PALISADES TIMBER SALE

DRAFT ENVIRONMENTAL ASSESSMENT

MONTANA DEPARTMENT OF NATURAL RESOURCES AND CONSERVATION

SOUTHERN LAND OFFICE

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Chapter 1 Purpose and Need for Action

The Montana Department of Natural Resources and Conservation (DNRC) Trust Land Management Division (TLMD), Southern Land Office is proposing the Palisades Timber Sale Project (proposed action). The proposed action is located in Carbon County, approximately 7 miles west of Red Lodge, Montana on state trust lands in the Luther area (*see Figure 1-1*).

Harvest activities would take place on approximately 789 acres within Sections 3, 5, 6, 7, 8, 9, 10 and 11, Township 7 South (T7S), Range 19 East (R19E). These sections, totaling approximately 4,755† acres, along with existing and proposed roads needed to access and support proposed activities on these sections, will herein be referred to as the project area (*see Figure 1-2*).

Purpose

Project Objectives were formed based on the DNRC Policies and Rules. These include the trust mandate as well as the management philosophy developed through the State Forest Land Management Plan (SFLMP: DNRC 1996) and Administrative Rules for Forest Management (Forest Management Rules: ARM 36.11401 through 471). The purpose of the project is to:

- Manage the forest to improve health, productivity and biodiversity.
- Generate revenue for trust beneficiaries; this includes capturing the value of live as well as dead and dying lodgepole pine before the resource is no longer merchantable for lumber.
- Develop a transportation system that will satisfy long-term management needs, address fish passage concerns and improve water quality through BMP compliance.

The lands involved in the proposed action are held by the State of Montana for the support of the Morrill Trust, and Pine Hill School (*Enabling Act of February 22, 1889*). The Board of Land Commissioners (Land Board) and the DNRC are required by law to administer these state trust lands to produce the largest measure of reasonable and legitimate return over the long run for these beneficiary institutions [*1972 Montana Constitution, Article X, Section 11; Montana Code Annotated (MCA) 77-1-202*].

DNRC strives to balance its fiduciary responsibilities with its stewardship responsibilities that are intended to promote biodiversity and subsequently protect the future income-generating capacity of the forest. All forested lands involved in the proposed action would thus be managed in accordance with the DNRC's SFLMP and Forest Management Rules [*Administrative Rules of Montana (ARM) 36.11.401 through 456*].

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Need

Conifer forest stands in the Palisades project area are heavily dominated by lodgepole pine and have little age class diversity. Many stands in the project area are overstocked, with trees showing signs of low vigor including poor annual leader and diameter growth. The lack of species and age class diversity combined with low growth and vigor predisposes stands to insect infestations and disease outbreaks. Mountain pine beetle is active in the Palisades project area, with mortality of lodgepole pine trees averaging 13 percent.

Active forest management would:

- improve species and age class diversity,
- increase stand growth and vigor,
- provide a measure of decreased risk against potential losses from damaging agents such as insects, diseases, and fire.

In addition, active forest management would produce revenue for the trust beneficiaries and move stands towards a sustainable stand composition, which is consistent with DNRC programmatic goals of managing for a healthy and biologically diverse forest.

The current transportation system in the project area does not meet Best Management Practice (BMP) standards for forestry and are currently affecting both water quality and fisheries habitat. Project activities associated with the timber sale would facilitate road improvements which would include adequate road surface drainage, sustainable road grades and locations and properly designed road stream crossings sites to accommodate both hydrologic and aquatic needs.

Relevant Agreements, Laws, Plans, Permits, Licenses and Other Authorizations

Management activities on lands within the proposed project area must comply with certain agreements, laws, plans, permits, licenses, and other authorizations. Following are some of DNRC's core guiding regulations for forest management on state trust land. In addition to the these program-wide policies, each of the following resource sections (vegetation, transportation, etc) will also describe those agreements, laws, plans, permits, licenses that are specific to that resource. These descriptions can be found in Chapter 3 Affected Environment and Environmental Consequences.

State Forest Land Management Plan

DNRC developed the SFLMP to "provide field personnel with consistent policy, direction, and guidance for the management of state forested lands" (DNRC 1996: Executive Summary). The SFLMP provides the philosophical basis, technical rationale, and direction for DNRC's forest management program. The SFLMP is premised on the philosophy that the best way to produce long-term income for the trust beneficiaries is to manage intensively for healthy and biologically

diverse forests. In the foreseeable future, timber management will continue to be the primary source of revenue and primary tool for achieving biodiversity objectives on DNRC forested state trust lands.

DNRC Forest Management Rules

DNRC Forest Management Rules (*ARM 36.11.401 through 456*) are the specific legal resource management standards and measures under which DNRC implements the SFLMP and subsequently its forest management program. The Forest Management Rules were adopted in March 2003 and provide the legal framework for DNRC project-level decisions and provide field personnel with consistent policy and direction for managing forested state trust lands. Project design considerations and mitigations developed for this project must comply with applicable Forest Management Rules.

Montana Best Management Practices (BMPs) for Forestry

Montana BMPs consist of forest stewardship practices that reduce forest management impacts to water quality and forest soils. The implementation of BMPs by DNRC is required under *ARM 36.11.422*. Key forestry BMP elements include: streamside management; road design and planning; timber harvesting and site preparation; stream crossing design and installation; winter logging; and hazardous substances storage, handling, and application.

Sustainable Yield Calculation

In addition to the SFLMP and Forest Management Rules, DNRC is required to re-calculate the annual sustainable yield for forested trust lands at least every 10 years (*MCA 77-5-221 through 223*). DNRC 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 determines the amount of timber that can be harvested annually on a sustainable basis from state trust lands, given all applicable laws and environmental commitments described in the SFLMP and Forest Management Rules. Important ecological commitments related to biodiversity, forest health, threatened and endangered species, riparian buffers, old growth, and desired species mix and cover types were incorporated into the SYC. After incorporating these commitments into the model, the statewide annual sustainable yield was determined to be 57.6 MMBF of timber.

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Figure 1-1. Palisades Timber Sale Vicinity Map.

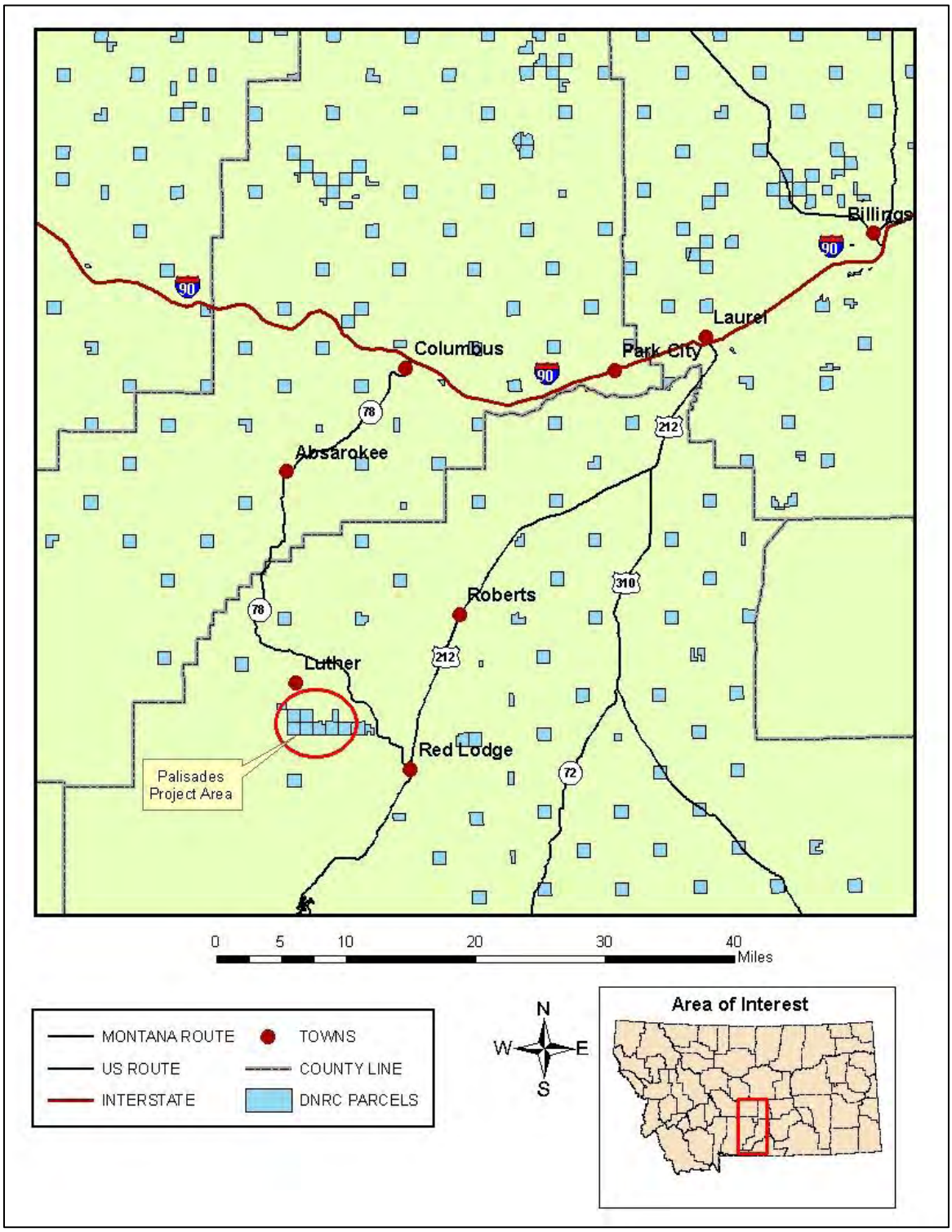
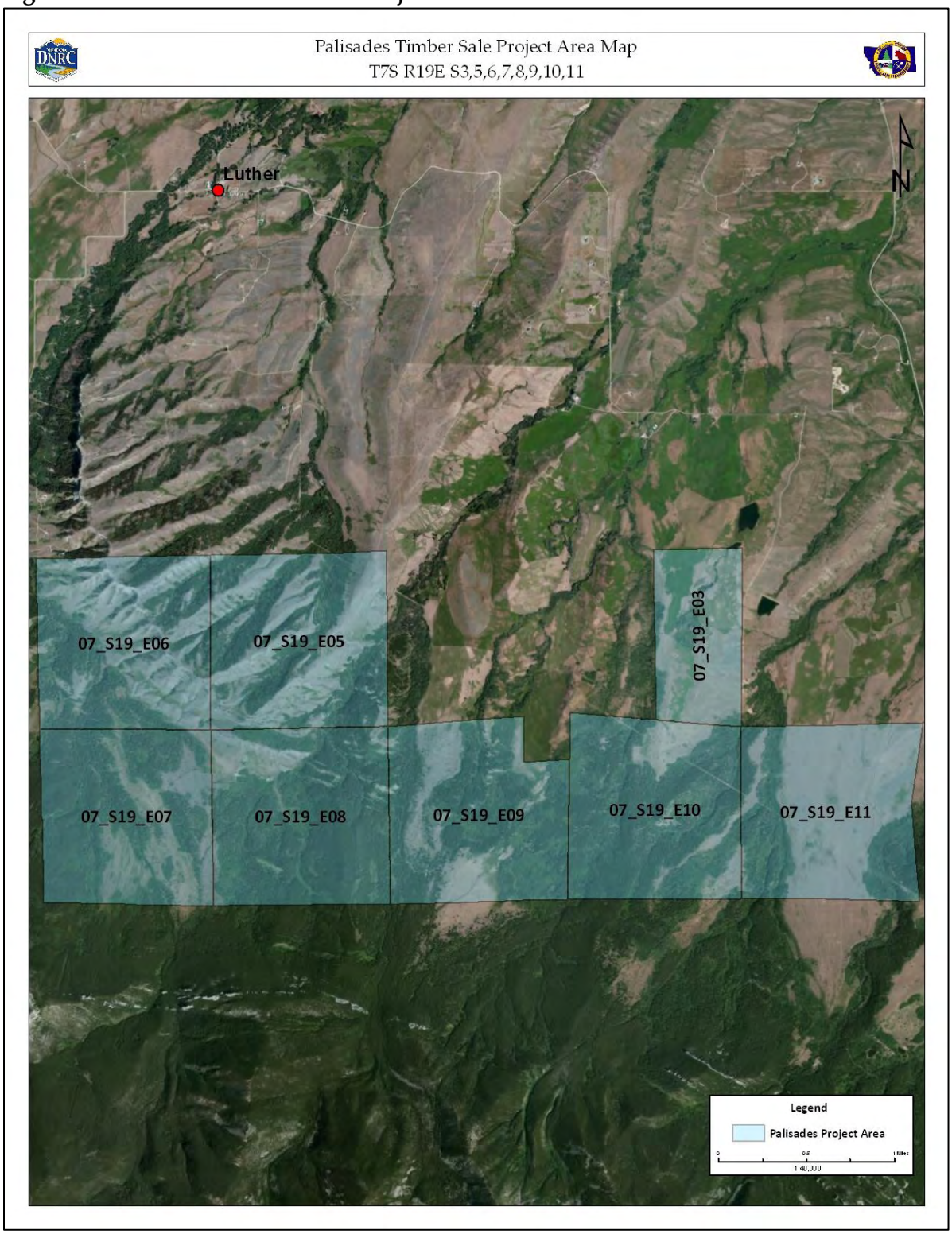


Figure 1-2. Palisades Timber Sale Project Area.



Chapter 2 Alternatives

Introduction

The purpose of this chapter is to describe both the No-Action and Action Alternatives in detail. This chapter will focus on the:

- Scoping
- Issues discovered through scoping
- Relevant past, present and future actions
- Development of the Action Alternative;
- Description of the Action Alternative;
- Summary comparison of the predicted environmental effects associated with each alternative; and
- Decision to be made

Public Participation

This section describes the process by which the Interdisciplinary Team (ID Team) involved the public in identifying issues pertinent to the development of alternatives and to the associated analyses within this Draft Environmental Assessment (EA).

The following public involvement activities took place during project development:

- A formal scoping period;
- Palisades website developed and regularly updated;
- Correspondence with interested individuals;
- Three DNRC-hosted open-house sessions;
- Various meetings with groups and individuals;
- Public review of the Draft EA

Scoping Period

Throughout project development the DNRC had a number of focused public participation efforts welcoming public comments. In addition, DNRC also welcomed comments from interested individuals, agencies, and organizations throughout project development.

The ID Team held one formal scoping period. In November 2011, DNRC initially solicited public comment by mailing the Proposed Palisades Timber Sale Scoping Notice to twenty-seven (27) individuals on the interested parties list which included adjacent landowners. The notice included proposed project area maps, project objectives, and contact information and was mailed to individuals, agencies, internal DNRC staff, industry representatives, and other organizations that had expressed interest in the Southern Land Office's forest management activities. A public notice was also placed in the Carbon County News newspaper. Interested parties were given 30 days to submit comments.

Eleven (11) letters and forty-nine (49) emails were received during the initial scoping period. From these letters and emails, the ID Team identified 201 comments .

In addition to the formal scoping period, DNRC has continued to accept comments throughout project development. These comments and concerns were utilized by the ID team to develop the Action Alternative (*See page 43 for description of the Action Alternative)*.

Project Website

Prior to the distribution of the November 2011 initial scoping letter, DNRC developed a project website in order to provide project information and timely updates to the public (*see http://dnrc.mt.gov/Trust/Timber/Information/Palisades/Default.asp)*. The Proposed Palisades Timber Sale Project website provides answers to frequently asked questions about the project and Montana State Trust Lands, a current map of the project area, a number of methods by which to submit comments on the proposed project, updates on the MEPA process, and project contact information.

Public Meetings

The scoping process identified a need for more comprehensive information about the proposed project. To satisfy this need the public was invited to attend public meetings to ask questions and learn more about the proposed project.

On April 17th, 2012, DNRC hosted a public meeting in Luther to discuss the project and its anticipated effects to resources within the project area. Fifty members of the public attended. DNRC presented an overview of the project along with a discussion of forest health, historical activities, existing conditions, desired outcomes and the MEPA process.

