S Christopher Anctil							Email
Scott Horngren		Haglund Kelley Horngren Jones & Wilder	Portland	OR	X		Email
STarshine				MT		X	Email
Stephen Braun			Whitefish	MT	X	X	Email
Stephen Wallace			Helena	MT		X	CD
Steve McEvoy			Helena	MT			Email
Steve Thompson		Montana Old Growth Project	Whitefish	MT	X		Email
Sue Ann Stephenson-Love			Great Falls	MT		X	Email
Suzanna McDougal			Hamilton	MT		X	Email
Suzy Holt			Helena	MT		X	Email
Tammie Storli			Kalispell	MT		X	Email

TABLE 6-1. DISTRIBUTION LIST FOR THE DRAFT AND FINAL MONTANA DNRC FORESTED STATE TRUST LANDS EIS/HCP (CONTINUED)

Name[1]	Title	Company/Organization	City[2]	State[2]	Received Draft EIS/HCP	Commented on Draft EIS/HCP	Distribution of Final EIS/HCP[3]
Ted Reeves						X	Email
Teresa Hastings			Helena	MT		X	Email
Terry Burns			Midland	TX		X	Email
Tim Busby			E. Helena	MT			Email
Tim Dowell			Kalispell	MT			NoA
Timothy Border			Bozeman	MT		X	Email
tmlynch						X	Email
Tom Facey			Missoula	MT			NoA
Tom Heyes			Helena	MT		X	Email
Tom Semple			Kalispell	MT			Email
Tony Martin							Email
Treasa Glinnwater						X	Email
Valley Ellingsen			Kalispell	MT		X	CD
Victoria Beschenbossel							Email
Wade Sikorski			Fallon County	MT		X	Email
Wally Congdon			Dell	MT			NoA
Will and Jennifer Swearingen			Bozeman	MT		X	Email
William Jones			Bigfork	MT			Email

[1] Commenters that submitted the NRDC and DOW form letters are listed in Tables 1-2 and 1-3 in Appendix G (Responses to Comments on the Draft EIS/HCP). These commenters received the Notice of Availability for the Final EIS/HCP and a link to the files on DNRC's HCP website via email.
[2] Blanks occur where no city or state was provided by the commenter.
[3] CD = Final EIS/HCP distributed to recipient on CDROM; Email = Notice of Availability for the Final EIS/HCP and a link to the files on DNRC's HCP website provided via email to recipient; NoA = Notice of Availability for the Final EIS/HCP provided to recipient via United States Postal Service; Letter = letter sent to tribes to notify them of availability of the Final EIS.
[4] Author of information submitted as an attachment to the Draft EIS/HCP comment letter submitted by Montana Environmental Information Center.

Chapter

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7 REFERENCES

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Chapter 8

GLOSSARY

8 GLOSSARY

100-year site index tree height – The average height predicted by site index curves for 100-year-old dominant or co-dominant tree species representative of the cover type in a given stand.

124 permit – A permit required under the Montana Stream Protection Act for any project that requires the construction of new facilities or the modification, operation, and maintenance of an existing facility that may affect the natural existing shape and form of any stream or its banks or tributaries. Montana Fish, Wildlife and Parks issues and administers the 124 permit under the regulatory authority of the Montana Stream Protection Act. The Act states that fisheries resources are to be protected and preserved in their natural state, except as may be necessary and appropriate after considering all factors involved. The 124 permit process ensures that plans to modify fisheries resources (e.g., stream channel, stream banks, etc.) either eliminate or diminish potential adverse effects to those fisheries resources.

303(d) listings – Section 303(d) of the federal Clean Water Act requires states to assess the condition of their waters to determine where water quality is impaired (does not fully meet standards) or threatened (is likely to violate standards in the near future). The result of this review is the 303(d) list, which must be submitted by each state to the U.S. Environmental Protection Agency every other year. The 303(d) list in Montana is administered by Montana Department of Environmental Quality.

Abandoned road – A road that is impassable due to effective closure but has drainage structures that have not been removed. Under the proposed HCP (Alternative 2), an abandoned road would not receive motorized use for low-intensity forest management activities or commercial forest management activities.

Active gravel pit – Any gravel pit or rock source that has excavation, processing, hauling, and/or other uses in a given calendar year. Motorized use of active pits may vary considerably from very limited low use to continuous motorized operation and hauling.

Active subunit – A bear management unit subunit in which DNRC is actively conducting commercial forest management activities.

Adaptive management – The process of monitoring the implementation of conservation measures, then adjusting future conservation measures according to what was learned. Adaptive management can also include testing of alternative conservation measures, monitoring the results, and then choosing the most effective and efficient measures for long-term implementation.

Administrative Rules of Montana (ARM) – A codification of the general and permanent rules published in the Montana Administrative Register by the executive departments and agencies of the state of Montana.

Allopatric redband trout – Redband trout that evolved outside the historical range of steelhead. See also **sympatric redband trout**.

Anadromous fish – Those species of fish that mature in the ocean and migrate to freshwater streams to spawn. For example, salmon are anadromous fish.

Animal unit – An animal unit is one mature cow of approximately 1,000 pounds and a calf up to weaning, usually 6 months of age, or their equivalent.

Animal unit month (AUM) – The amount of forage required by an animal unit for one month.

Bankfull depth – The depth of water in a stream as measured from the surface to the channel bottom when the water surface is even with the top of the stream bank.

Bankfull flows – The bankfull flow stage corresponds to the discharge at which channel maintenance is the most effective, that is, the discharge at which moving sediment, forming or removing bars, forming or changing bends and meanders, and generally doing work that results in the average morphologic characteristics of channels.

Bear – The grizzly bear (*Ursus arctos horribilis*).

Bear management unit (BMU) – A federally defined sub-designation within a grizzly bear recovery zone used for habitat evaluation and population monitoring (*Grizzly Bear Recovery Plan*, USFWS 1993).

Bear-resistant – Secured in a hard-sided camper, vehicle trunk, cab, hard-sided dwelling, hard-sided storage building, approved bear-resistant container, within an effective electric fence, or suspended with the bottom of the item at least 10 feet up and 4 feet out from an upright support.