Early in 2013, DNRC received additional public comments regarding the project. The ID Team decided that additional open house sessions were necessary to ensure that the Team had identified and understood the full range of public comments and concerns prior to the development of formal issue statements for project analyses. On May 1st and May 2nd, 2013, open house sessions were held in Billings (May 1) and Luther (May 2). The sessions focused on listening to public comments and concerns, sharing comments and concerns that we had previously heard from the public, providing an update on the project's status, and clearing up misconceptions about the project. The Open House in Billings had six attendees and the Open House in Luther had five.

Other Meetings

Throughout the development of the project, members of the ID team attended meetings requested by other groups or individuals to inform them of the proposed activities and discuss any concerns they had about the project. Project leaders also met on a regular basis with adjacent landowners and local community members to discuss the proposed activities. In all cases the public was invited to submit comments on the proposed project.

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Changes Made to the Originally Proposed Action

In response to public input changes were made to the originally proposed action presented during the scoping period. Some of these included changes to the project area, haul routes, project area roads and unit size and location.

Changes to Designation of Haul Routes

Through the development of the proposed timber sale, DNRC considered three routes by which to haul timber out of the project area.

1. Haul route exiting state property via USFS property to the west side of the sale and through Red Lodge Creek Road. This route was dismissed for the following reasons:

    - Required hauling logs through the town of Luther
    - Required construction of permanent roads through USFS property
    - Possible increased legal and illegal motorized access
    - Haul route would require additional road construction
    - Potential conflicts between log hauling and recreational activity
    - Residential disturbance near Sheep Mountain

2. Haul route exiting state property via private lands to Barlow Creek Road (13 Gate Road). This route was dismissed for the following reasons:

    - Potential noise and dust to local residents on Barlow Creek Road
    - Potential impacts to grazing management (gate management-there are 13 gates along this route.)

3. Haul route exiting northeast corner Section 3 of state property via private land to Upper Luther Road. This route was chosen for the following reasons:

    - Does not pass through Luther.
    - Minimizes dust and noise disturbance to local residents.
    - Shortest distance to paved roads.
    - Easements to use the existing two-track across private land were available with agreeable landowners.

Changes to Designation of Project Area Roads

Roads within the state section were also commented on by the public. Concerns were noted related to:

- increasing the length of overall road
- road closures
- reclamation after harvesting
- public access
- illegal access after harvesting was complete
- environmental effects of roads on streams and wildlife

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In response to these and other concerns the road traveling across state section 11 was eliminated from the plan which reduced road construction by approximately 1 mile. The current road plan within the boundary of the project area establishes 4.1 miles of new permanent road and 5.2 miles of new temporary road.

After project completion the transportation plan will reclaim the 5.2 miles of new temporary road and also 2.0 miles of old road that has been determined to be no longer necessary, in a poor location, or not meeting best management practices (BMPs). Other small existing roads will be reclassified to motorized trail as this description will better define their future use. This results in only a 1.4 mile net gain in permanent restricted road over the project area. All roads within the project area will be subject to a Class A closure and would only be available for use for administrative and management activities by DNRC employees, lessees or contractors.

Changes to Cutting Unit Boundaries

In the original proposal, the planned cutting units for the Palisades Timber Sale included 1,140 acres to be harvested across a 5,400 acre project area. Public input identified several concerns about the initially proposed cutting units, particularly from the residents of the Sheep Mountain area regarding proposed cutting units near the western border of the project area and from hunters regarding a popular hunting area in the eastern portion of the project area. These reasons contributed to modifications or removal of cutting units in the following areas:

- Cutting units were removed on the east side of section 11 and west side of section 12. This eliminated all cutting units from section 12 and removed the section from the project area.
- Two cutting units on the west side of section 11were removed.
- The cutting unit on the south half of section 8's size was significantly decreased due to public input and data collection.
- Two cutting units in section 5 were removed from the plan.
- Three cutting units in section 6 were removed from the plan along the western border.
- The shape of the largest cutting unit, located in section 7 was changed and decreased for multiple reasons. These reasons include having a lesser visual impact on residents near that area, to remove all harvesting from a watershed which is a fish bearing stream and to lessen the impact on species found in the area which include a northern goshawk nest managed by the USFS found just outside state property lines.

Changes in these cutting units reduced the cutting unit acreage from approximately 1,140 to approximately 789 acres (See figures 2-1 for changes in harvest units). The estimated harvest volume fell from approximately 7 million board feet (7MMBF) to 6.011 million board feet (6.011MMBF). The approximate value of the timber in the cutting units removed from the proposed Palisades Timber sale was $133,000.

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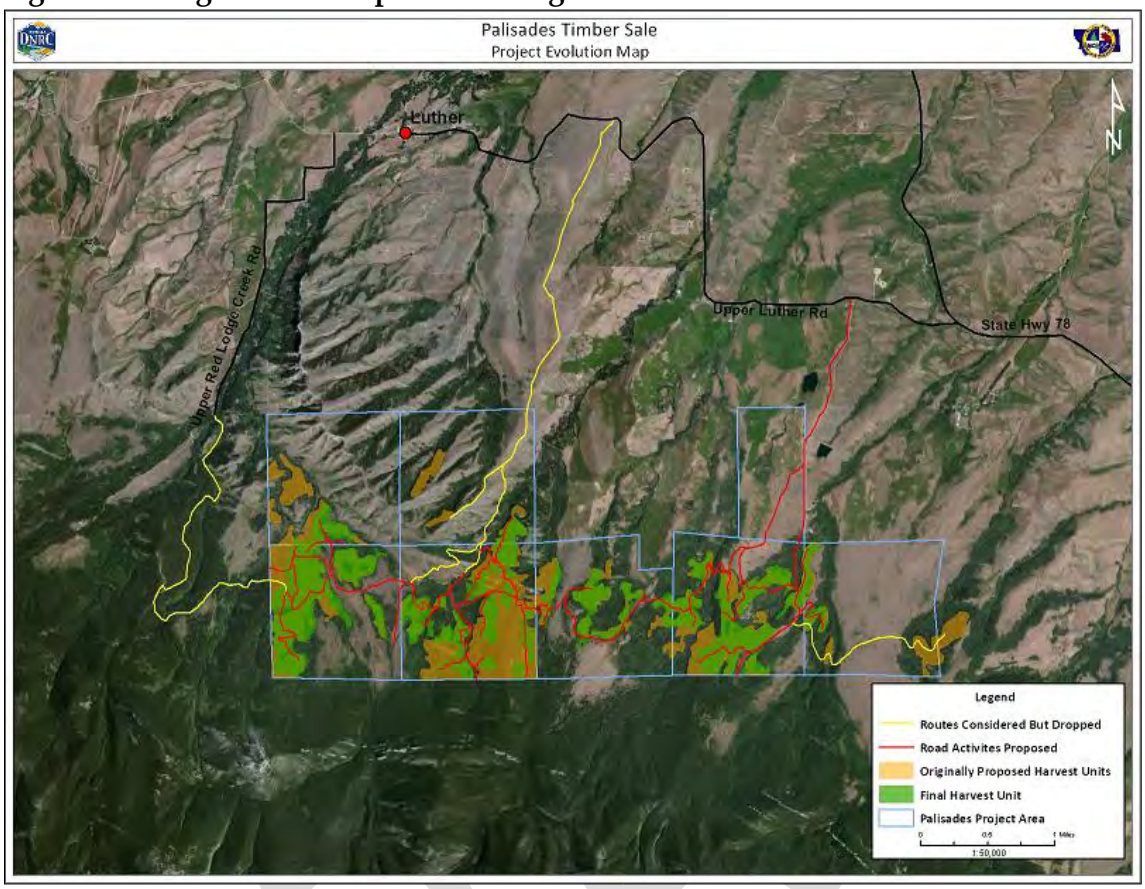
Figure 2-1. Original and Proposed Cutting Units of Palisades Timber Sale



Issues Studied in Detail and Issues Eliminated from Further Analysis

Through careful consideration of public comments submitted and through extensive field reconnaissance, the ID Team identified potential issues related to the proposed project. Issues are derived from concerns expressed about the potential impacts the project may have on various resources. The ID Team developed formal issue statements and determined which of those issues would be analyzed in detail and which would be eliminated from further analysis. Issues to be analyzed in detail were determined to be relevant and within the scope of the project and were thus included in the impacts analyses and used to assist the ID Team in alternative development (*Table I-1*). Issues that were eliminated from further analysis were those that were determined to be either not relevant to alternative development or beyond the scope of the project (*Table I-2*).

Table I-1-ISSUES STUDIED IN DETAIL BY RESOURCE AREA

RESOURCE AREA	ISSUES STUDIED IN DETAIL
Chapter 3 — Transportation	If new roads are added to the existing road system there would be an overabundance of roads in the project area.
	Increased public use and illegal activity would occur as a result of increased road densities associated with the project.
	Following harvest activity temporary roads would not be reclaimed.
Chapter 3 — Vegetation	Harvesting activities associated with this project may produce homogenous landscape conditions and reduce forest cover type and age class diversity.
	Harvesting activities and conifer encroachment into aspen galleries may reduce the amount of aspen in the project area.
	Timber harvesting associated with this project may adversely affect old-growth forests in the project area.
	The current level of mountain pine beetle activity and susceptibility of forest stands to mountain pine beetle infestation is a concern. Active forest management may not effectively protect forests from mountain pine beetle infestation.
	Forest management activities associated with this project may not effectively reduce fire hazard or will directly or indirectly increase fire hazard in the project area.
	Forest management activities associated with this project may adversely affect populations of threatened, endangered, or sensitive plant species.
	Timber harvesting and road building associated with this project may introduce or spread noxious weeds in the project area.
Chapter 3 — Water Resources and Fisheries	The proposed action may adversely affect fisheries populations and fisheries habitat features, including channel forms, stream temperature and connectivity.
	Timber harvesting and related road activities may impact surface water-quality through increased erosion and sediment delivery to streams.
	Timber harvest and associated road activities may affect the timing, distribution and amount of water yield in the affected watersheds. Increases in water yield resulting from the proposed timber harvest could increase the risk of flooding and may impact stream channel stability.
	The proposed timber harvest and associated road activities may impact wetlands.
	Improvements to stream crossings that currently block fish passage could allow hybrid species to move into habitat occupied by pure,

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RESOURCE AREA	ISSUES STUDIED IN DETAIL
	native strains.
	Spring runoff following the proposed project may damage fisheries.
	There is a concern that permanent habitat damage could adversely affect Yellowstone cutthroat trout survival in Red Lodge Creek.
Chapter 3 — Geology and Soils	Road construction and log landings can displace and compact surface soils and permanently change the land use of these impacted areas from forest products to transportation.
	Removal of both coarse and fine woody material off site during timber harvest operations can reduce nutrient inputs required for future forest stands and can affect the long-term productivity of the site.
	Ground-based harvest techniques can displace and compact soils which can adversely affect the hydrologic function and long-term productivity of the impacted area.
	Reduced infiltration capacity of an impacted soil can result in overland flow and off site erosion typically localized to road surfaces, main skid trails and log landings.
	Activities associated with the proposed actions such as timber harvest and road construction have the potential to affect slope stability through increased water yields and road surface drainage concentration resulting in the exceedence of resisting forces.
Chapter 3 — Wildlife	Logging, and road construction and use could fragment habitat and adversely affect wildlife linkage and an important habitat corridor for large free-ranging species, such as elk, deer, grizzly bears, black bears, moose, mountain lions and wolves.
	The abundance of snags and coarse woody debris would be reduced, which could cause adverse effects to species that depend upon these habitat attributes for food and shelter.
	Cumulative effects associated with large wildfires in this area and the USFS proposed vegetation management project should be considered.
	Timber harvesting activities could remove security cover, cause displacement of bears, increase roads, and increase presence of unnatural attractants and bear foods, which could adversely affect grizzly bears.
	Timber harvesting and associated activities could remove canopy closure, alter stand conditions, and/or cause motorized disturbance, which could alter lynx habitat, rendering it unsuitable for supporting lynx.
	Timber harvesting and road building will reduce security and seasonal cover for moose, elk, white-tailed deer, and mule deer, resulting in reduced numbers and/or their displacement from the area (both short

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RESOURCE AREA	ISSUES STUDIED IN DETAIL
	and long-term).
	Timber harvesting will reduce winter thermal cover for moose, elk, white-tailed deer, and mule deer, resulting in reduced numbers and/or their displacement from the area.
	Timber harvesting and log hauling could adversely affect habitat for goshawks, resulting in their displacement, both short and long term. Also, nesting pairs could be disturbed, resulting in nest abandonment and subsequent loss of chicks.
	Timber harvesting and log hauling could adversely affect habitat for great gray owls, resulting in their displacement, both short and long term. Also, nesting pairs could be disturbed, resulting in nest abandonment and subsequent loss of chicks.
Chapter 3- Recreation	Increases in road densities may result in ATV and other motorized use of the area which may adversely affect current recreational users within the project area.
	Harvest activities may adversely affect recreational experiences within the project area.
Chapter 3- Cultural Resources	The project may damage a historical trail.
Chapter 3 — Aesthetics	The size, shape, and boundaries of harvest units would alter visual quality.
	Activities associated with this project may increase local noise levels.
Chapter 3 — Economics	The project may not profit the trust beneficiaries due to significant project costs including road development, and the project might move forward regardless of these costs and benefits.
	The project may not sell in current markets.
Chapter 3 — Air Quality	Dust produced from harvest activities, road building and maintenance, and hauling associated with this project may adversely affect local air quality.
	Smoke produced from logging slash pile and broadcast burning associated with this project may adversely affect local air quality.

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Table I-2-ISSUES ELIMINITATED FROM FUTHER ANALYSIS AND ACCOMPANYING RATIONALE

ISSUES ELIMINATED FROM FURTHER ANALYSIS	DNRC RATIONALE
Interest in DNRC developing an EIS.	According to DNRC's Administrative Rules for MEPA, the agency is required to develop an EIS when issues related to the project are likely to involve significant impacts to the human environment. According to *ARM 36.2.524*, DNRC is required to consider a list of criteria in determining the significance of impacts. Through extensive field work and careful consideration of public comments and of the significance criteria, the ID Team has recommended that impacts that would remain after mitigation measures are applied would be below the level of significance, and an EA provides an adequate analysis for this project. Ultimately, the Decision Maker will determine whether or not issues presented by the proposed action would likely involve any significant impacts to the human environment thereby requiring the development of an EIS (*see Chapter 2 — Decisions to be Made*).
Large or small scale forest management is not appropriate in this area because of slower growth rates due to the area's cold and dry climate.	Several environmental factors, including climatic conditions, influence forest growth and development, and as a result, some forest types will exhibit higher potential for growth than others. DNRC considers these factors in its forest management activities, but sites with less favorable growing conditions are not excluded from management for several reasons: first, the State Board of Land Commissioners (Land Board) and DNRC are required by law to administer state trust lands to produce the largest measure of reasonable and legitimate return over the long run for the trust beneficiaries (MCA 77-1-202). Second, DNRC's State Forest Land Management Plan is premised on the philosophy that the best way to produce long-term income for the trust beneficiaries is to manage extensively for healthy and biologically diverse forests, and that timber management constitutes the primary source of revenue and primary tool for achieving biodiversity objectives on forested state trust lands. Finally, DNRC is prohibited by law (MCA 77-5-116) from foregoing management on state forest lands without receiving full market value of that designation, treatment, or disposition. For those reasons, DNRC performs forest management activities across the full spectrum of forest types and growing sites found on forested state trust lands.

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ISSUES ELIMINATED FROM FURTHER ANALYSIS	DNRC RATIONALE
Why harvest these lands when land in the western part of the state is closer to mills?	As described above, DNRC performs forest management activities across the full spectrum of forest types and growing sites found on forested state trust lands without regard to their location within the state. While many larger mills are in western Montana, there are existing mills and markets in the central and eastern portions of the state. Additionally, many processing facilities in western Montana are receiving logs harvested in eastern and central Montana. There are several reasons why management is needed in this area and several objectives that DNRC wishes to accomplish through this project as described in Chapter 1—Purpose and Need for Action.
There are concerns about the proposed silvicultural prescriptions for timber harvesting, including clearcutting.	DNRC strives to employ silvicultural treatments that to the extent practicable emulate naturally occurring disturbance regimes. In the project area, lodgepole pine is a dominant cover type and species, and the dominant fire regime occurring in that type is stand-replacing event. Clearcutting can emulate many of the same effects of stand-replacing fire in lodgepole pine stands, and therefore it is an appropriate silvicultural treatment to apply in the project area. Several other treatment types were also considered during project design, but these were deemed not feasible for this project because they would be less likely to accomplish project objectives, would be difficult and costly to lay out and implement, would result in a high likelihood of windthrow, or did not match the naturally occurring disturbance regimes found in this area.
Harvesting could take place without any new roads, especially permanent roads.	Helicopter logging systems are currently the only logging systems available that require no new road construction. This type of logging system is not economically feasible within the Palisades project area. Considering this constraint, new roads must be constructed to manage these lands. The current road system is inadequate to facilitate the proposed actions while meeting water quality standards. The end result of the proposed actions would be an efficient transportation system that meets BMP's, protects water quality, provides fish passage and requires minimal long-term maintenance. The permanent new roads proposed were minimized to the extent practicable.