Best management practice (BMP) – A practice or combination of land use management practices that are used to achieve sediment control and protect soil productivity and prevent or reduce non-point pollution to a level compatible with water quality goals. The practices must be technically and economically feasible and socially acceptable.

Best management practice (BMP) audit – An established monitoring and reporting process conducted both internally by DNRC (internal BMP audits) and by third parties (statewide BMP audits) to evaluate and document the implementation and effectiveness of BMPs applied on individual DNRC timber harvesting operations and associated site preparation, slash disposal, road construction, and road maintenance activities.

Biological diversity (or Biodiversity) – The variety of life and its processes. It includes the variety of living organisms, the genetic differences among them, and the communities and ecosystems in which they occur.

Blocked lands – Areas where parcels owned by DNRC are within proximity to one another. Blocked lands comprise greater than 15,000 acres, or a series of parcels in a checkerboard pattern, or parcels situated in proximity to one another or that lie adjacent to each other and form small to medium-sized blocks. For the purposes of the proposed HCP (Alternative 2), blocked lands refer to those lands exhibiting these characteristics within the Swan River, Stillwater, or Coal Creek State Forests.

Bear management unit (BMU) subunit – A federally defined sub-designation of a BMU that approximates a female grizzly bear's home range; BMU subunits are used for habitat evaluation and population monitoring.

Board foot – A unit for measuring wood volumes. One board foot is a piece of wood 1 foot long, 1 foot wide, and 1 inch thick (144 cubic inches). This measurement is commonly used to express the amount of wood in a tree, saw log, or individual piece of lumber. A thousand board feet is abbreviated mbf.

Borrow (source or site) – Small sources of gravel, rock, or fill material within 0.25 mile of open or restricted roads. Sizes of borrows can range from small, disturbed areas associated with the removal of several cubic yards of material up to larger areas of 1 acre. For the purposes of the HCP commitments, the number of borrows is not limited when associated with allowable road construction and/or road maintenance activities.

Bottomless arch culvert – A three-sided culvert that allows a natural stream bed in order to achieve substrate and stream flow conditions similar to undisturbed channel conditions.

Box culvert – A concrete (pre-cast or cast-in-place) or metal rectangular culvert, which can be countersunk in the stream bed to provide substrate that emulates natural conditions.

Broadcast burning (also referred to as slash burning) – A controlled burn, where the fire is intentionally ignited and allowed to proceed over a designated area within well-defined boundaries for the reduction of fuel hazard after logging or for site preparation before planting.

Browse (noun) **–** That part of leaf and twig growth of shrubs, woody vines, and trees available for animal consumption.

Buffer – A forested area of trees left unharvested or harvested with site-specific or modified prescriptions during timber harvest to protect sensitive ecosystems or wildlife habitat, or potentially unstable slopes. Forest management activities may be allowed if consistent with the objectives for the buffer.

Bull trout core habitat – Bull trout core habitat is defined as habitat that contains, or if restored would contain, all of the essential physical elements to allow for the full expression of life history forms of one or more local populations of bull trout. A core habitat area represents the closest approximation of a biologically functioning unit for bull trout. Core habitat may include currently unoccupied habitat if that habitat contains essential elements for bull trout to persist or is deemed critical to recovery (USFWS 2002a). See also **State of Montana bull trout core habitat**.

Bull trout nodal habitat – Bull trout nodal habitat is a designation developed by the Montana Bull Trout Restoration Team during preparation of the *Restoration Plan for Bull Trout in the Clark Fork River Basin and Kootenai River Basin* (MBTRT 2000). Nodal habitats are those used by sub-adult and adult bull trout as migratory corridors, rearing areas, and overwintering areas and for other critical life history requirements.

Carrying capacity – The maximum livestock stocking rate possible without inducing permanent or long-term damage to vegetation or related resources. The stocking rate may vary from year to year in the same area as a result of fluctuating forage production.

Changed circumstance – Changed circumstances means changes in circumstances affecting a species or geographic area covered by a conservation plan that can reasonably be anticipated by plan developers and the USFWS and/or NMFS and that can be planned for (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).

Channel migration zone (CMZ) – The width of the flood prone area at an elevation twice the maximum bankfull depth.

Classified forest trust lands – Montana state trust lands are legally assigned to one of four land use classes. The four classes are grazing, agricultural, forest, and other (which includes administrative sites, cabin sites, commercial leases, military sites). The basis for classification is to ensure that lands are used to best meet the Land Board's trust and multiple-use responsibilities and that no lands are sold, leased, or used under a different classification than that to which they belong.

Coarse-filter approach (**terrestrial**) – An approach to maintaining biodiversity as described in the State Forest Land Management Plan (DNRC 1996) that involves maintaining a diversity of structures and species composition within stands and a diversity of ecosystems across the landscape. The intent is to meet most of the habitat requirements of most of the native species. Compare with **fine-filter approach**.

Coarse woody debris (CWD) – Dead woody material such as stems or limbs, generally larger than three inches in diameter (ARM 36.11.403(19)).

Code of Federal Regulations (CFR) – A codification of the general and permanent rules published in the Federal Register by the executive departments and agencies of the federal government.

Commercial forest management activities – Timber harvest and salvage harvest activities, (which includes logging, yarding (including tractor, cable, and helicopter types), and hauling), road construction, and road reconstruction.

Commercial forestland – Timber land capable of growing commercial crops of trees. Land that can grow 20 cubic feet of timber volume per acre per year.

Compliance monitoring – Monitoring conducted to determine the degree to which forest landowners and operators are adhering to regulatory policies for forest practices.

Connectivity (fish) – Connectivity is the capability of different life stages (e.g., adult or juvenile fish) of HCP fish species to move among the accessible habitats within normally occupied stream segments. For example, a culvert or dam may reduce connectivity by preventing or impeding upstream or downstream migration. For the proposed HCP, the objective for connectivity will focus exclusively on road-stream crossings.

Connectivity (lynx) – Stand conditions where sapling, pole, or sawtimber stands possess at least 40 percent crown canopy closure, in a patch greater than 300 feet wide.

Conservation commitment – Specific actions and requirements comprising conservation strategies.

Conservation strategy – A collection of conservation commitments intended to meet the goals and objectives of an HCP.