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ISSUES ELIMINATED FROM FURTHER ANALYSIS	DNRC RATIONALE
Logging and Road Building will disturb existing improvements such as gates, fences, culverts and irrigation systems.	Attempts will be made to minimize any impacts to such improvements that currently exist in the project area. If damage occurs to fences, gates, etc. during project operations, provisions in the DNRC timber contract would require the contractor to repair the improvement back to its existing condition. Discussions on existing improvements related to water and fisheries can be found in the Water Resource and Fisheries Sections in Chapter 3 of this document.
The legally mandated "reasonable and legitimate return" could be augmented if the state actually charged fair market value for all of its grazing leases rather than subsidizing certain Lessees with below market price lease.	Thank you for your comment. DNRC's grazing program is administered separately from its forest management program, and issues related to grazing are beyond the scope of this project.
How is the designated 57.6 MMBF allocated among various DNRC districts?	The allocation of yearly volume targets by land office are designated using a number of factors: • Acreage of forested trust lands per land office • Standing volume as identified in DNRC's forest inventory database • Emergency salvage situations • Any special time constraints, such as limited access granted by neighboring land owners.
Will all trees less than 6" in diameter be removed in clearcut prescriptions?	Trees less than 6" will be retained.
Why was Palisades chosen as a project area?	The proposed project area was chosen for harvest because it contains a large amount of mature, merchantable timber. This volume is available to contribute to the State's annual sustainable harvest. .
The logging should be carried out over a longer period of time such that total disturbed area is smaller with some areas being allowed to commence recovery before	DNRC's operational approach is to have less frequent entries with longer periods of time between entries. There are several reasons DNRC chooses this approach. • Reduce the time period for recovery of forest vegetation • Reduce the time period for recovery of soils

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ISSUES ELIMINATED FROM FURTHER ANALYSIS	DNRC RATIONALE
other areas are disturbed.	• Minimize disturbance to wildlife in the area • Maximize revenue to the trust. Minimizing operational timing restraints contributes to higher stumpage bids Additionally, if DNRC were to conduct small-scale operations in this area, it would typically do so through the issuance of timber permits. By law, the volume harvested under a timber permit cannot exceed 100 MBF. The proposed harvesting activities and volume would require at least 60 separate timber permits; however, Montana law states that "repeated permits of this kind (timber permits) may not be issued to avoid advertising and the consequent competition secured by advertising" (MCA 77-5-212).
Why can't logging continue as it has in the past with a series of small timber sales?	DNRC's responsibility as the manager of state trust lands is to manage them in such a way as to "secure the largest measure of legitimate and reasonable advantage to the state" (MCA 77-1-202). In the past, small timber sales in this area accomplished this by providing post and pole material or sawtimber for individuals who only needed small volumes. These sales were accomplished through the issuance of timber permits. By law, the volume harvested under a timber permit cannot exceed 100 MBF (MCA 77-5-212). The proposed harvesting activities and volume would require at least 60 separate permits; however, Montana law states that "repeated permits of this kind (timber permits) may not be issued to avoid advertising and the consequent competition secured by advertising" (MCA 77-5-212). Conducting a larger timber sale is less costly from both the seller's and purchaser's standpoints, and brings a greater financial benefit for the associated trusts by harvesting a greater sold volume sold and generating a higher bid price, which fulfills DNRC's fiduciary responsibilities to the trust beneficiaries to a greater degree than through small-scale operations. Additionally and as previously mentioned, DNRC prefers to operate using less frequent entries over a longer timber period to provide for prompt reforestation and soil recovery and to avoid prolonged periods of disturbance to wildlife, local residents, and recreationists using the project area.

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ISSUES ELIMINATED FROM FURTHER ANALYSIS	DNRC RATIONALE
The proposed Palisades Timber sale represents .1% of the trees managed by DNRC on forested state trust lands. The 6.00 MMBF represents 10.4% of the annual statewide harvest quota. This ratio represents a disproportionate burden being imposed on these lands.	DNRC's annual sustainable yield identifies the quantity of timber that can be harvested from forested state trust lands each year in accordance with applicable state and federal laws (MCA 77-5-221), and also identifies the level of management necessary to fulfill DNRC's responsibility to "secure the largest measure of legitimate and reasonable advantage to the state" (MCA 77-1-202). Forested trust lands throughout Montana contribute to the state's annual sustainable yield; however, in any given year, only a small proportion of forested state lands are harvested. Over time, harvesting shifts to different locations and treats stands where appropriate and operationally feasible. Larger sales in focused areas are both economically and logistically more practical than numerous, scattered projects. It is often 20 or more years between harvest entries on forested state lands and this particular area has not contributed to the annual harvest from state lands in the recent past. Trees in the area have reached maturity and slowed growth, and DNRC is planning management to "secure the largest measure of legitimate and reasonable advantage to the state" (MCA 77-1-202) through a large timber sale. It is also less environmentally impactful to have one entry removing 6 million feet of timber than to have a series of small timber sales over many years.
Why is there a plan to log so many younger and healthy trees that aren't infected?	There are a number of tree species present in the Palisades project area that aren't affected by mountain pine beetles, and proposed harvest units that have higher proportions of these species would generally retain greater numbers of mature trees in them following logging. Most of the lodgepole pine trees in the project area have reached maturity, with ages typically ranging between 85 and 110 years old. Even though many of these trees have not been attacked by mountain pine beetle (mortality currently averages 13 percent in lodgepole pine across the project area), harvesting them prior to large-scale outbreak provides: • a greater opportunity to generate a higher financial return from these parcels • increased options for forest management activities as opposed to salvaging dead and dying timber

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ISSUES ELIMINATED FROM FURTHER ANALYSIS	DNRC RATIONALE
	• increased age class and species diversity, making these stands less susceptible to outbreak and more resilient to an outbreak should if one were to occur.
There is very little evidence to support the success of efforts to capture the value of dead and dying timber.	DNRC respectfully disagrees, as the agency has successfully accomplished several timber sales in the recent past to salvage dead and dying timber from state trust lands. However, salvaging dead and dying timber is not a primary objective of the proposed project, although any such merchantable material encountered in the project area would be harvested.
The project area is already a mosaic of conifer, deciduous, and grasslands. Importantly, the lands immediately adjacent to private property (Sheep Mountain subdivision) is grassland, which creates the most desirable condition for fire suppression efforts.	Potential effects on the distribution of vegetation cover types are described in the vegetation analysis of Chapter 3. The proposed action alternative is not expected to alter the amount or distribution of forested and non-forested cover types in the project area.
There will be a change in road status and no one has been notified.	The road status would not change as a result of this project. See chapter 3 transportation and Recreation.
Why were sections 11 & 12 dropped from the proposal?	A small part of section 11 on the west side of Harney Creek is still included in the proposed action. Modifications to the originally proposed scale of this project were the result of further field reconnaissance and public input and are described in Chapter 2. The originally proposed cutting units in the eastern portion of section 11 and western portion of section 12 would require new road to access those areas, and building such road would not be cost effective. The public participation process also alerted

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ISSUES ELIMINATED FROM FURTHER ANALYSIS	DNRC RATIONALE
	DNRC about a popular hunting area in those locations.
People would drive these roads in the winter and get stuck. This could lead to public safety concerns.	All roads within the project area will be closed using Class A restrictions. Class A road closure restrictions allow use only for administrative purposes by DNRC and state land lessees or individuals with management to perform, such as ditch maintenance. No recreational or hunting motorized access is allowed. No new access routes to this area of state land are proposed and no public motorized access is available. Therefore, access will remain the same, resulting in no change to driving or public safety.
The Bench Road access will be changed as a result of this project.	Thank you for your comment. The Bench Road is not a proposed haul route for this project.
Why would Pine Ridge Road be eliminated and replaced with one in a poor location.	Segments of the Pine Ridge road are adjacent to the stream and near wetlands. The new road segment will be located away from the stream. See Response Letter November 8, 2012 in project file.
If there is not a haul road going west of section 7, why is the logging road being constructed for that area a permanent road?	Current road infrastructure existing within the Palisades project area includes a poorly constructed and maintained road that leads across section 7 all the way to the border with the adjacent landowner to the west. A large section of this existing road on the west side of section 7 is being reclaimed as part of the project. In order to maintain access to the west side of section 7, to improve the road infrastructure and to best facilitate removal of the wood from cutting unit 7.1, a new road is being constructed in this west side of section 7. This road is permanent as it will provide access to the west side of section 7 for long term management purposes. Temporary roads are also being constructed on the west side of section 7 to facilitate the harvesting of cutting unit 7.1, but these will be reclaimed as access to the area will be sufficient with the one remaining permanent road on the west side of this section.
Increased access will actually increase management costs due to increased fire	All roads in the project area are currently restricted to public motorized use, and no new public access would be created by this project. Potential effects on fire suppression

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ISSUES ELIMINATED FROM FURTHER ANALYSIS	DNRC RATIONALE
suppression response, road maintenance needs, weed management, and law enforcement.	and law enforcement costs are beyond the scope of this project. Fire suppression and law enforcement activities are the responsibility of several agencies, including the DNRC Forestry Division, Montana Department of Fish, Wildlife, and Parks, and the USDA Forest Service. Road maintenance and weed management activities can be accomplished by the timber sale purchasers as specified in the contractual agreement, or through separate contracts funded by DNRC's Forest Improvement program. Costs and revenues associated with the timber sale are shown in Chapter 3.
Proposed increases in access may be associated with increased management costs.	No additional legal access will be granted following the proposed action. Necessary additional road infrastructure maintenance costs will be covered under timber sale contracts.
Access through Upper Red Lodge Road or the 13 Gate Road (aka Bench Road) makes more sense than the proposed haul route.	Three haul routes were considered during project development, including routes exiting state land to the west via Red Lodge Creek Road and to the north via Barlow Creek Road ("13 Gate" Road). These routes were eliminated from consideration due to several concerns that made them unfavorable for use as described in Chapter 2, including: • Requiring hauling logs through the town of Luther • Requiring construction of permanent roads through USFS property • Possible increased legal and illegal motorized access • Additional road construction • Potential conflicts between log hauling and recreational activity • Residential disturbance near Sheep Mountain • Potential noise and dust to local residents on Barlow Creek Road • Potential impacts to grazing management (gate management-there are 13 gates along this route.)
New roads would result in new road use by the public and lessees.	Upon project completion net road miles will increase 1.4 miles across the project area. The increase in roads is a result of upgrading the current road system to meet Best Management Practices (BMPs) standards. The new road system will access the same sections as the old system, and

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ISSUES ELIMINATED FROM FURTHER ANALYSIS	DNRC RATIONALE
	will cause a reduction in sedimentation delivered to streams and reduced long term erosion in the project area. No new access points are being developed, and public access to the project area will not change with this project.
Increased public access would increase maintenance costs.	There is no increase in public access within the scope of this project. Private easements for the purpose of a timber sale were obtained to allow this project to move forward, but the easements do not provide for public access. Completion of this project will not change public access to these state sections.
Increased fire danger may result from increased human and equipment activity in the area.	The vegetation analysis in Chapter 3 describes the potential effects of No Action and the Action Alternative on potential fire behavior. DNRC timber sale contracts require contractors and equipment operators to have fire suppression equipment on site. Current fire restrictions will be followed during harvest operations as indicated in the contract. Slash from harvesting activities will be piled and burned when weather conditions are appropriate, generally in the late fall or winter after recent moisture or when adequate snow is present. There will be no change in public access to the project area as a result of project activities. Use by grazing lessees, individuals conducting ditch work and DNRC personnel would be expected to continue at pre-project levels following the completion of project-associated activities.
There would be no law enforcement on the newly constructed roads.	Law enforcement on this area of state lands is handled by Montana Fish, Wildlife and Parks (FWP) game wardens. FWP Game wardens will continue to enforce laws on state trust lands upon completion of the timber sale, just as they enforce them currently.
Trespass and vandalism would occur because of new roads.	While new roads and an improved road system are part of this project, no new access points will be developed and public access will remain as it is now. All roads will be closed, as they currently are, with a Class A closure.
If motorized access is allowed people would drive the roads in poor conditions and	Public motorized access within the project area is not currently allowed and will not be allowed upon project completion. Currently all roads within the project area are

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ISSUES ELIMINATED FROM FURTHER ANALYSIS	DNRC RATIONALE
rutting will occur.	subject to a Class A closure and upon project completion all roads within the project area will be subject to a Class A closure.
If motorized access is allowed people would leave gates open and cows will get out.	Public motorized access within the project area is not currently allowed and will not be allowed upon project completion. Currently all roads within the project area are subject to a Class A closure and upon project completion all roads within the project area will be subject to a Class A closure.
This project would result in a land swap with Palisades ranch.	No sale, exchange, swap or elimination of state lands in the area is proposed within the scope of this project.
The public has been left out of the planning process and their input has not been used to help shape the project.	DNRC has solicited public input through multiple venues throughout the development of this project. Please see Chapter 2, Public Participation and Development of Alternatives, for further detail.
Correspondence during project development seemed to indicate that DNRC had only received complaints about the proposed project from two people.	DNRC has received and considered input from several members of the public throughout the period of project development. A response to this comment was sent to the commenter and is available in the project file.
The DNRC/USFS joint project would have visual impacts.	The proposed project is not a joint DNRC/USFS project. Potential visual impacts associated with the Palisades Timber Sale project are described in the aesthetics analysis in Chapter 3.
Several comments regarding the USFS GRLA project or correspondence from the USDA Forest Service regarding the GRLA project were received, including questions about the use of the USFS easement with the Eaton family, fuel reduction and mitigation, the size of the project area, request for an environmental impact statement, and capturing economic value.	The comments address a USDA Forest Service project that is not being conducted by the DNRC and is separate from and not associated with the proposed Palisades Timber Sale project. As such, those comments are beyond the scope of this project. Responses to these comments were provided and are available in the project file. Cumulative effects of the proposed Palisades project and GRLA project were analyzed in Chapter 3.

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ISSUES ELIMINATED FROM FURTHER ANALYSIS	DNRC RATIONALE
The easement granted to the USFS would be too limited in scope and usage.	No USFS easements are being used to complete this timber sale. Haul routes travel across state trust land, private property which has had an easement negotiated and on paved county roads.
Eliminating state lands in the area would significantly impact public use.	No sale, exchange, swap or elimination of state lands in the area is proposed within the scope of this project.
The USFS does not have the right to grant or alter its current easement.	No USFS easements are being used to complete this timber sale. Haul routes travel across state trust land, private property which has had an easement negotiated and on paved county roads.
Permanent motorized access through the Custer National Forest would be acquired as part of this project.	Permanent motorized access through the Custer National Forest is not part of this project and will not be developed with this project.
If log trucks haul on HWY 78 or 212 people would not go to Yellowstone via these routes	Both of these routes are currently used for transportation of cattle or other common goods. Transportation of logs would be expected to have a similar effect as current use, which does not currently preclude travel for tourism.
Local economies would suffer because there would be log trucks on the road.	Area roads are currently used for transportation of cattle and other common goods. Transportation of logs would be expected to have a similar effect as current use. Please see Chapter 3 for more information on the predicted economic effects of this project.
The project would cause people to avoid forest service campgrounds and scenic travel routes in the area.	Effects of the proposed action on recreation opportunities are described in the recreation analysis in Chapter 3.
Increased weed production would decrease grazing revenues.	Predictions on future grazing revenues are beyond the scope of this project. Grazing leases are issued by competitive bid over a fixed term, so weed production would not affect revenues until the expiration of the current lease period. At that time, any increases in noxious weed populations could decrease the AUM for a given grazing lease; however, DNRC is proposing several mitigation measures to limit the spread or introduction of noxious weeds as a result of project implementation.
The project would negatively affect recreational property value in the area.	Property value of private land within the area of the project area is not within the scope of this analysis.