Contingency plan – A response to a changed circumstance that will be collaboratively prepared by DNRC and the USFWS.

Cooperative management response (CMR) – A process by which minor adjustments can be made to improve the HCP or to clarify HCP language.

Cost-share agreement – An agreement between the State of Montana and the USFS Region 1 whereby both parties agree to share in the land costs and road construction and maintenance of mutually used roads in a manner commensurate to the amount of lands being accessed. The resulting agreement is formalized by an exchange of documents issued by each party. The agreement requires that the USFS determine the tributary area being accessed by said road system, and then picking up any third-party shares when there is third-party usage within said road system. Due to other applicable federal laws, the USFS becomes the controlling party of any roadway over trust lands, with an assumption of liability, maintenance, and future access requests to third parties. The cost-share agreement referred to herein is specifically applicable to the master cost-share agreement, known as the "Montana Master Share Agreement," and not any other cost-share agreement that the State of Montana or the USFS may periodically enter into independently.

Covered activities – Otherwise legal activities covered by an HCP and Permit. For the proposed HCP, covered activities include selected DNRC forest management activities related to timber harvest, roads, and grazing licenses. Covered activities include commercial forestry activities (e.g., timber harvest, salvage harvest, thinning, slash disposal, prescribed burning, site preparation, reforestation, weed control, fertilization, and inventory); forest management road construction, reconstruction, maintenance, use, and associated gravel quarrying for road surface materials; grazing licenses on classified forest trust lands (see definitions for **grazing license** and **grazing lease**); and roaded access.

Critical habitat – The specific areas occupied by the species at the time it is listed on which are found those physical or biological features that are (1) essential to the conservation of the species and (2) may require special management considerations or protection. Also, specific areas outside the area occupied by the species at the time it is listed upon a determination that such areas are essential for the conservation of that species (summarized from the Endangered Species Act).

Crown closure – The percentage of the ground surface covered by vertical projection of tree crowns. Synonymous with canopy cover and crown cover.

Cumulative effects – Per 40 CFR 1508.7, the impact on the environment that results from the incremental impact of the action when added to other past, present, and reasonably foreseeable future actions, regardless of what agency (federal or non-federal) or person undertakes such other actions.

Cumulative watershed effects (CWE) – The collective impacts specifically affecting watershed resource features, such as water yield, flow regimes, channel stability, and in-stream, and upland sedimentation due to surface erosion and mass wasting.

Den site (lynx) – Natural or man-made piles at least 8 feet in diameter of slash and downed logs, which are at least 3 feet tall at their highest point will be considered as potential den sites. Potential den sites must be situated greater than 300 feet from open or restricted roads.

Desired future condition (DFC) – The land or resource conditions that will exist if goals and objectives are fully achieved (ARM 36.11.403 (24)).

Diameter at breast height (dbh) – The diameter of a tree, measured 4.5 feet above the ground on the uphill side of the tree.

Disturbance regime – A disturbance regime for an area comprises all of the various disturbances that may occur. There typically would be several types of disturbances, each characterized in terms of its type, size, spatial distribution, frequency, magnitude, and other spatial and temporal characteristics.

Duff – Decaying vegetable matter on the forest floor, such as leaves, twigs, and cones. Duff is important for soil production.

Effectiveness monitoring – Monitoring performed to determine whether the HCP conservation commitments being implemented are having the desired biological effect on the given resource or species.

Enabling Act – The act by which land was granted by Congress to the State of Montana and held in trust for the support of common schools.

Endangered species – A species listed under the Endangered Species Act that is in danger of extinction throughout all or a significant portion of its range.

Endangered Species Act (ESA) – The Endangered Species Act, 16 USC 1531 et seq., as amended, and its implementing regulations. The ESA is federal legislation that provides a means to ensure the continued existence of threatened or endangered species and the protection of critical habitat of such species.

Engineered substrate – Stream bottom material, such as gravel and cobbles, mechanically placed within a stream channel or culvert to emulate the natural conditions upstream or downstream.

Environmental assessment (EA) – A concise public document that briefly provides sufficient evidence and analysis for determining whether to prepare an environmental impact statement or a finding of no significant impact (40 CFR 1508.9). The appropriate level of environmental review for actions that either do not significantly affect the human environment or for which the agency is uncertain whether an environmental impact statement is required (Montana Environmental Policy Act).

Environmental impact statement (EIS) – A document prepared under the National or Montana Environmental Policy Acts to assess the effects that a particular action or program will have on the environment. An EIS addresses significant environmental impacts and informs decision makers and the public of the reasonable alternatives that would avoid or minimize adverse impacts or enhance the quality of the human environment.

Equivalent clearcut area (ECA) – The total area within a particular watershed or sub-drainage that does or will exist in a clearcut condition. An ECA value is determined by adding the area actually in a clearcut condition with an equivalent clearcut area for roads, and partial or selective cut units.

Even-aged management – Forest management prescriptions, such as clearcut, seed tree, and shelterwood harvests, that are designed to initiate the establishment of new stands of young trees. See also **uneven-aged management**.

Fall period (grizzly bears) – The period from September 16 through November 15.

Federally listed species – A species listed as threatened or endangered under the federal Endangered Species Act.

Fine-filter approach – An approach to maintaining biodiversity as described in the State Forest Land Management Plan (DNRC 1996) that is directed toward particular habitats or individual species that might not be adequately considered under a coarse-filter approach to management. The habitats may be critical in some way, and the species may be sensitive, threatened, or endangered. See also **coarse-filter approach**.

Fishery – An area of water where fish are caught for recreational or commercial purposes.

Forage (noun) **–** All browse and herbage that is available and acceptable to grazing animals or that may be harvested for feeding purposes.

Ford – A dip constructed in the roadbed at a stream crossing, instead of a culvert or bridge. The stream bed should be of erosion-resistant material, or such material must be placed in contact with the stream bed.

Forest Management Administrative Rules (Forest Management ARMs) – State rules that apply to forest management activities on all forested state trust lands administered by DNRC that provide field personnel with consistent policy, direction, and guidance for the management of forested state trust lands.

Forested state trust lands (also referred to as forested trust lands) – Forested state lands managed by the Trust Land Management Division of DNRC for the economic benefit of the trust beneficiaries and endowed institutions of Montana. These lands, totaling approximately 727,000 acres, are currently managed under the State Forest Land Management Plan and the Forest Management Administrative Rules (ARMs 36.11.401 through 36.11.450). Forested state trust lands may include trust lands classified under any of the four land use classes.

Fuel loading – The mass of combustible materials available for a fire.

Full market value – A real estate transaction whereby the purchase price of a property equals the appraised market value.

Geographic information system (**GIS**) **–** A computer system used to store and manipulate spatial data for the purposes of producing maps and performing analyses of spatial features. Spatial data maintained within a GIS can represent point, line, and area features on the ground, such as bald eagle nests (points), roads and streams (lines), and habitat types (areas).

Gravel quarrying – As a covered activity, includes DNRC's development and operation of gravel pits and borrow sites and DNRC's obtaining, stockpiling, hauling, and unloading gravel from DNRC or non-DNRC borrows or gravel pits. For the purposes of the HCP commitments, the number of borrows is not limited when associated with allowable road construction and/or road maintenance activities. Only medium and large gravel pits count against the allowable number of pits on a given administrative unit within grizzly bear recovery zones and non-recovery occupied habitat. See also **borrow (source or site)**, **medium gravel pit**, and **large gravel pit**.

Grazing lease – A lease to graze livestock on trust lands that are classified grazing lands. The minimum rental rate for grazing leases is set by a formula that includes the average weighted price for beef cattle sold in Montana during the previous year. Because grazing leases are issued by the Agriculture and Grazing Management Bureau of DNRC and are not associated with DNRC forest management activities, they are not included as a covered activity under the proposed HCP.

Grazing license – A license to graze livestock on trust lands that are classified forest lands. Official written permission to graze a specific number, kind, and class of livestock for a specified period on a defined allotment or management area. Because grazing licenses are associated with DNRC forest management activities, they are included as a covered activity under the proposed HCP.

Green timber – Live trees.

Habitat conservation plan (HCP) – Under Section 10(a)(2)(A) of the Endangered Species Act, a planning document that is a mandatory component of an incidental take permit application. The HCP process is intended to provide a comprehensive, long-term management plan to protect and facilitate the recovery of threatened and endangered species and to provide a framework for creative partnerships between the public and private sectors in endangered species conservation.

Habitat type group – A system for stratifying the site potential of forest stands based on the habitat type climax vegetation classification system described by Pfister et al. (1977). The system was devised by Green et al. (1992) for the purposes of characterizing old-growth stands in the northern region of the USFS (comprising the Northern Rockies). Groupings reflect similarity of disturbance response, potential productivity, potential stocking density, potential for down wood accumulation, fire frequency, and tree species. The habitat types within each group also exhibit similar temperature and moisture regimes.

Habitat types – Forest vegetation types that follow the habitat type climax vegetation classification system developed by Pfister et al. (1977).

Habitat conservation plan (HCP) fish species (**HCP aquatic species**) **–** The fish (aquatic) species covered by an HCP and incidental take permit. For the proposed HCP, HCP fish species are bull trout (*Salvelinus confluentus*), westslope cutthroat trout (*Oncorhynchus clarki lewisi*), and Columbia redband trout (*O. mykiss gairdneri*).

Habitat conservation plan (HCP) species – The aquatic and terrestrial species covered by an HCP and incidental take permit. For the proposed HCP, aquatic HCP species are bull trout (*Salvelinus confluentus*), westslope cutthroat trout (*Oncorhynchus clarki lewisi*), and Columbia redband trout (*O. mykiss gairdneri*). Terrestrial HCP species are grizzly bear (*Ursus arctos horribilis*) and Canada lynx (*Lynx canadensis*).

Habitat conservation plan (HCP) project area – The lands (including lands added to the HCP pursuant to the transition lands strategy) where the covered activities occur and the lands to which the HCP's conservation commitments apply. For the proposed HCP, the HCP project area includes the blocked lands comprising the Stillwater, Coal Creek, and Swan River State Forests, as well as numerous scattered parcels throughout the Northwestern, Southwestern, and Central Land Offices of DNRC as depicted in HCP Figure C-1 in Appendix C (HCP Figures).

Human environment – The natural and physical environment and the relationship of people with that environment.

Hydrologic unit code (HUC) – For the purposes of watershed classification, a unique 11-digit number assigned to individual watersheds by the U.S. Geological Survey.

Hyporheic flow – The percolating flow of water through the sand, gravel, sediments, and other permeable soils under and beside the open stream bed.

Implementation monitoring – Monitoring performed to determine whether the HCP conservation commitments are being implemented so that DNRC's covered activities remain in compliance with HCP requirements.

Implementing Agreement – Part of the application for an incidental take permit that specifies the HCP terms and conditions and legally binds the USFWS and permit holder (DNRC for the proposed HCP) to the requirements and responsibilities of the HCP and incidental take permit.

Inactive subunit – A bear management unit subunit in which DNRC is prohibited from conducting commercial forest management activities.

Incidental take – The taking of a federally listed wildlife species, when that taking is incidental to, but not the purpose of, carrying out otherwise legal activities.

Incidental take permit (Permit) – A permit that exempts a permittee from the take prohibition of Section 9 of the Endangered Species Act, provided that a conservation plan has been developed that specifies the likely take and steps that the applicant will use to mitigate and minimize the take. A Permit is issued by the USFWS or NMFS or both under Section 10 of the Endangered Species Act for non-federal applicants.

In-stream shade – The total solar energy affecting the surface of the stream in the stream reach adjacent to the timber harvest unit.

Interdisciplinary (ID) Team – A group of individuals, each with unique resource training, assembled to prepare an environmental assessment or environmental impact statement. The team is assembled out of recognition that no one scientific discipline is sufficiently broad to prepare all resource sections (affected environment and environmental consequences) of the document. The project leader is responsible for coordinating the efforts of the team. Through interaction, participants bring different points of view to bear on the planning process and work together to develop project alternatives.

Intermittent stream – Any non-permanent (flows only for part of the year) flowing drainage feature having a definable channel and evidence of annual scour or deposition.