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ISSUES ELIMINATED FROM FURTHER ANALYSIS	DNRC RATIONALE
What type of revenue was generated on similar sales?	Fluctuations in market prices and hauling distances to mills make it difficult to directly compare revenues from similar sales to the proposed action. The Bear Canyon timber sale is the most similar based on location and species composition. In that sale, approximately 33,439 Tons (~4.99 million board feet) were sold with a stumpage value of $17.56/ton in 2011. Forest Improvement fees were collected from that sale at a rate of $2.46/ton.
Proposed management activities have a high likelihood of actually creating a net drain on state coffers.	The costs of proposed project activities are analyzed in detail in the economics analysis of Chapter 3.
Grazing will generate more revenue if properly managed than lumber.	Grazing and forest management activities are not mutually exclusive activities, and predictions on future grazing revenues are beyond the scope of this project. On forested state lands, DNRC's philosophy as described in the State Forest Land Management Plan is that the best way to produce long-term income for the trust beneficiaries is to manage intensively for healthy and biologically diverse forests, and that timber management constitutes the primary source of revenue and primary tool for achieving biodiversity objectives on forested state trust lands.
The existing management for the area is, by and large, the best one for meeting DNRC's trust responsibilities.	The economic analysis in Chapter 3 compares the potential revenue generation for the trust beneficiaries of No Action and the proposed Action alternative. As described in Chapter 3, DNRC's existing management of state trust lands is guided by the State Forest Land Management Plan (SFLMP), which states that for the foreseeable future, timber management will continue to be the primary source of revenue and primary tool for achieving biodiversity objectives on DNRC forested state trust lands.
Increased fire starts will increase the cost of fire suppression efforts. This should be included in overall economic calculations for this project.	Predictions on fire suppression costs of potential future events are beyond the scope of this project.
Increased costs of weed management, and decreased	Weed management activities can be accomplished by the timber sale purchasers as specified in the contractual

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ISSUES ELIMINATED FROM FURTHER ANALYSIS	DNRC RATIONALE
value of forage (grazing fees) and decreased value for wildlife (hunting fees) should be included in the economic calculations for this project.	agreement, or through separate contracts funded by DNRC's Forest Improvement program. Costs and revenues associated with the timber sale are shown in Chapter 3. Predictions on future grazing revenues are beyond the scope of this project. DNRC charges a fee that is included with the purchase of a conservation license issued by the Montana Department of Fish, Wildlife, and Parks for recreational use of state trust lands by hunters and anglers. No additional fees are charged to hunt on state trust lands.
The region's economic positives depend on the unspoiled natural aesthetics in the area.	DNRC acknowledges that timber management can affect the visual quality of certain areas. Potential effects on aesthetics are described in Chapter 3—Aesthetics. Economic impacts of this project are described in Chapter 3—Economics. Several events, including both natural (wildfire, insect outbreaks) and human-caused (timber management, residential or commercial development, etc.) can alter visual quality/aesthetics. However, by law DNRC cannot forego management on state lands to reduce or avoid visual impacts without receiving full market value of designation, treatment, or disposition (MCA 77-5-116).
The area is a unique ecosystem that supports numerous wildlife species and it needs protection.	The project area and neighboring lands do provide valuable habitat for a number of species. The coarse and fine filter wildlife analyses provide detailed assessments that address this concern in more specificity and detail. DNRC is required under the Montana Environmental Policy Act, and Forest Management Administrative Rules to provide mitigations for activities that may cause impacts. However by law, DNRC may not set aside or defer management of lands without full market compensation.
New road construction and maintenance will have adverse long-term effects on wildlife	This concern is addressed in detail in the coarse and fine filter wildlife analyses, particularly the sections pertaining to habitat fragmentation, habitat linkage, big game and grizzly bears.
The area provides habitat for the following species: moose, elk, mule deer, white-tailed	DNRC acknowledges that the project area contains habitat that provides for the life requisites of many wildlife species. Most of these individual species are addressed

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deer, black bears, grizzly bears, mountain lions, ruffed grouse, goshawks, great gray owls, wolves, green-tailed towee, waterfowl, sandhill cranes, foxes, eagles, old growth associated species, and wolverines.	elsewhere in this analysis in more detail. The following species will not be discussed further in the analysis for the following reasons: Green-tailed towee -- This bird is a member of the sparrow family and is a species of concern in Montana due to recent population declines. The species nests and feeds on or near the ground in shrub plant communities and generally avoids forested areas. Habitat for this species is not likely to be affected for this species by either of the alternatives considered. Waterfowl -- The project area contains a number of riparian areas and wet sites potentially suitable for limited use by some duck species (eg. mallards). Occasional nesting by a few individual pairs may occur. However, wetland areas greater than an acre that would support an abundance of waterfowl of various species are not present on the project area. Logging would not occur in close proximity to wet areas suitable for use by ducks, thus minimal effects associated with either alternative would be anticipated. Sandhill cranes -- Sandhill cranes feed and nest in some pastures and meadows on the project area in the spring and summer. Disturbance associated with logging activities could temporarily displace some individuals, however, important habitat in upland pastures and meadows would be minimally affected. Thus, minimal effects to sandhill cranes associated with either alternative would be anticipated. Red fox -- The project area provides diverse habitats usable by red foxes. The red fox is a generalist species that is adaptable and can live in a broad range of habitats and environments, including urban areas with high levels of human use. Foxes are common in Montana and populations are secure. Proposed logging activities under the action alternative could reduce cover in mature conifer stands in the project area and foxes may be temporarily displaced from the project area. However, following

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ISSUES ELIMINATED FROM FURTHER ANALYSIS	DNRC RATIONALE
	completion of project activities, suitable habitat for red foxes would remain in the project area. Thus, minimal effects to red foxes would be anticipated under either alternative considered. Old growth associated species -- DNRC defines old growth stands following the tree size and age class metrics described by Green et al. 1992. Identifying these important habitat areas in this manner is required by DNRC's Forest Management Administrative Rules [ARM 36.11.403(48)]. Stands that meet the age and tree sizes required by Green et al. (1992) do not currently occur in the project area. However, mature stands are present in the project area that possess or are developing old growth attributes, such as an abundance of downed wood and snags, multiple canopy layers etc. Old growth associated species such as winter wrens and brown creepers could occur in the project area. However, logging associated with the proposed action would target lodgepole pine trees and stands that tend to provide relatively poor and short-lived snags for many old growth associated species. Areas targeted for harvesting would also tend to be less structurally diverse than mixed species stands with greater tree species diversity. Two notable species that can be associated with old growth and mature forest stands that have been documented on the project area include goshawks and great gray owls. These two species are addressed in greater detail in specific subsections of the wildlife analysis.
There is concern that the project will decrease biodiversity.	DNRC defines biodiversity as 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 (DNRC 1996). DNRC primarily promotes biodiversity by taking a "coarse filter" approach to forest management, thereby favoring an appropriate mix of stand structures and compositions on state lands. A coarse filter approach "assumes that if landscape patterns and processes (similar to those species evolved with) are maintained, then the full complement of species will persist and biodiversity will be maintained" (Jensen and Everett 1993). Proposed treatments would emulate natural fire disturbance by removing most

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	lodgepole pine and aspen (which have thin bark) and would retain a greater representation of thicker barked Douglas-fir, and spruce and subalpine fir, which occur on wet and cool sites. Harvest units would have irregularly shaped naturally appearing boundaries emulating historic natural burn disturbance patterns. Within a decade following logging young stands of lodgepole pine and aspen would be expected to develop following disturbance, contributing to the maintenance of a mosaic of age classes of these types in this forest/grassland ecotone. We believe the proposed treatments are consistent with emulating natural disturbance patterns and processes that endemic species evolved with in this local area and that they would promote and help maintain habitat and species diversity over time, not decrease it. This landscape has been historically shaped and influenced by natural disturbances, which continues today as evidenced by recent wildfires in the region. In a historical U.S. Geological Survey annual report, Brandegee (1899) estimated that in the broad landscape encompassing this area (Climatic Section M331A), 70% of the forest had been burned over between 1870 and 1900 (Losensky 1997).
The project area vicinity is an increasingly rare ecosystem.	The project area is a part of a geographic area with a number of amenities valued by many members of the local community, particularly recreation, aesthetics and wildlife habitat. The lands are also valued as a part of a grazing allotment. DNRC is not, however, aware of any formal designation of project area lands lying within an identified "rare ecosystem." DNRC is also not aware of the presence of any particularly rare vegetation community types that should be given additional consideration.
There is concern that logging will push grizzly bears closer to residential areas.	DNRC is aware of no published studies that have demonstrated that bears may be likely to move closer to residential areas during or following logging as described. In the project area, the arrangement of preferred wet areas and desirable vegetation community types would not change. Bears would likely use the landscape similarly following logging and road closures. Changes in cover abundance and distribution would not likely alter nighttime movements and habitat use by bears appreciably. Published research and current bear mortality

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	data for Montana would suggest that the presence and availability of unnatural foods and attractants near residential areas would be much more likely to attract bears closer to residential areas. Other issues related to potential impacts to grizzly bears are addressed in more detail in the grizzly bear analysis contained in this EA.
A concern was expressed by several individuals that *aspen* community types (particularly those that are decadent and/or heavily encroached by conifers) are important wildlife habitat and they are in need of enhancement and improvement. Other individuals voiced that aspen stands present are generally healthy, natural stands that do not need further enhancement, and where enhancement has been applied in the past, dense unnatural clones have resulted.	See vegetation analysis regarding aspen and anticipated effects of the proposed activities.
Supportive of the project.	Thank you for your comments.

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Relevant Past, Present, and Related Future Actions

In order to adequately address cumulative effects of the proposed action on pertinent resources, each analysis accounts for the effects of past, present, and related future actions within a determined analysis area. The locations and sizes of the analysis areas vary by resource (water resources, vegetation, etc.) and species (grizzly bear, big game, etc.) and are further described by resource in *Chapter 3*.

Past, present, and related future actions on DNRC lands and adjacent ownerships were considered for each analysis conducted within this EA. Where data were lacking on adjacent ownerships, associated impacts were considered and described qualitatively for cumulative effects. Aerial photography from 2008 and 2011 was used for this analysis, which accounted for

cumulative changes attributable to past, relevant timber sale projects and large wildfires that have influenced wildlife habitat in the local area.

Following is the list of agency relevant actions considered in this EA:

Within the project area:

- DNRC 1995 Timber Permits 13,612; Section 10, T7S R 19E 87.8 MBF
- DNRC 1996 Timber Permit 13657; Section 10 T7S R19E 99.7 MBF
- DNRC 1995 Timber Permit 13491; Section 10 T7S R19E 1 MBF

Project area lands influenced by several grazing leases and the Hogan Creek and Burnt Fork grazing allotments.

Outside of the project area:
U.S. Forest Service Proposed -- Greater Red Lodge Area (GRLA) Forest and Habitat Management Project; multiple sections in T6S R18E, T7S R18E and T7S R19E and include mechanical fuels treatments, hand thinning and prescribed fire treatments. Approximately 2,176 acres have been proposed for treatment (1,221 acres commercial, 955 acres non-commercial) and 8 miles of temporary road could be constructed and used, and 5.4 miles of existing roads would be decommissioned (USFS 2013). DNRC analyzed the best information that was available at the time of the analysis. However, many aspects of the USFS project could change as the project develops and they complete the environmental review process. Some of the estimates and quantified values used in this EA may change from what was analyzed.

Development of the Action Alternative

History and Development Process

An ID Team was formed to work on the proposed Palisades Timber Sale Project in the fall of 2011. The ID Team consisted of a project leader and resource specialists from various disciplines including: fisheries, wildlife biology, hydrology, geology and soils, planning, and forestry. The role of the ID Team was to summarize issues and concerns, develop alternatives of the proposed action within the project area, and analyze the potential environmental effects of the alternatives on the human and natural environments.

The ID Team began reviewing resources in the proposed project area soon after the initial scoping period began in December 2011. Field reviews were conducted and data was collected within the project area to aid in the analyses for affected resources including: vegetation, water resources and hydrology, fisheries, wildlife, geology and soils, economics, air quality, recreation, archeological, and aesthetic resources. In-depth quantitative and qualitative analysis of the data assisted the ID Team in assessing the existing environment for each resource and in determining the potential environmental effects of each alternative on the affected resources. Based on data collected from the field, and issues received from the public and internally, the ID Team developed one Action Alternative to meet the project objectives while considering, to the

extent practicable, the various issues and concerns raised by the public. The Action Alternative incorporates harvest unit design, prescriptions, mitigations, and road development activities that allow the DNRC to conduct forest management activities consistent with direction contained in the SFLMP and the Forest Management Rules.

Description of the Action Alternative

DNRC has developed one Action Alternative to meet the project objectives while considering, to the extent practicable, the various issues and concerns raised by the public. Below is a summary of the proposed project activities that collectively describe the proposed action.

Under the proposed action DNRC proposes to:

- harvest approximately 6.011 million board feet (MMBF) from approximately 789 acres within the project area using a combination of variable retention thinning and clearcut with reserves silvicultural prescriptions;
- construct 4.1 miles of new, permanent roads;
- construct 5.2 miles of new, temporary roads;
- reclaim 7.2 miles and reclassify 1.0 mile of road from existing road to motorized trail upon project completion. Reclaimed road would be closed with slash and debris;
- conduct slash pile burning following project implementation; and
- conduct weed spraying along existing and proposed roads, skid trails, landings, and burn piles.

Summary Comparison of No-Action and Action Alternative

Table 2 - 1. Summary description of alternatives and comparison of project activities.

PROPOSED ACTIVITY	NO-ACTION	ACTION
Timber Harvest	None	• Harvest approximately 6.011 MMbf[1] from approximately 789 acres within the project area using a combination of clearcut with reserves and variable retention thinning. • 29 units encompassing 700 acres would be treated with a clearcut with reserves prescription, yielding approximately 91% of the harvest volume. • 3 units encompassing 89 acres wwould be treated with a variable retention thinning prescription, yielding approximately 9% of the harvest volume. • Harvest will remove lodgepole pine and retain all other species. [2]
Road Construction	None	• New, Temporary road construction= 5.2 miles • New, Permanent road construction= 4.1 miles
Road Use/Restrictions	None	Pre-project open road= 0.0 miles Post-project open road= 0.0 miles
Reclaimed and Reclassified Road	None	Reclaimed existing road (post-project)= 2.0 miles Reclassify 1.0 miles of road from existing road to motorized trail

PROPOSED ACTIVITY	NO-ACTION	ACTION
		Reclaimed new road (post-project)= 5.2 miles
Stream Crossings	None	Reclaim 7 existing stream crossing, improve/upgrade 5 existing stream crossings, install 5 new permanent stream crossings, install and reclaim 4 temporary stream crossings.
Prescribed Burning	None	• Conduct slash pile burning within the harvest units and along new road ROW following harvest activities.
Weed Management	None	• Monitor and treat roads, skid trails, landings and burn piles for weed infestations as appropriate.

[1] The estimated timber volume is based on stand volume data obtained from field reconnaissance and other available data used in the analysis. Advertised volumes may vary from preliminary estimated volumes due to increased statistical accuracy of measured data obtained during sale layout. While the estimated log volume may be different, the environmental effects are based on acres treated and postharvest stand conditions; these effects would remain similar to those shown in this Final EA.