Internal (DNRC) best management practice (BMP) audits – An established monitoring and reporting process conducted internally by a DNRC water resource specialist, soil scientist, and fisheries biologist. The audit procedures are identical to those utilized by the third-party audits (statewide BMP audits) to evaluate and document the implementation and effectiveness of BMPs applied on individual DNRC timber harvest operations and associated site preparation, slash disposal, road construction, and road maintenance activities.

Large gravel pit – A source of gravel or rock that involves 5 to 40 acres of disturbed area. Large pits receive sporadic intensive levels of use that may be relatively continuous during some operating seasons. 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 involve mining, crushing, sorting, and/or asphalt operations over 1 or more years. Large gravel pits are typically subject to rules, regulations, and permitting governed by the Montana Opencut Mining Act (ARMs 17.24.201 through 225) administered by the Montana Department of Environmental Quality.

Large woody debris (LWD) – Dead woody material, including logs, trees, or parts of trees that are greater than 4 inches (10 centimeters) in diameter and are located within a stream or river. LWD contributes to healthy aquatic systems by providing habitat for fish and aquatic insects, supplying nutrients to the stream, trapping sediment, forming pools, and stabilizing banks and stream channels.

Legacy road – an historical road constructed prior to best management practice development and implementation.

Level 1 watershed analysis – a watershed coarse-filter analysis relying primarily on existing data and information, and including documentation of rationale describing those variables that may contribute to cumulative watershed effects, an assessment of adverse cumulative watershed effects risk, and a description of additional detailed analysis, if required.

Level 2 watershed analysis – an evaluation of Level 1 watershed analysis results, field review of the project area, evaluation of baseline existing conditions, and a qualitative assessment of projected effects of proposed actions relative to the baseline existing conditions.

Level 3 watershed analysis – an evaluation of Level 1 and/or Level 2 watershed analysis results, field review of the project area, evaluation of baseline existing conditions, and a detailed quantitative assessment of projected effects of proposed actions relative to the baseline existing conditions.

Listed species – A species recognized as endangered, threatened, or sensitive by a federal or state agency. See also **federally listed species**.

Low-intensity forest management activities – Timber inventory, timber sale preparation, road location, road maintenance, bridge replacement, mechanical site preparation, tree planting, pre-commercial thinning, prescriptive and hazard reduction burning, patrol of fall and winter slash burns, heavy and non-heavy equipment slash treatments, monitoring, data collection, and noxious weed management, but not commercial forest management activities.

Lynx habitat – Forestlands consisting of subalpine fir or hemlock habitat types, as described by Pfister et al. (1977). Forest types may be mixed species composition (subalpine fir, hemlock, Engelmann spruce, Douglas-fir, grand fir, western larch, lodgepole pine, and hardwoods), as well as stands dominated by lodgepole pine. Moist Douglas-fir, grand fir, cedar, and Engelmann spruce habitat types where they are inter-mixed with subalpine fir habitat types also provide habitat for lynx.

Lynx management area (LMA) – A key geographic area in the context of DNRC ownership that is of notable importance for lynx. LMAs are delineated zones that contain forested trust lands where increased levels of lynx conservation commitments are applied. Within these areas, records indicate that lynx are likely present (or have been in the relatively recent past) or lands are considered important for maintenance of resident lynx populations.

Mass movement – The downslope movement of rock and soil, under the influence of gravity.

Mass wasting – A geologic term that can be used to describe multiple erosional processes acting in unison that contribute to base erosion rates of landscapes, watersheds, or similar geomorphic units.

Medium gravel pit – A source of gravel or rock that involves 1 to 4.9 acres of disturbed area. Medium pits 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 involve excavating, crushing, sorting, and/or asphalt operations.

Microclimate – The physical state of the atmosphere close to a very small area of the earth's surface, often in relation to living matter, such as forests or insects.

Monitoring – The process of gathering data that provides DNRC and the public with information on how plans are being implemented and whether they work as intended.

Montana Environmental Policy Act (MEPA) – Legislation that provides a public process requiring the state government to make a deliberate effort to identify the impacts a decision may have on the human environment before that decision is made. This is the state equivalent of the federal National Environmental Policy Act.

Motorized activities – Motorized activities include chainsaw operation and timber felling, pre-commercial thinning, motorized vehicle trips associated with administrative uses, skidding and ground-based yarding operations, aerial yarding, motorized road construction and maintenance, log loading, log processing, and log hauling.

Motorized trail – A trail that is used by motorized vehicles.

National Environmental Policy Act (NEPA) – The law requiring all federal agencies to consider and analyze all significant environmental impacts of any action proposed by those agencies; to inform and involve the public in the agencies' decision-making processes; and to consider the environmental impacts in those processes.

No Surprises regulation – A regulation of the NMFS and USFWS providing regulatory assurances to an HCP incidental take permit (Permit) holder that no additional land use restrictions or financial compensation would be required with respect to species covered by the applicant's Permit, even if unforeseen circumstances arise after the permit is issued that indicate additional mitigation is needed to protect the species (50 CFR Part 17).

Non-denning season – The time of year when grizzly bears are out of hibernation and are active. On the Stillwater Block, this means April 1 through November 30. On all other forested trust lands, this means April 1 through November 15.

Non-habitat areas (**lynx) –** Permanent non-forested areas such as dry forest types, rock, lakes, meadows, etc.

Non-recovery occupied habitat (**NROH) (grizzly bears) –** The fixed land area outside the boundaries of established grizzly bear recovery zones where one would reasonably expect to find grizzly bear use occurring during any/most years, as of 2002, as defined by Wittinger (2002).

Non-stocked stand – A forest stand with fewer than 50 seedlings and saplings per acre, equivalent to the grass/forb habitat type.

Non-vegetated gravel pit – Previously forested areas that have fewer than 180 sapling trees per acre or less than 40 percent total stand crown closure.

Noxious weed – An unwanted plant specified by federal, state, or local laws as being especially undesirable, troublesome, and difficult to control. It grows and spreads in places where it interferes with the growth and production of native plants or desired crops.

Old-growth – Forest stands that meet or exceed the minimum number, size, and age of those large trees as noted in *Old-Growth Forest Types of the Northern Region* by Green et al. (1992).

Open road – A road without limitation on motorized vehicle use. Some open roads could be restricted for specific management reasons other than the HCP (spring breakup for example). For the purpose of calculating open road density on scattered parcels, open roads include roads open year-long with uncontrolled public and administrative use; roads where status is currently unknown; roads restricted year-long or seasonally by other landowners where DNRC does not control access; and roads restricted during the winter period by DNRC that do not limit access during spring, summer, or fall periods.

Ordinary high water mark (OHWM) – The stage regularly reached by a body of water at the peak of fluctuation in its water level. The OHWM is generally observable as a clear, natural line impressed on the bank. It may be indicated by such characteristics as terracing, changes in soil characteristics, destruction of vegetation, presence or absence of litter or debris, or other similar characteristics.

Other suitable habitat (lynx) – Forested habitat within lynx habitat with at least medium stocking levels (at least 40 percent crown closure) in any combination of seedling/sapling, pole, or sawtimber size classes as identified in DNRC's stand level inventory database. Other suitable habitat also includes stands of saplings that contain at least 180 stems per acre that are greater than or equal to 6 feet tall. Other suitable habitat is a subset of suitable lynx habitat but does not contain the necessary attributes to classify as winter foraging habitat or summer foraging habitat. Under current rules, other suitable habitat also includes ~~or~~ young foraging habitat as defined in the Forest Management ARMs.

Parcel – A legally definable tract of land based on a 640-acre section. Portions of a legally described 640-acre section that are less than 640 acres but share a common boundary line (such as a NE 1/4 section and a SE 1/4 section; i.e., a 1/2 section in total) typically are considered as **one** parcel. Portions of a legally described 640-acre section that are less than 640 acres but share a common corner (such as a NE 1/4 section and a SW 1/4 section) typically are considered as **two** parcels. However, multiple 640-acre sections that share common boundary lines (or full 640-acre sections with adjoining smaller units such as an adjacent 40-acre tract) typically are considered as separate parcels. Two or more tracts within a section that are linked through boundary lines **(not** diagonally across corners) typically are considered as one parcel. Parcels may be more specifically defined for purposes such as establishing grazing animal unit months, or for identification in conjunction with acquisition, disposal, or special projects.

Perennial stream – A well-defined channel that contains water year round during a year of normal rainfall with the aquatic bed located below the water table for most of the year.

Physiographic region – A geographic region in which climate and geology have given rise to a distinct array of land forms that are notably different from those of surrounding regions.

Planning area – The geographic area potentially influenced by implementation of the proposed HCP. The planning area encompasses the HCP project area and all other lands in the three land offices containing the HCP project area. As such, the planning area includes trust lands managed by DNRC but not included in the HCP project area, as well as lands owned by other state, local, private, federal, and tribal entities.

Poletimber – Forest stands dominated by trees between 5 and 9 inches diameter at breast height.

Present net value (PNV) – Present net value is the difference between the present value of cash inflows and the present value of cash outflows. PNV is used in capital budgeting to analyze the profitability of an investment or project. PNV compares the value of a dollar today to the value of that same dollar in the future, taking inflation and returns into account.

Primary closure device – A closure device (e.g., gate, berm, barricade, or tank trap) designed for restricting road access situated off an open road system that is primarily responsible for restricting access on a particular road or road system. Secondary closure devices (which can be structures similar to primary closure devices) may or may not be present on road segments behind primary closure devices.

Proposed 4(d) special rule – Refers to Section 4(d) of the federal Endangered Species Act. Pursuant to section 4(d), special rules may be promulgated "to provide for the conservation of [threatened] species." Such special rules may limit the application of the prohibition against take.

Proposed threatened or endangered species – Species proposed by the USFWS or NMFS for listing as threatened or endangered under the federal Endangered Species Act; not a final designation.

Reciprocal access agreements – The method established by MCA 77-1-617 whereby DNRC can acquire access to isolated trust lands by exchanging an equal right on trust lands. The tract(s) the state is acquiring access to must be isolated in either a legal sense (i.e., there is no legal access to the state land) or there are portions of the tract that have substantial physical restrictions that prevent access. A state tract may have legal access and be burdened by reciprocity as long as one or more state tracts obtain access through the reciprocal agreement. Rights do not have to be equal if the trust beneficiary burdened by reciprocity is compensated.

Reclaimed gravel pit – A gravel pit that has been made capable of supporting the uses those lands were capable of supporting prior to any mining activity, through any combination of the following or other means: backfilling, grading, stabilizing, or re-contouring, and re-vegetating.

Reclaimed road – A road that is impassable due to effective closure. It has been stabilized, and culverts and other structures, if present, have been removed, but the road prism may remain. A reclaimed road will not receive motorized use for low-intensity forest management activities or commercial forest management activities (as defined under the proposed HCP – Alternative 2).

Resident lynx population – A group of lynx that has exhibited long-term persistence in an area, as determined by a variety of factors, such as evidence of reproduction, successful recruitment into the breeding cohort, and maintenance of home ranges (68 FR 40076-40101, July 3, 2003).

Rest period – A period during the non-denning season when project activities are restricted or prohibited to provide secure areas for grizzly bears.

Restricted road – A road that is managed to limit the manner in which motorized vehicles may be used. Restricted roads will have a physical barrier that restricts the general use of motorized vehicles. Restrictions will be man-made or naturally occurring (gates, barricades, earthen berms, vegetation that makes the road impassable, eroded road prism, rocks, etc.).

Riparian area – Areas of land directly influenced by water or that influence water. Riparian areas usually have visible vegetative or physical characteristics reflecting the influence of water. Riversides and lake shores are typical riparian areas. Commonly referred to as "riparian zone."

Riparian management zone (RMZ) – Under the Forest Management Administrative Rules (ARMs 36.11.401 through 36.11.450), an RMZ refers to streamside buffer established when forest management activities are proposed on sites with high erosion risk or on sites that are adjacent to fish-bearing streams or lakes (ARM 36.11.425). For the purposes of the proposed HCP, under the aquatic conservation strategy, the combined streamside management zone (SMZ) and RMZ are referred to as an RMZ, as defined in the September 2003 version of the ARMs for the Streamside Management Zone (ARMs 36.11.301 through 36.11.312).