[2] There will be incidental removal of other species for the following reasons:

- Trees are located in designated skidding corridors or road locations.
- Trees are removed for crew safety concerns
- Aspen trees removed to stimulate aspen regeneration

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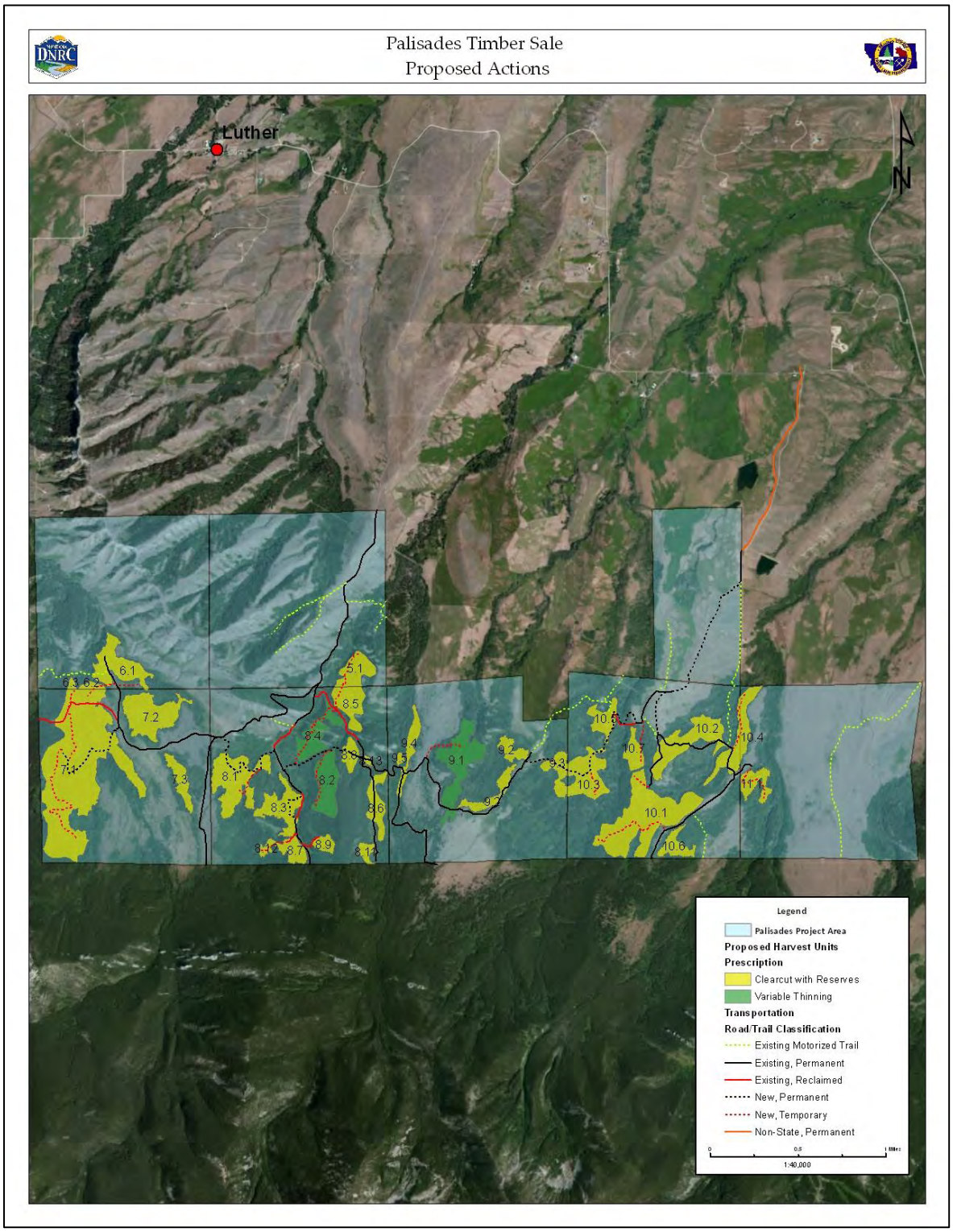
Figure 2-2. Project activities associated with the Action Alternative.



Decisions to be Made

Draft EA

During the spring of 2013, the ID Team developed the Draft EA. Issues received from the public and internal agency staff drove the analyses for the various resources. Upon publication, notification will be sent to individuals on the scoping list. The Draft EA will be circulated to individuals, agencies, and organizations who requested a copy of the documents. The Draft EA will also be placed on the DNRC website (http://dnrc.mt.gov/env_docs/default.asp). Comments to the Draft EA will be accepted for 30 days following publication.

Final EA and Decision Notice

After public comments are received, compiled, and addressed, DNRC will prepare a Final EA. The Final EA would primarily be a revision of the Draft EA that incorporates any necessary changes based on public comments received during the 30-day public review period. The Final EA would also include responses to comments received during the review period.
Following development of the Final EA, the Decision Maker would review public comments, the Final EA, and information contained in the project file. The Decision Maker would consider and determine the following:

- which alternative presented in the Final EA meets the project's purpose and objectives;
- which alternative (or combination/modification of alternatives) should be implemented and why;
- whether issues and concerns have been adequately addressed; and
- whether there is a need for further environmental analysis or to prepare an EIS.

These determinations would be published and all interested parties would be notified. The decisions presented in the Decision Notice would become recommendations from DNRC to the Land Board. Ultimately the Land Board makes the final decision to approve or not approve the alternative selected by the Decision Maker.

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Chapter 3 Affected Environment and Environmental Consequences

Introduction

This chapter covers the existing conditions (affected environment) and the predicted environmental effects (environmental consequences) of both the No-Action and the Action Alternative on the following resources: transportation, vegetation, water resources and fisheries, geology and soils, wildlife, recreation, cultural resources, aesthetics, economics, and air quality.

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Transportation

The state trust lands sections in the Palisades area are supported by a network of roads that provide access to state trust lands for the purposes of conducting forest management activities, grazing activities and fire suppression. 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 pressures).

The network of roads on the state trust lands in the Palisades area is not accessible by county road or other legal road access for the general public. Easements across private property were obtained to complete this project.

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 in the Palisades area. Specific road-related effects on other resources are discussed in the *Chapter 3 — Geology and Soils, Water resources and Fisheries, Wildlife, Air Quality, Recreation and Aesthetics analyses*. The following discussion of the 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 the DNRC-managed roads in the Palisades Timber Sale project area. The subsequent analysis of environmental consequences addresses issues rose during public scoping and describes likely changes to DNRC's road network in the Palisades area and its management under the No-Action and Action Alternatives.

Analysis Areas

The analysis area used to determine the direct, indirect and cumulative environmental effects of the transportation system included in the proposed action will include the 4,755 acres of blocked state trust land in the Palisades project area and the roads accessing the project area form Highway 78. This analysis area will herein be referred to as the cumulative-effects analysis area.

Analysis Methods

Issues and Measurement Criteria

A number of concerns were raised during the scoping period regarding how potential impacts to the transportation system may affect the project area and the neighbors of the project area. The following issue statements account for those concerns and ultimately guide this analysis:

- If new roads are added to the existing road system there would be an overabundance of roads in the project area.
- Increased public use and illegal activity would occur as a result of increased road densities associated with the project.
- Following harvest activity temporary roads would not be reclaimed.

Quantitative and qualitative changes to the following measurement criteria are intended to 'measure' the extent of potential direct, indirect, and cumulative environmental effects the transportation system included in the proposed action may have on the area:

- condition of roads within and leading up to the project area
- amount, and status of roads

Relevant Agreements, Laws, Plans, Permits, Licenses, and Other Authorizations

DNRC's road-related activities supporting forest management activities on state 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 is partially funded through DNRC's forest improvement program. Road management standards were established in the SFLMP and subsequently adopted as part of the Forest Management Rules (*ARM 36.11.421*).

A number of roads and motorized trails are found within the Palisades Timber Sale project area. Distinguishing between a road and motorized trail requires looking at how each is defined.

Road – Any created or evolved access route (usually with a constructed prism) that is greater than 500 feet long and is or was intended to be reasonably and prudently drivable with a conventional passenger car or pickup.

Motorized Trail –Any route longer than 500 feet that does not qualify as a "road", including those routes that conventional four-wheel drive vehicles could negotiate. DNRC does not typically promote or manage off-road trail systems or maintain them as legal accessible roads in the road database. If management intent is to allow such a route to persist in a particular area, they should be classified as open or restricted road where it is consistent management objectives.

DNRC currently uses 5 levels of access classification as defined in the Forest Management Rules. All roads with the project area of the Palisades Timber Sale are currently classified as Motorized Use Restricted Year Round. Upon completion of the projects all roads will continue to be Motorized Use Restricted Year Round.

- **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 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 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.

Affected Environment

Condition of Roads

The existing road system as depicted on *Figure-T1* below consist of approximately 13.0 miles of vegetated native surface roads as well as 5.1 miles of existing motorized trail. These roads and motorized trails were established to access homesteads, irrigation ditches, and the management of forest and grazing activates. (*see Chapter 2 — Relevant Past, Present, and Related Future Actions*). Much of the existing road infrastructure requires maintenance and improvements to bring the roads up to Best Management Practices (BMPs) standards which are set to reduce sedimentation and impacts of the road on surrounding areas, particularly water quality. Other roads within the project area are constructed on a steep grade and have inadequate erosion control measures such as proper grading, a road crown, waterbars or broad based dips. This increases erosion and sedimentation while failing to provide a long-term usable road for management activities.

Some roads within the project area are located parallel and adjacent to stream channels while others have poorly constructed stream crossings or crossings that have already failed. An example of these poor stream crossings can be found in the stream crossing located on the West Fork of Hogan Creek which originally contained a 24" steel round pipe and a 30" corrugated metal pipe. As shown, these pipes and the associated crossing have been completely washed out. Information specific to the conditions found in each watershed can be found in the "Affected Watershed—Existing Conditions" section of this report. The roads that do not meet BMP standards result in high levels of erosion and thus sedimentation in local streams compared to a road system that follows BMP standards.

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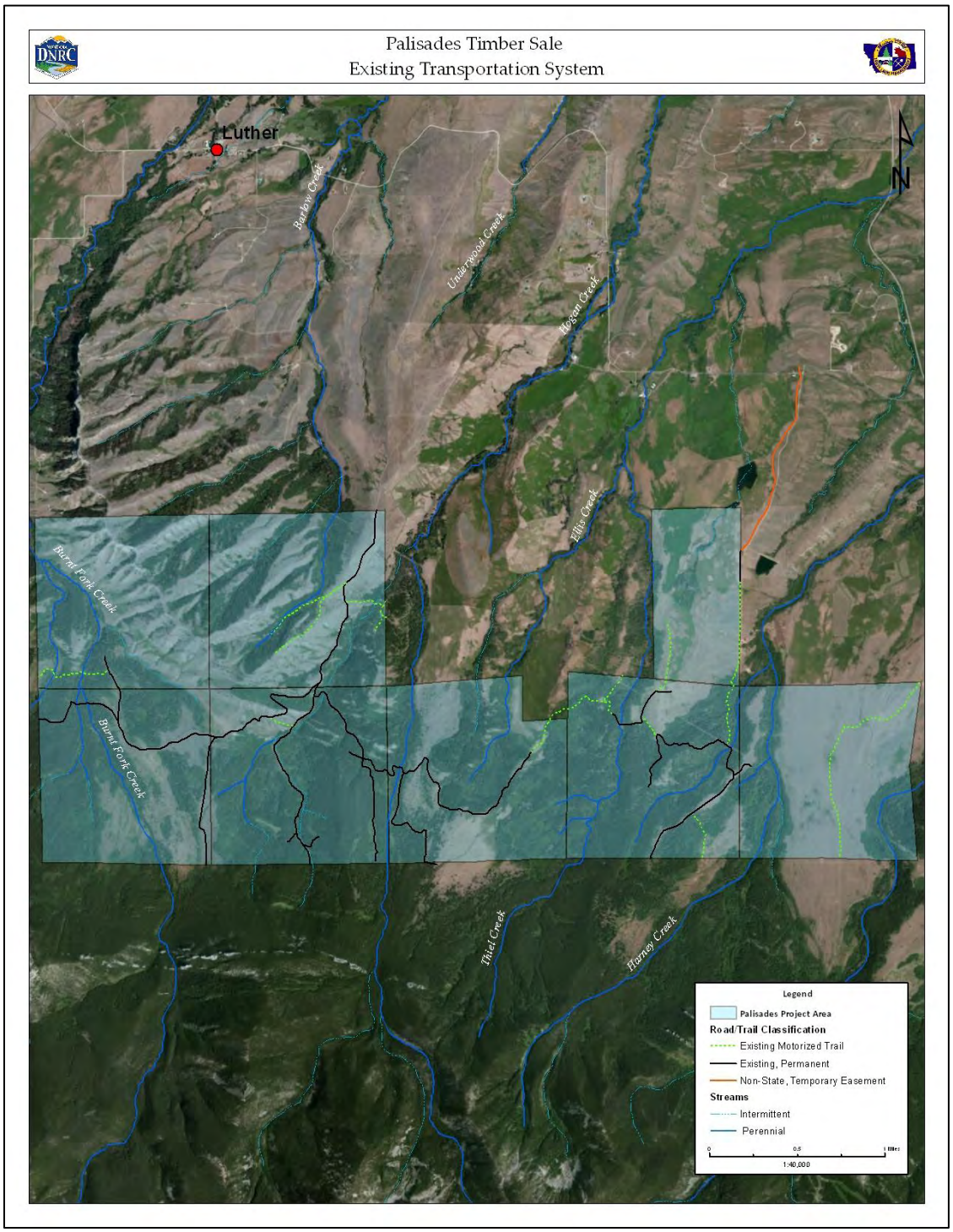
Figure T-1. Existing transportation system to and within the project area.



Amount and Status 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.

The current road system supporting the project area consists of 13.0 miles of road that are designated Motorized Use Restricted Year-Round. The current road system also supports 5.1 miles of motorized trail exists within the project area which is utilized for various management activities by grazing lessees and individuals managing ditch rights which flow across these state sections. No roads or motorized trail within the project area are open to public use. All roads and motorized trail within the Palisades Project Area are Motorized Use Restricted Year-Round, also known as a Class A Closure**.** These roads are restricted year-round to motorized public access but are open for commercial and agency use. This management designation allows for motorized use by state officials and commercial use in association with trust land management activities (e.g. timber harvest, grazing, firewood), but does not allow for public or recreational motorized use. The public in possession of a recreational use permit or a hunting license while hunting (*see Chapter 3 — Recreation*) is allowed to use the existing road system for non-motorized travel.

Environmental Consequences

--Direct and Indirect Effects of the No-Action Alternative

Road density in the project area would remain unchanged. Roads within the project area would continue to be managed as Motorized Use Restricted Year-Round with enforcement by Montana Fish, Wildlife and Parks (FWP). Most of the road conditions would remain in their current pre sale condition including roads that do not meet BMP standards. The roads would continue to be used for administrative purposes and support the recreational uses associated with non-motorized travel. No new temporary or permanent roads would be constructed and none of the improvements to stream crossings or existing roads would be completed.

Motorized traffic by DNRC personnel and associated trust land management activities would remain occasional.

--Direct and Indirect Effects of the Action Alternative

Condition

Current road conditions within the project area are comprised of a network of dirt roads and motorized trails. Following the plan for Alternative Action the condition of roads within the Palisades Project area would be improved or constructed to meet BMP standards. Stream crossings which are poorly constructed or have failed will be constructed to meet BMP standards and will be useful for administrative use and management of commercial activities as the crossings will be able to support large trucks and equipment. This action will result in a road infrastructure which provides reduced erosion possibilities and thereby reduced sedimentation of streams in the area. In the process of bringing roads and crossings up to BMP standards roads and crossings will be constructed or corrected to meet criteria based on road location, erosion mitigation, proper drainage, and grade.

Amount, and Status of Roads

Under the Action Alternative, up to 4.1 miles of new permanent road and 5.2 miles of new temporary road would be constructed to support harvest activities. Upon completion of harvest activities the 5.2 miles of new temporary road and 2.0 miles of existing road will be reclaimed. For reclaimed roads, culverts would be removed and the roadbeds would be seeded with grass and closed with debris while leaving the road prism in place. These roads would also be administratively closed for travel to allow them to re-vegetate. Reclamation of roads and closure of temporary roads will be described and required of the purchaser in the timber sale contract. Some existing small roads would be re-designated as motorized trail. Reconstruction and maintenance activities would also take place on 8.5 miles of the existing roads in order to meet the BMP standards detailed in the *Chapter 3 — Water Resources and Fisheries.*

Upon completion of the project 14.4 miles of permanent road and 6.1 miles of motorized trail would remain within the project area resulting in an increase of 1.4 miles of permanent road and an increase of 1.0 miles of motorized trail within the project area. Road densities within the project area would be 2.1mi/mi^2 and individual sections could be as high as 3 mi/mi^2.