Road – Any created or evolved access route that is greater than 500 feet long and is reasonably and prudently drivable with a conventional two-wheel-drive passenger car or two-wheel-drive pickup. See also **abandoned road**, **open road**, **reclaimed road**, **restricted road**, and **temporary road**.

Record of Decision (ROD) – For a project that requires an environmental impact statement, a record of decision is required. This document states what the decision was, identifies all alternatives considered, and states whether all practicable means to avoid or minimize environmental harm have been adopted, and if not, why they were not.

Rosgen channel types – A classification system for rivers based on channel morphology that was developed by Rosgen (1994). Stream reaches are divided into seven major stream type categories (Aa+, A, B, C, D, DA, E, F, and G) that differ in entrenchment, gradient, width/depth ratio, and sinuosity in various landforms. The major categories can be further broken down into sub-categories based on dominant channel materials.

Salmonid – Fish species belonging to the family Salmonidae, including trout, salmon, char, and whitefish species.

Salvage harvest – The removal of dead trees or trees damaged or dying because of injurious agents other than competition (such as fire, insects, disease, or blowdown) to recover the economic value that would otherwise be lost (ARM 36.11.403).

Sawtimber – Forest stands dominated by trees greater than 9 inches diameter at breast height; young sawtimber is generally less than 100 years old, and mature sawtimber is generally greater than 100 years old, but lacking some old-growth characteristics.

Scattered parcels (**scattered lands) –** Any DNRC section or parcel that is not part of blocked lands. For the purposes of the proposed HCP, blocked lands are identified within the Swan River, Stillwater, or Coal Creek State Forests.

Scoping – The process of determining the range of proposed actions, alternatives, and impacts to be discussed in a National Environmental Policy Act or Montana Environmental Policy Act document.

Secondary closure device – Any closure device (e.g., gate, berm, barricade, tank trap, etc.) that is secondarily restricting access and is situated on a restricted road or restricted road system behind a primary closure device.

Secure habitat for grizzly bears – Defined by the Interagency Grizzly Bear Committee (IGBC 1998) as areas that are a minimum distance of 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 core areas. It is recommended that core areas be established to encompass lands that meet the seasonal habitat needs of bears.

Security core areas (grizzly bears) – 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).

Seedling/sapling – Forest stands dominated by trees less than 5 inches diameter at breast height.

Seral stages – A temporal stage of vegetation development in the process of succession.

Sight distance – The distance at which 90 percent of an animal is hidden from view. On forested trust lands, this is approximately 100 feet, but may be more or less, depending on specific vegetative and topographic conditions.

Site potential tree height (SPTH) – The average maximum height for mature trees on a site, given the local growing conditions.

Species of Concern (SOC) – Taxa that are at risk or potentially at risk due to rarity, restricted distribution, habitat loss, and/or other factors (MNHP 2008a).

Spring habitat (grizzly bears) – 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 management restrictions apply to the Stillwater Block from April 1 until June 16 within non-spring habitat, and from April 1 until July 1 within spring habitat. 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.

Spring period (grizzly bears) – For the Stillwater Block, this is April 1 through June 15 for non-spring habitat and April 1 through June 30 for areas within spring habitat. For lands within the Swan River State Forest and DNRC scattered parcels in recovery zones, and non-recovery occupied lands this is April 1 through June 15.

State Forest Land Management Plan (SFLMP) – A programmatic plan, applicable to forested trust lands, which provides the philosophical basis and technical rationale for DNRC's forest management program.

State of Montana bull trout core habitat – A designation developed by the Montana Bull Trout Restoration Team (MBTRT), a state appointed entity, during preparation of the *Restoration Plan for Bull Trout in the Clark Fork River Basin and Kootenai River Basin Montana* (MBTRT 2000). Core habitat areas are watersheds (including tributary drainages and adjoining uplands) used by migratory bull trout for spawning and early rearing and by resident bull trout for all life history requirements. Core areas typically support the strongest remaining bull trout populations of spawning and early rearing habitat within a restoration/conservation area and usually occur in relatively undisturbed watersheds. Twelve restoration/conservation areas were established in Montana and delineated by the Montana Bull Trout Scientific Group. Restoration/conservation areas have been delineated largely because of fragmentation of historically connected stream systems used by bull trout. These restoration/conservation areas essentially function as smaller, individual bull trout metapopulations. See MBTRT (2000) for additional information.

Statewide best management practice (BMP) audits – An established monitoring and reporting process conducted by third parties to evaluate and document the implementation and effectiveness of BMPs that are applied on timber harvest operations and associated site preparation, slash disposal, road construction, and road maintenance activities by various different landowner groups, including DNRC. Audits are conducted every 2 years by interdisciplinary teams composed of individual representing landowners, federal and state natural resource agencies, the timber industry, and conservation groups.

Stillwater Block – The blocked portions of the Stillwater and Coal Creek State Forests within the Northern Continental Divide Ecosystem recovery zone as identified in the Stillwater Block Transportation Plan Map (Figure D-4 in Appendix D, EIS Figures).

Stream order – A stream numbering system ranging from 1 to 6 or higher, which ranks streams beginning from the headwaters to a river terminus, and designates the relative position of a stream or stream segment in a drainage basin network. First-order streams have no discrete tributaries; the junction of two first-order streams produces a second-order stream; the junction of two second-order streams produces a third-order stream; etc.

Streamside management zone (SMZ) – A stream, lake, or other body of water and an adjacent area of varying width where management practices that might affect wildlife habitat or water quality, fish, or other aquatic resources need to be modified. An SMZ encompasses a buffer strip at least 50 feet wide on each side of a stream, lake, or other body of water, measured from the ordinary high water mark, and extends beyond the high water mark to include wetlands and areas that provide additional protection in zones with steep slopes or erosive soils.

Suitable lynx habitat – Forest stands within habitat types considered to be preferred by lynx that possess at least a medium stocking level (at least 40 percent crown closure) in any combination of seedling/sapling, pole, or sawtimber size classes as identified in DNRC's stand level inventory database. Suitable lynx habitat also includes stands that contain at least 180 stems per acre greater than or equal to 6 feet tall. On the Northwestern and Southwestern Land Offices, suitable lynx habitat includes the subsets of ~~young~~summer foraging habitat (or young foraging habitat as defined in the Forest Management ARMs), winter foraging habitat, and other suitable habitat categories. On the Central Land Office, suitable lynx habitat is defined as stands occurring between 5,500 to 8,000 feet elevation that possess at least medium stocking levels (at least 40 percent stand crown closure) in any combination of poletimber and/or sawtimber size classes as identified in DNRC's stand level inventory database.

Summer foraging habitat (lynx) – Dense sapling stands and moderate to densely stocked poletimber stands within suitable lynx habitat that possess abundant horizontal cover.

Summer period – For the Stillwater Block, this is July 1 through September 15. For lands within the Swan River State Forest and DNRC scattered parcels, this is June 16 through September 15.

Sustainable yield – Per MCA 77-5-221, the quantity of timber that can be harvested from forested trust 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 MCA Title 75, Chapter 5, taking into account the ability of state forests to generate replacement tree growth.

Swim performance – A measure of the swimming ability of an individual fish species. Swim performance is compared to culvert water velocities to properly size culverts so they are passable for local fish species.

Sympatric redband trout – Redband trout that either occur within the range of steelhead or were evolved from steelhead populations. See also **allopatric redband trout**.

Take – Regarding federally listed species, take is defined by the Endangered Species Act as "to harass, harm, pursue, hunt, shoot, wound, kill, trap, capture, or collect, or to attempt to engage in any such conduct." The USFWS' implementing regulations define harm as "an act or omission which actually injures or kills wildlife, including acts which annoy it to such an extent as to significantly disrupt essential behavior patterns, which include, but are not limited to, breeding, feeding or sheltering; significant environmental modification or degradation which has such effects."

Temporary non-suitable habitat (lynx) – Recently harvested or naturally disturbed (e.g., burned) areas that have fewer than 180 saplings per acre that are at least 6-foot-tall, or less than 40 percent total stand canopy cover, but have the potential to be forested suitable lynx habitat over time.

Temporary road – A low-standard road that is used for forest management and that, following use, is treated so that it no longer functions as an open road, restricted road, or trail. Following their temporary usage, they may no longer be accessed for commercial, administrative, or public motorized use. Drainage structures may or may not be removed. The road prism may remain. Applicable best management practices would be implemented on these roads.

Threatened species – A species listed under the Endangered Species Act that is likely to become an endangered species within the foreseeable future through all or a significant part of its range.

Timber permit – A commercial timber sale that does not exceed 100,000 board feet of timber, or, in cases of an emergency, such as salvage sales, does not exceed 200,000 board feet of timber.

Total maximum daily load (TMDL) – Section 303(d) of the federal Clean Water Act directs states to develop TMDLs that regulate the amount of pollutants released to water quality limited water bodies. Use of TMDLs is incorporated into an overall state strategy for bringing a polluted water body into compliance with water quality standards.

Total potential lynx habitat – The total habitat acres that are within habitat types considered to be preferred by lynx. Preferred habitat structure may or may not be present on some acreage included under this designation. Total potential lynx habitat includes the habitat subsets of (1) suitable lynx habitat and (2) temporary non-suitable habitat.

Trail – Any route longer than 500 feet that does not qualify as a "road," including those routes that conventional four-wheel-drive trucks could negotiate.

Transition lands strategy – A process, which is included as part of the Implementing Agreement, by which DNRC can allow changes in land ownership and use within the HCP project area over the 50-year incidental take permit term.

U.S. Fish and Wildlife Service (USFWS) – The federal agency that is the listing authority for species, other than some marine mammals and most anadromous fish, under the federal Endangered Species Act.

Uneven-aged management – Forest management that involves the selective removal of single trees or groups of trees within a harvest unit. This results in a multi-age forest condition because regeneration is initiated after each entry. See also **even-aged management**.

Unforeseen circumstances – Changes in the circumstances affecting a species or geographic area covered by a conservation plan that could not reasonably have been anticipated by plan developers and the USFWS and/or NMFS at the time of the conservation plan's negotiation and development, and that result in a substantial and adverse change in the status of the covered species (50 CFR 17.3).

Visual screening – Vegetation and/or topography providing visual obstruction capable of hiding a grizzly bear from view. The distance or patch size and configuration required to provide effective visual screening depends on the topography and/or type and density of cover available.

Watershed – The drainage basin contributing water, organic matter, dissolved nutrients, and sediments to a stream or lake.

Wetland – An area that is inundated or saturated by surface water or groundwater at a frequency and duration sufficient to support a prevalence of vegetation typically adapted for life in saturated soil conditions. Wetlands include marshes, swamps, bogs, and similar areas.

Wetland management zone (WMZ) – A specified area adjacent to and encompassing an isolated wetland or adjacent to a wetland located next to a stream, lake, or other body of water where specific resource protection measures are implemented (ARM 36.11.403 (94)).

Winter foraging habitat (lynx) – Sawtimber stands within lynx habitat that possess multi-layering of moderate- or well-stocked coniferous vegetation and horizontal cover. Winter foraging habitat consists of stands that must exhibit the following minimum structural characteristics: (1) stands must occur on habitat types preferred by lynx; (2) stands must have one or more of the following species present: subalpine fir, grand fir, or Engelmann spruce; (3) stands must have at least 10 percent canopy closure in trees greater than or equal to 9 inches diameter at breast height (i.e., sawtimber category in DNRC's stand level inventory database); (4) stands must have a minimum of 40 percent total stand crown density in understory and overstory combined; and (5) stands must not occur in big game winter areas.

Winter period (bears) – The bear denning season, November 16 through March 31.

Young foraging habitat (lynx) – Conifer seedling and sapling stands within lynx habitat with an average height greater than or equal to 6 feet and a density greater than or equal to ~~2,000~~4,000 stems per acre (ARM 36.11.403(96)).

64 copies of this document were published at an estimated cost of $60.50 per copy, for a total cost of $3,872.00, which includes $56.40 for printing and $4.10 for distribution.