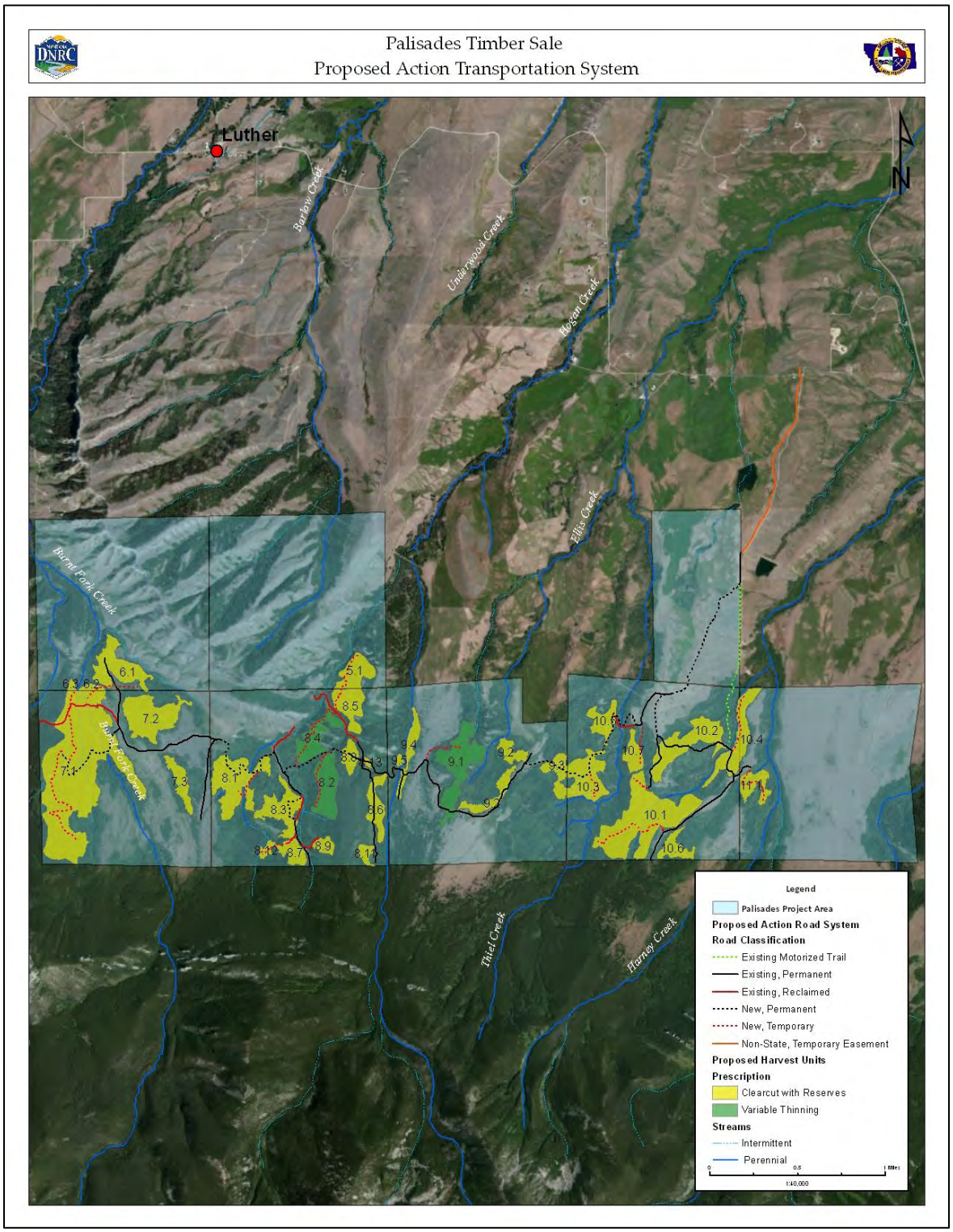
During and after harvest operations, the existing and the new roads constructed would be managed as Motorized Use Restricted Year-Round. This management designation would only allow motorized use by DNRC and by the commercial users associated with harvest activities. Signs informing the public of road-use activities would be placed at the Upper Luther Loop road, Highway 78, and other access points around the project area. This classification of road use is appropriate as there is no motorized public access to these sections. This classification does not change the current road classification and would result in no change to public access to these state sections.

DNRC would maintain access to the project area though private land with an easement that a landowner granted through October, 2021. Access after this point would need to be renegotiated. The negotiated access route, which exits state section 3 to the northeast and joins Upper Luther Road is also the haul route that the log trucks would take to and from the project area. This route brings the logging traffic out on the paved portion of Upper Luther Loop Road and then onto Highway 78.

Table T - 1. Amount and densities of road associated with the No-Action and Action Alternatives expected during harvest activities.

Project Actions	Alternatives	
	No-Action	Action
Miles of Permanent Road	13.0	14.4
Miles of Road Reconstruction and Maintenance to Meet BMPs	0	8.5
Miles of New Road Construction	0	9.3
Project Area Road Density (mi/mi^2)	1.8	2.1
Max Section Road Density (mi/mi^2)	2.5	3

Figure T - 2. Existing roads and new roads associated with the Action Alternative.



--Cumulative Effects of the No-Action Alternative

The transportation system roads managed as Motorized Use Restricted Year-Round would continue to be used for administrative purposes including; weed management, grazing management, and future forest management activities including timber permits and sales. Traffic and maintenance as well as public use and illegal activity would continue to be allowed and enforced in the same pattern as they did before harvest. No new roads would be added to the cumulative effects analysis area and no existing roads would be reclaimed within the analysis area.

--Cumulative Effects of the Action Alternative

Condition

Current condition of roads within the cumulative effects area varies between road type. The county roads which are planned to be used are Upper Luther Road and Highway 78. Both of these roads are well maintained blacktop paved roads that can handle large truck traffic.

Roads within the state sections and private land that will be utilized for access are natural surface roads, primarily dirt roads with a mixture of current conditions. While some have been well constructed, located and maintained much of the existing road infrastructure requires maintenance and improvements to bring the roads up to Best Management Practices (BMPs) standards. Some roads within the project area are located parallel and adjacent to stream channels while others have poorly constructed stream crossings or crossings that have already failed.

Amount and Status of Roads

Upon completion of the project 14.4 miles of permanent road and 6.1 miles of motorized trail would remain within the project area resulting in an increase of 1.4 miles of permanent road and an increase of 1.0 miles of motorized trail within the project area.

During and after harvest operations, the existing and the new roads constructed would be managed as Motorized Use Restricted Year-Round. This management designation would only allow motorized use by DNRC and by the commercial users associated with harvest activities. This classification of road use is appropriate as there is no motorized public access to these sections. This classification does not change the current road classification and would result in no change to public access to these state sections.

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Vegetation

Introduction

The vegetation assessment describes the present conditions and components of the vegetation communities in the area, as well as the anticipated effects of both the No-Action and Action Alternatives on vegetation.

Issues and Measurement Criteria

Issues expressed during initial scoping internally and by the public are summarized by the following statements:

- Harvesting activities associated with this project may produce homogenous landscape conditions and reduce forest cover type and age class diversity.
  Measurement criteria: cover type distribution, desired future conditions, age class distribution, stand structure
- Harvesting activities and conifer encroachment into aspen galleries may reduce the amount of aspen in the project area.
  Measurement criteria: cover type distribution, desired future conditions
- Timber harvesting associated with this project may adversely affect old-growth forests in the project area.
  Measurement criteria: age class distribution
- The current level of mountain pine beetle activity and susceptibility of forest stands to mountain pine beetle infestation is a concern. Active forest management may not effectively protect forests from mountain pine beetle infestation.
  Measurement criteria: insect presence and distribution, probability of mountain pine beetle outbreak
- Forest management activities associated with this project may not effectively reduce fire hazard or will directly or indirectly increase fire hazard in the project area.
  Measurement criteria: fuel loading, potential flame length, torching index, crowning index
- Forest management activities associated with this project may adversely affect populations of threatened, endangered, or sensitive plant species.
  Measurement criteria: species presence and distribution
- Timber harvesting and road building may introduce or spread noxious weeds in the project area.
  Measurement criteria: species presence and distribution

Analysis Areas

This analysis includes two geographic scales for assessing potential direct, indirect, and cumulative effects of the No-Action and Action Alternatives.

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Direct and Indirect Effects Analysis Area

The analysis area for direct and indirect effects includes the state owned parcels in Sections 3, 5, 6, 7, 8, 9, 10, and 11 of T.7S, R.19E (*Figure V-1*). This area is referred to as the project area (*see Chapter I — Purpose and Need*).

Cumulative Effects Analysis Area

An analysis area, hereafter referred to as the Palisades Landscape, was identified for the purpose of analyzing cumulative effects to forest vegetation associated with this project. This area of 37,310 acres is west-northwest of Red Lodge and surrounds the project area (*Figure V-1*). The Palisades Landscape generally includes portions of the following drainages west of State Highway 78 and south of the Upper Luther Road: West Red Lodge Creek, Burnt Fork Creek, Barlow Creek, Underwood Creek, Hogan Creek, Ellis Creek, Thiel Creek, Harney Creek, Cole Creek, and Powers Creek. Prominent land features within the Palisades Landscape include Bare Mountain, Burnt Mountain, Sheep Mountain, and the Limestone Palisades. This area includes the Beartooth Front and transition areas to plains and steppe in the north. Steep and rugged mountainous terrain is found in the southern portion of the area, while rolling terrain exists in the central and northern portions of the area. Property ownership within the Palisades Landscape is generally divided among three categories: National Forest lands managed by the USFS Custer National Forest (49 percent), private ownership (35 percent), and State Trust Lands (16 percent). National Forest lands are primarily forested and are located in the southern and western portions of the area. Private ownership is primarily non-forested and located in the northern and eastern portions of the area. State ownership is located in the central portion of the Palisades Landscape and contains a mix of forested and non-forested vegetation types.

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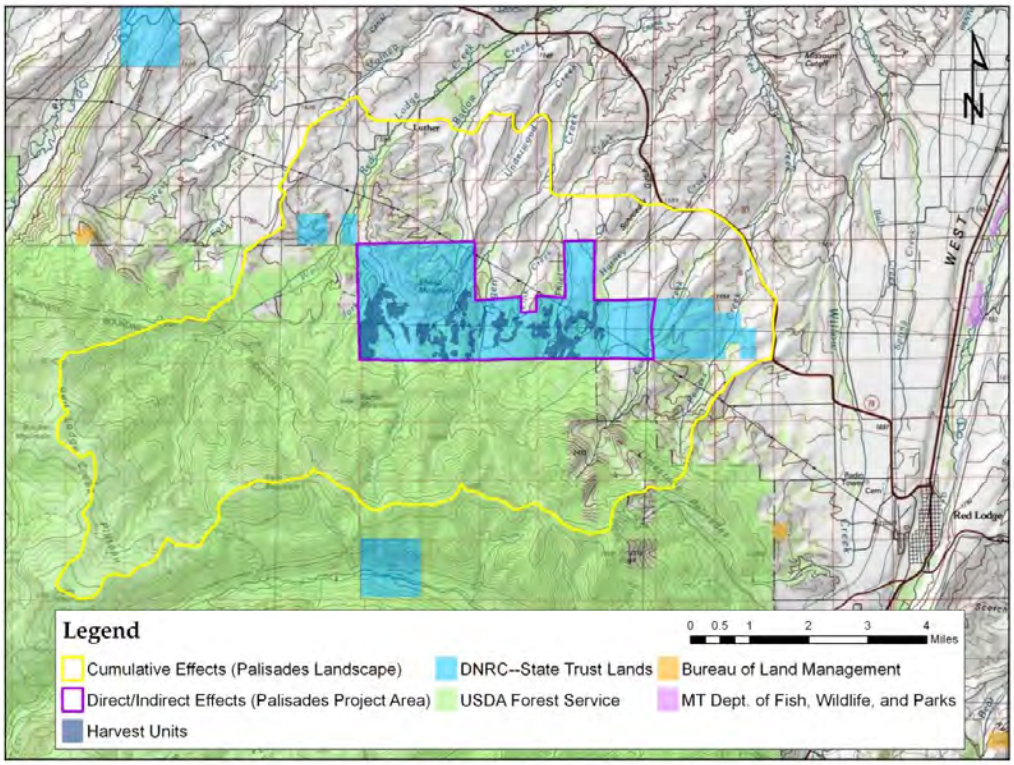
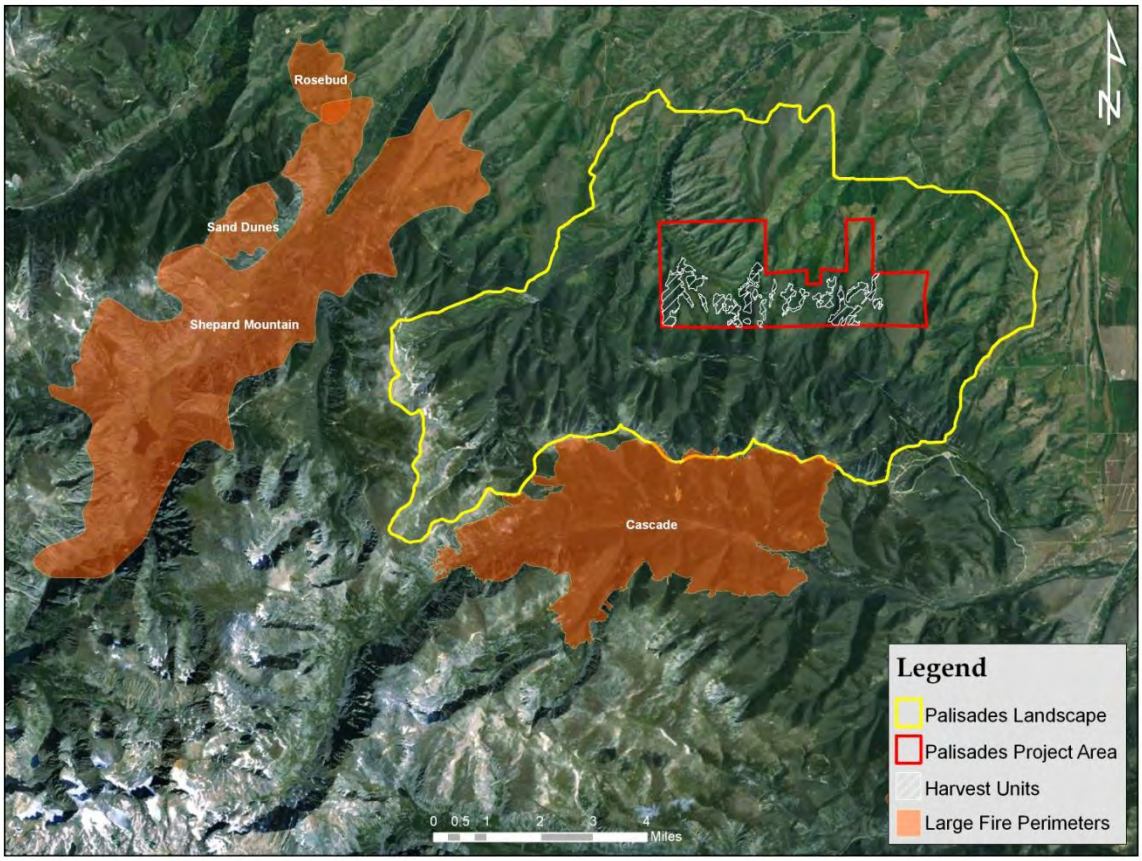
Figure V-1. Vegetation analysis areas for direct, indirect, and cumulative effects.



Stand History and Past Management

Natural and human-caused events have shaped forest development in the Palisades project area and landscape. The primary natural event affecting stand development in the Palisades Landscape is fire. Tree age data collected in the project area during 2011 indicated that most forests in the project area are relatively even-aged and are between 85 and 110 years old. This relatively narrow distribution of tree ages indicates that one or two single, large disturbances in the late 1800s or early 1900s, most likely fires, initiated the development of the stands presently found in the project area and Palisades Landscape. Local historical accounts indicate that a large fire burned in the vicinity of the Palisades Landscape in the late 1890s (USFS R1 1997). Examination of aerial photos taken in 1932 shows that much of the project area had less canopy cover than today and also showed several openings created by fire. Fire has been largely absent from the project area and Palisades Landscape over the last 80 years, due primarily to effective suppression of fire starts that have occurred. Within the past 20 years, however, there have been several large wildfires immediately adjacent to the Palisades Landscape, including the Sand Dunes (1990), Shepard Mountain (1996), Cascade (2008), and Rosebud (2012) Fires (*Figure V-2*). A significant wind event that occurred in November 2007 blew down several thousand acres of timber on portions of the Beartooth Face (CCDES 2013; CNF 2013).

Figure V-2. Large fires occurring within the vicinity of the Palisades Landscape.



The majority of the forests within the project area have no history of past timber management; however, several small-scale timber harvests have taken place in the project area since the 1980s. These activities have primarily occurred in Sections 8 and 10, and focused on removal of material suitable for post and pole production. Past harvests created small gaps or openings in the forest canopy, as well as reduced tree density and increased tree spacing where harvesting occurred. Small-scale firewood cutting has also occurred in the project area (*see Chapter 2 — Relevant Past, Present, and Related Future Actions*).

As with the project area, the majority of forests in the Palisades Landscape have no history of past management. Aerial photography shows several harvest units on Forest Service land in the West Red Lodge Creek drainage; these harvests included small clearcuts in lodgepole pine (*Pinus contorta*) stands and aspen enhancement or stimulation treatments that were designed to reduce conifer encroachment into aspen stands or to stimulate new aspen growth in decadent stands. Harvesting was also done in the Cole Creek drainage to clear ski runs for Red Lodge Mountain Resort. Comparing aerial photos taken in 1932 with current imagery shows a decrease in the area occupied by aspen galleries, particularly in the northern and central portions of the Palisades Landscape, due to ranching and agricultural activities. Additionally,

changes in fire regimes and behavior due to fire suppression, and heavy ungulate browsing have reduced the acreage of aspen in the Beartooth Mountains by 50 percent throughout the 1900s (CNF 2013, Steed and Kearns 2010).

Other relevant projects that have occurred in the past, are in progress, or planned in both the project area and Palisades Landscape are listed in *Chapter 2 — Relevant Past, Present, and Related Future Actions*. The effects of past actions are included in the described affected environment for the project area and Palisades Landscape.

Forest Cover Types, Age Classes, and Stand Structure

Issues Addressed

- Harvesting activities associated with this project may produce homogenous landscape conditions and reduce forest cover type and age class diversity.
- Harvesting activities and conifer encroachment into aspen galleries may reduce the amount of aspen in the project area.
- Timber harvesting associated with this project may adversely affect old-growth forests in the project area.

Analysis Methods

To assess the effects of the Action Alternative on forest cover types in the project area, stand exam data collected by DNRC foresters in the fall of 2011 were used in combination with US Geological Survey Gap Analysis Program (GAP) data to determine current cover types in the project area. These same data were also used to determine the desired future condition (DFC) cover type for stands in the project area according to DNRC's model described in *ARM 36.11.405*. GAP data were used to determine cover types in the Palisades Landscape. The Forest Vegetation Simulator (FVS) (Eastern Montana variant) was used to evaluate the effects of the No-Action and Action alternatives on forest cover types.

Age classes of forested stands in the project area and Palisades Landscape were determined using aerial photographs and stand exam data collected by DNRC foresters during the fall of 2011.

Affected Environment

Project Area Cover Types and DFCs

Within the project area, there are 3,099 acres of forested land and 1,656 acres of non-forest land (*Table V-1*). Of the forested acres, lodgepole pine is the most commonly occurring cover type; it is found on 28 percent (1,321 acres) of the project area (*Table V-1*). In the project area, stands classified as lodgepole pine are typically pure lodgepole pine stands or mixed-species stands containing at least 60 percent lodgepole pine (by board foot volume) and lesser amounts of Douglas-fir (*Pseudotsuga menziesii*), Engelmann spruce (*Picea engelmannii*), subalpine fir (*Abies lasiocarpa*), or quaking aspen (*Populus tremuloides*). Hardwood cover types are found on 1,314 acres (28 percent) of the project area; these consist of pure stands of quaking aspen or aspen-mixed conifer stands with at least 50 percent aspen. Douglas-fir stands, those with greater than

60 percent Douglas-fir, are found on 7 percent (335 acres) of the project area. Minor amounts of limber pine (*Pinus flexilis*)-juniper (*Juniperus* spp.) (2 percent/86 acres) and mixed conifer forests dominated by Engelmann spruce and subalpine fir (1 percent/42 acres) are also present. Non-forested cover types in the project area include grasslands, meadows, agricultural and ranch land, sagebrush steppe, and wetlands and shrub-dominated riparian areas. Of those types, sagebrush steppe is the most common, occurring on 24% (1,135 acres) of the project area.

Table V-1 also shows DNRC's DFC for the stands in the project area. The DFC represents the cover type that DNRC aims to manage toward in a given stand in order to implement its coarse-filter approach to managing for biodiversity (*ARM 36.11.404*). In the project area, all acres currently match their DFC.

Table V-1. Current cover types and desired future conditions for the project area.

COVER TYPE	***Pre-Treatment (Current Cover)***		***Post-Treatment***		***DFC***	
	Acres*	Percent*	Acres*	Percent*	Acres*	Percent*
Douglas-fir	335	7	476	10	335	7
Hardwoods	1,314	28	1,314	28	1,314	28
Limber pine	86	2	86	2	86	2
Lodgepole pine	1,321	28	884	19	1,321	28
Mixed conifer	42	1	338	7	42	1
Non-forest	1,656	35	1,656	35	1,656	35
TOTAL	***4,755***	***100***	***4,755***	***100***	***4,755***	***100***

*numbers may not sum to total due to rounding.

Palisades Landscape Cover Types

Within the Palisades Landscape, there are 22,203 acres of forest land and 15,287 acres of non-forest land (*Table V-2; Figure V-3*). Of the forested acres, lodgepole pine is the most commonly occurring cover type; it is found on 21 percent (8,004 acres) of the Palisades Landscape (*Table V-2*). Mixed conifer and subalpine cover types dominated by Engelmann spruce and subalpine fir occupy 16 percent of the Palisades Landscape, and hardwood cover types of aspen or aspen with mixed conifers are found on 11percent. Douglas-fir cover types (9 percent) are also common. Non-forested cover types in the Palisades Landscape are predominately sagebrush steppe (15 percent), shrub-dominated riparian areas (11 percent), alpine habitats (5 percent), and grasslands (4 percent) and meadows (4 percent). Wetlands, pastures, and cropland are also present.

Figure V-3. GAP land cover data in the project area and Palisades Landscape.

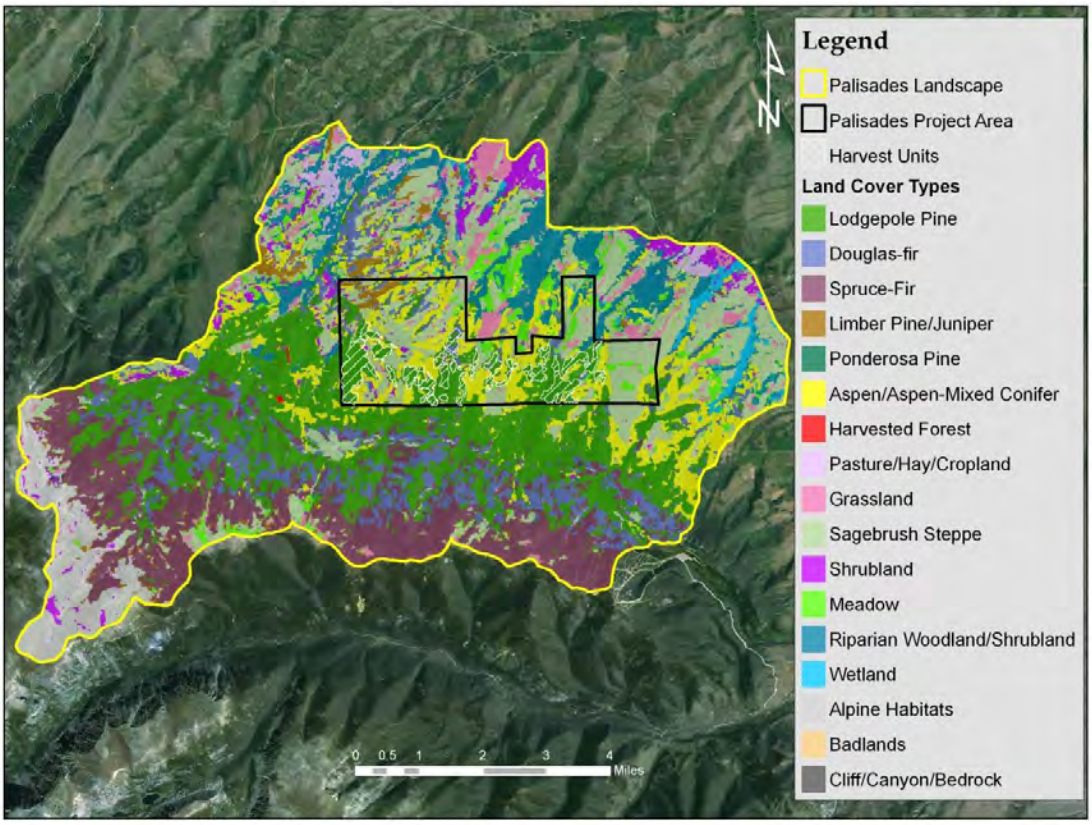


Table V-2. Current cover types for the Palisades Landscape.

COVER TYPE	Acres*	Percent*
Douglas-fir	3,510	9
Hardwoods	3,924	11
Limber pine	781	2
Lodgepole pine	8,004	21
Mixed conifer/Subalpine	5,798	16
Ponderosa pine	5	trace
Non-forest	15,287	41
TOTAL	***37,310***	***100***

*numbers may not sum to total due to rounding.

Age Classes
Forest stands in the project area and Palisades Landscape are predominantly 85 to 110 years old with occasional individual Douglas-fir over 150 years old. Areas of lodgepole pine and aspen that were harvested during the last several decades are typically 0 to 39 years old.

DNRC has adopted the Green et al. (1992) criteria for determining old growth stands on state lands (*ARM 36.11.403*). For lodgepole pine forests in eastern Montana, the minimum criteria to be considered a potential old growth stand are 12 trees per acre averaging at least 10 inches diameter at breast height (d.b.h.) and 150 years old. Although many of the stands in the project area have sufficient numbers of trees per acre at least 10 inches d.b.h., they do not meet the minimum age requirement to be considered old growth.

Stand Structure
Stands in the project area and Palisades Landscape are predominantly single- or two-storied stands; meaning that they have one or two well-defined canopy layers. Single-storied stands have one overstory canopy layer composed of mature trees, and there may be scattered individuals, usually seedlings or saplings of shade-tolerant species, present below the mature canopy. This stand structure is prevalent in the lodgepole pine and hardwood cover types in the project area. In two-storied stands, there is an overstory canopy with well-established seedling or sapling regeneration, usually Douglas-fir or Engelmann spruce, beneath the mature overstory. This condition is typically found in the Douglas-fir cover types and is occasionally found in some lodgepole pine stands. Multi-storied stands, those with three or more well-defined canopy layers, exist but are not common in the project area and Palisades Landscape.

-Environmental Effects

--Direct and Indirect Effects of the No-Action Alternative
With no action, the acreage of existing cover types in the project area would not be expected to change. However, in forested stands, subtle shifts in species composition would be expected to occur over time. In current lodgepole pine cover types, natural mortality of lodgepole pine would be expected to decrease the current proportion of lodgepole pine while the proportion of comparatively more shade-tolerant species such as Douglas-fir, Engelmann spruce, and subalpine fir would be expected to increase as those species grow and advance into the dominant canopy layer. Increases in mountain pine beetle activity would accelerate the rate of this shift in species composition; however, over time a new age class of regenerating lodgepole pine would be expected to develop, especially in larger canopy openings created by beetle-caused mortality.

In hardwood (aspen) cover types, conifer encroachment into aspen galleries would be expected over time, reducing the proportion of aspen in those stands.

The average stand age of 85-110 years would be expected to increase over time, and in the absence of disturbing agents such as wildfire and insect outbreaks, some stands could potentially achieve an average age greater than 150 years, qualifying them as potential old growth provided they still contain at least 12 trees greater than 10 inches d.b.h. Previously

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harvested areas currently occupied by seedling/sapling lodgepole pine would be expected to increase in age, becoming poletimber- and sawtimber-sized stands over time.

Stand structure could change over time depending on the amount of regeneration that is currently present under the dominant canopy layer or the success of new regeneration in establishing beneath the dominant canopy layer(s). Stands that are currently single-storied but with little development of regeneration in the understory would be expected to remain single-storied stands. If regeneration successfully establishes in single-storied stands, two-storied stand would develop. In stands that are currently two-storied, two-storied conditions would be expected to persist, or if regeneration were able to successfully establish, multi-storied structures could develop.

--Direct and Indirect Effects of the Action Alternative

Within the project area, the proposed harvesting activities would be expected to alter coniferous cover types over the short term. The proposed harvesting activities occur in stands currently dominated by lodgepole pine, and the removal of merchantable lodgepole pine would be expected to alter species composition on approximately 437 acres (9 percent) in the project area. 141 acres of lodgepole pine would be converted to the Douglas-fir cover type following harvesting, and 296 acres of lodgepole pine would be converted to the mixed conifer cover type. Harvesting on 352 acres of lodgepole pine would not be expected to change the cover type. The anticipated changes in cover type represent minor and temporary movement away from the DFC cover types in the project area; this is due to the focus on removal of lodgepole pine in favor of other species for the purposes of increasing species diversity within stands, retention of snags and snag recruits, and for wildlife habitat. Over the next 30 years, the development of regenerating lodgepole pine in treated areas would be expected to initiate movement back toward the DFC cover types.

In proposed cutting units 8.2, 8.4, and 9.1 (*Figure 2-2*), implementation of a variable thinning prescription would be expected to result in an immediate shift from the lodgepole pine cover type to the Douglas-fir cover type on approximately 89 acres. The post-harvest condition of these stands would consist of variably-sized groups and scattered individuals of Douglas-fir in the main canopy layer over a layer of advance Douglas-fir saplings. Sub-merchantable (less than 6.0 inches d.b.h.) lodgepole pine would also be scattered throughout the stand. Harvesting of mature lodgepole pine would create variably sized openings where lodgepole pine would be expected to regenerate. The average basal area remaining after harvesting would be between 45-60 ft.^{2}/acre in these stands. Over a 100-year period, these stands would continue to be dominated by a Douglas-fir canopy, and the proportion of lodgepole pine would be expected to increase as it regenerates and develops in openings created by harvesting. Multi-storied stand structures would be expected to develop as lodgepole pine regenerates in the openings, creating three canopy layers where Douglas-fir occupies the upper and middle canopy layers and lodgepole pine regenerates in the openings created by harvesting. Due to the method that DNRC uses to determine stand age class, there would be no change in the age class of these stands following harvesting. DNRC bases age class on the dominant overstory trees, and since an overstory of mature Douglas-fir would be left following harvesting it would be used to

determine the stands' age class although stands with two or three distinct age classes would be expected to develop.

In proposed cutting units 5.1, 8.5, 9.4, and 9.5 (*Figure 2-2*), implementation of a clearcut with reserves prescription would be expected to result in an immediate shift from the lodgepole pine cover type to the Douglas-fir cover type on approximately 52 acres. Initially after harvesting, these stands would consist of small groups and scattered individuals of Douglas-fir in the main canopy layer with sub-merchantable lodgepole pine scattered throughout the stand. Harvesting of mature lodgepole pine would create relatively large openings where lodgepole pine would be expected to regenerate. The average basal area remaining after harvesting would be approximately 25-35 $ft.^2$/acre in these stands. Over a 100-year period, Douglas-fir would be expected to dominate the stand for the first 50 years following harvesting, after which lodgepole pine would be expected to become the dominant species as it regenerates and develops in openings created by harvesting. Small patches of aspen would also be expected to develop in these areas, particularly in openings where older and decadent individual aspen trees are toppled during harvesting activities. Two-storied stand structures would be expected to develop as lodgepole pine regenerates in the openings, creating two canopy layers where Douglas-fir occupies the upper canopy layer and lodgepole pine regenerates in the openings created by harvesting. There would be no change in the age class of these stands following harvesting.

In proposed cutting units 6.1, 6.2, 6.3, 7.1, 8.1, 8.3, 8.7, 8.12 (*Figure 2-2*), implementation of a clearcut with reserves prescription would be expected to result in an immediate shift from the lodgepole pine cover type to a mixed conifer cover type on approximately 296 acres. After harvesting, Engelmann spruce and sub-merchantable lodgepole pine would be the primary species remaining, with minor amounts of Douglas-fir and subalpine fir also present. These trees would be left in small groups and as scattered individuals throughout the stand. Harvesting of mature lodgepole pine would create relatively large openings where lodgepole pine would be expected to regenerate. The average basal area remaining after harvesting would be approximately 35 $ft.^2$/acre in these stands. Over a 100-year period, Engelmann spruce and lodgepole pine would be expected to co-dominate the stand, with the proportion of lodgepole pine increasing over time as it regenerates and develops in openings created by harvesting. Small patches of aspen would also be expected to develop in these areas, particularly in openings where older and decadent individual aspen trees are toppled during harvesting activities. Two-storied stand structures would be expected to develop as lodgepole pine regenerates in the openings, creating two canopy layers where Engelmann spruce and lodgepole pine occupy the upper canopy layer and lodgepole pine regenerates in the openings created by harvesting. There would be no change in the age class of these stands following harvesting.

In the remaining cutting units (7.2, 7.3, 8.6, 8.8, 8.9, 8.11, 8.13, 9.2, 9.3, 10.1, 10.2, 10.3, 10.4, 10.5, 10.6, 10.7, and 11.1) encompassing approximately 352 acres, implementation of a clearcut with reserves prescription would not be expected to alter stand species composition. These stands are nearly pure lodgepole pine stands and would continue to be so after harvesting. After harvesting, sub-merchantable lodgepole pine would be the primary species remaining, and

these trees would be left in small groups and as scattered individuals throughout the stand. Harvesting of mature lodgepole pine would create relatively large openings where lodgepole pine would be expected to regenerate. The average basal area remaining in these stands after harvesting would be less than 20 ft.^{2}/acre, with the exception of cutting units 9.3, 10.3, 10.4, and 10.6 (approximately 84 acres, combined), where approximately 40 ft.^{2}/acre would be left due to the presence of a substantial component of sub-merchantable lodgepole pine. Over a 100-year period, lodgepole pine would be expected regenerate and develop in openings created by harvesting. Small patches of aspen would also be expected to develop in these areas, particularly in openings where older and decadent individual aspen trees are toppled during harvesting activities. In cutting units 9.3, 10.3, 10.4, and 10.6, where more lodgepole pine would be present after harvesting, a two-storied stand structure would be expected to develop as lodgepole pine regenerates in the openings created by harvesting. There would be no change in age class on those 84 acres, although stands with two distinct age classes would be expected to develop. In the remaining units, the lower amount of trees left after harvesting would be expected to result in the development of single-storied stands as lodgepole pine regenerates in the openings created by harvesting. The age class on those 268 acres would shift from mature stands to seedling/sapling stands.

The action alternative would not be expected to alter cover types, age classes, or stand structure in untreated areas within the project area. The development of such stands would be as described under no action.

--Cumulative Effects of the No-Action Alternative

Cumulative effects of no action in untreated stands within the Palisades Landscape would be similar to those described for no action in the project area. In the absence of disturbance, cover types in untreated stands would not be expected to change appreciably; however, subtle shifts in species composition within stands, increasing the amount of shade-tolerant species, would be expected to occur. Stands would be expected to increase in age, and canopy structure would be expected to become more complex.

Treatments associated with other projects proposed within the Palisades Landscape could alter cover types and age classes. The USDA Forest Service, Custer National Forest, has proposed the Greater Red Lodge Area Forest and Habitat Management Project (GRLA), under which treatments could be implemented on approximately 1,304 acres (3 percent) of the Palisades Landscape. Noncommercial treatments associated with the GRLA project are proposed on approximately 381 acres, and would focus on thinning non-merchantable material from young lodgepole pine stands, removing encroaching conifers from aspen galleries and riparian areas, and stimulating aspen regeneration. Commercial treatments proposed in the GRLA project could be implemented on approximately 923 acres within the Palisades Landscape. These treatments would focus on reducing stand density, creating openings for lodgepole pine to regenerate, addressing insect and disease issues, and stimulating aspen regeneration. The treatments proposed in the GRLA project would be expected to alter species composition, density, and structure to varying degrees within individual stands depending on the prescription implemented, with more substantial effects in stands receiving more intensive treatments. Stand age class would be expected to change from mature forests to

seedling/sapling forests on approximately 358 acres (1 percent of the Palisades Landscape) where regeneration-type cutting prescriptions would create openings conducive to establishment of tree regeneration. Non-commercial and commercial thinning or similar treatments would be expected to reduce stand density but would not be expected to affect stand age class.

--Cumulative Effects of the Action Alternative

Treatments to forest stands included with the DNRC Palisades Timber Sale project and Custer National Forest GRLA project could potentially occur on approximately 2,093 acres (6 percent) of the Palisades Landscape. These treatments would be expected to decrease stand density, decrease the proportion of lodgepole pine occurring within stands and on the landscape in favor of other conifer species and aspen, alter stand structure, and increase age class diversity by reducing the amount of mature forests and increasing the amount of seedling/sapling forests by 626 acres.

Cumulative effects to untreated stands within the Palisades Landscape would be similar to those described for no action.

Forest Insects

Issues Addressed

- The current level of mountain pine beetle activity and susceptibility of forest stands to mountain pine beetle infestation is a concern. Active forest management may not effectively protect forests from mountain pine beetle infestation.

Analysis Methods

USFS Aerial Detection Survey (ADS) data from 2011 was used to estimate the distribution and type of insect activity in the Palisades Landscape; this represents the most current data available with coverage for the Palisades Landscape as an ADS was not conducted in the area during 2012. Results of ground surveys of insect damage conducted in Carbon County during 2012 (Hayes 2013) were also used to identify insect activity and damage in the Palisades Landscape. Stand exam data collected by DNRC foresters during the fall of 2011 was used to estimate the amount of mortality due to insects in the project area. The Lodgepole Pine Mountain Pine Beetle Extension for the Forest Vegetation Simulator (FVS) was used to estimate the probability of mountain pine beetle outbreak.

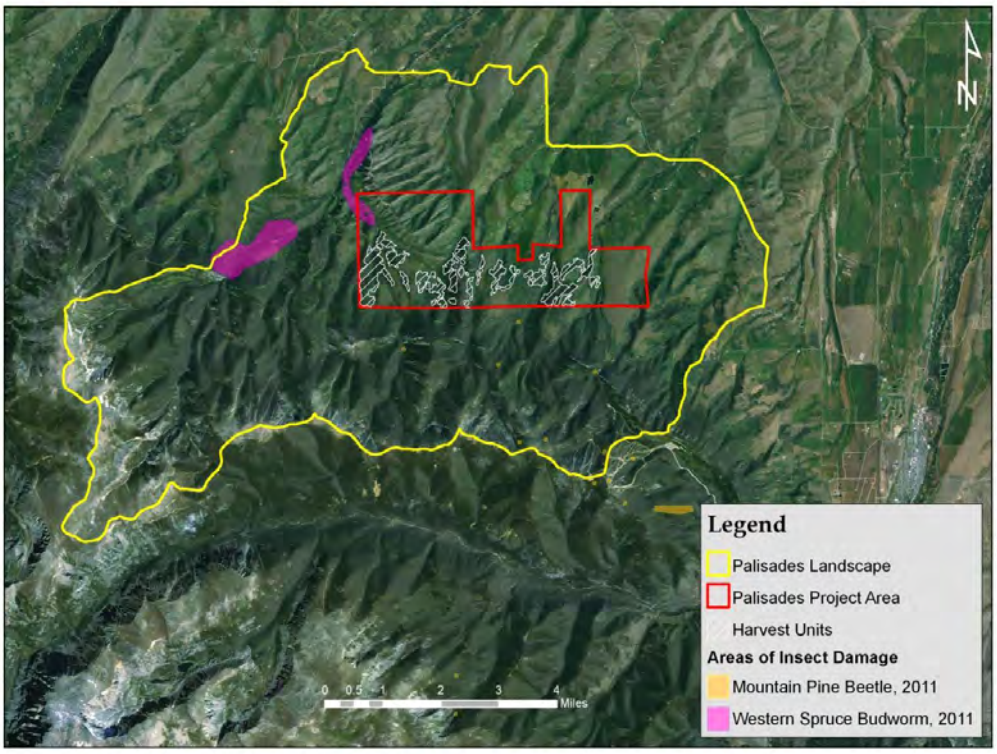
Affected Environment

Three insects are currently active and causing damage to forests within the project area and Palisades Landscape: mountain pine beetle (*Dendroctonus ponderosae*), spruce beetle (*Dendroctonus rufipennis*), and western spruce budworm (*Choristoneura occidentalis*)(*Figure V-4*). Mountain pine beetle is active in lodgepole pine forests in localized portions of the project area and Palisades Landscape, while mortality from spruce beetle was observed in one location in the project area. Western spruce budworm was identified in riparian areas along West Red Lodge Creek and Burnt Fork Creek.

ADS data was not collected in Carbon County in 2012; however, ground surveys indicated that mortality of lodgepole pine caused by mountain pine beetle increased in Carbon County in 2012 (Hayes 2013). The 2011 ADS did not identify mortality caused by mountain pine beetle in the project area, but did identify several small patches less than 2 acres in size of mountain pine beetle-caused mortality within the Palisades Landscape (*Figure V-4*). The ADS surveys capture only the previous year's mortality (i.e.—areas of mortality surveyed in 2011 were actually from infestation in 2010), and for that reason may underestimate the amount of mortality while the infestation is still growing. Beetle-hit trees that are still green are unlikely to be identified by the ADS, since the needles of beetle-hit trees do not turn red until the year following attack.

Although the 2011 ADS did not identify mountain pine beetle activity in the project area, DNRC stand exams conducted in the fall of 2011 found mountain pine beetle activity and associated mortality throughout the project area. The average mortality within stands of lodgepole pine trees was 13 percent, with values for individual stands ranging from 0 to 44 percent. Mortality in lodgepole pine within the project area is most prevalent in Sections 11 and 10 as well as portions of Sections 7 and 8, and is generally seen in small groups or individual trees. Field observation by DNRC staff in the spring of 2013 showed several new patches of dead lodgepole pine in the project area, especially in Section 10.

Figure V- 4. Forest insect damage in the project area and Palisades Landscape.



Stand exam data collection by DNRC foresters in the fall of 2011 found mortality from spruce beetle in one area of Section 8. Hayes (2013) indicated epidemic levels of spruce beetle south of the Palisades Landscape in the Rock Creek Drainage of Carbon County; however, morality is decreasing compared to prior years.

ADS surveys indentified approximately 680 acres (less than 2 percent) of the Palisades Landscape affected by western spruce budworm; affected areas are primarily in riparian areas along West Red Lodge and Burnt Fork Creeks. DNRC foresters also observed and recorded minor amounts of damage from western spruce budworm in the project area. Spruce budworm is a defoliator that targets spruces, true firs, and Douglas-fir, but it generally does not cause mortality except in severe cases of defoliation over multiple years.

-Environmental Effects

--Direct, Indirect, and Cumulative Effects of the No-Action Alternative

The Lodgepole Pine Mountain Pine Beetle Extension for FVS was used to estimate the probability of a mountain pine beetle outbreak in lodgepole pine in the project area over successive 10-year periods for 100 years. Simulation of no action indicates high probability of outbreak in the first 10-year period of the simulation, after which an expected outbreak would decrease the probability of future outbreak due to a lack of available host trees from prior mortality (*Table V-3*) and altered stand structure. This simulation does not mean that an outbreak would occur within 10 years or during another 10-year period, but instead serves as an indicator of conditions and their relative susceptibility to an outbreak.

Because mountain pine beetle is active and causing mortality in lodgepole pine, and similar conditions exist for both size and age class of lodgepole pine in both the project area and Palisades Landscape, there is potential for widespread mortality of lodgepole pine due to mountain pine beetle in the foreseeable future. Such conditions would persist until natural or human-caused events, such as wildfire, insect outbreaks, windthrow, or forest management activities, alter the size, age class, and amount of available host trees. As the amount of available host trees is depleted, beetle populations would likely return to endemic levels in the project area and Palisades Landscape, and future outbreaks of mountain pine beetle would not be likely to occur for several decades. Treatments proposed in the GRLA project could reduce susceptibility to mountain pine beetle attack on approximately 800 acres (2 percent) of the Palisades Landscape, or 10 percent of the lodgepole pine cover type within the Palisades Landscape.

Spruce beetle would not be expected to cause substantial mortality within the project area due to a relatively limited distribution of host tree species (Engelmann spruce) within the project area. Most of the spruce forest types in the Palisades Landscape are located in the higher elevation areas along the crest of the Beartooth Front, and because of this the southernmost portions of the Landscape immediately adjacent to the Rock Creek drainage are most susceptible to damage from spruce beetle. Because no proposed actions would occur within that area of the Palisades Landscape, no cumulative effects on spruce beetle would be expected.

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Western spruce budworm would continue to impact forests in the project area and Palisades Landscape to varying degrees. Areas where overstocked conditions and/or multi-storied tree canopies exist in stands of the preferred tree host species are more susceptible to damage from spruce budworm than stands that lack those characteristics. Treatments occurring under the GRLA project could reduce the risk of impact from spruce budworm in those areas.

Table V-3. Average probability of mountain pine beetle outbreaks over a 100-year period from simulation of the no action and action alternatives using the Forest Vegetation Simulator (FVS).

Period (ending year)	No Action	Action
1 (2021)	0.581	0.000
2 (2031)	0.147	0.001
3 (2041)	0.236	0.032
4 (2051)	0.319	0.063
5 (2061)	0.175	0.086
6 (2071)	0.060	0.286
7 (2081)	0.089	0.449
8 (2091)	0.134	0.488
9 (2101)	0.187	0.625
10 (2111)	0.244	0.300

--Direct, Indirect, and Cumulative Effects of the Action Alternative

Harvesting of lodgepole pine in the project area would alter the size class, age class, and amount of available host trees, reducing stand susceptibility to attack by mountain pine beetle on 789 acres. Modeling the proposed treatments with FVS and simulating subsequent forest growth over a 100-year period indicates that the effect of treatment on reducing stand susceptibility in the project area would last for several decades (*Table V-3*). Together with harvesting activities proposed in the GRLA project, alteration of stand conditions in the action alternative could reduce susceptibility to mountain pine beetle outbreaks on 1,589 acres (4 percent) within the Palisades Landscape, or nearly 20 percent of the lodgepole pine cover types in the Palisades Landscape. Effects in untreated stands with the project area and Palisades Landscape would be expected to be similar to no action.

Effects of the action alternative on spruce beetle and western spruce budworm would be expected to be similar to no action, as the amounts of preferred host species are not expected to change with the proposed action.

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Fire Ecology and Behavior

Issues Addressed

- Forest management activities associated with this project may not effectively reduce fire hazard or will directly or indirectly increase fire hazard in the project area.

Analysis Methods

Potential fire behavior was determined using the Fire and Fuels Extension of FVS (FFE-FVS). FFE-FVS can be used to evaluate stand characteristics and estimate the behavior of a potential fire given those characteristics, as well as estimate the necessary conditions for certain types of fire behavior to occur. Potential fire behavior was evaluated under the following weather and fuel moisture conditions: 20 mile per hour wind speed with an ambient air temperature of 70 degrees Fahrenheit, and surface fuel moisture of 4 percent for dead material less than 1 inch diameter, 5 percent for dead material 1 to 3 inches diameter, 10 percent for dead material greater than 3 inches in diameter, 15 percent for duff, and 70 percent for live material. Surface and standing fuel loads were evaluated, as well as potential flame lengths, torching index, and crowning index.

Affected Environment

Fire Ecology

The fire ecology of forests in the project area is characterized by 3 fire groups—Seven, Six, and Zero—described by Fischer and Clayton (1983) and summarized in *Table V-4*. Fire Group Seven includes cool habitat types dominated by lodgepole pine, and describes the most commonly occurring fire regime in the project area. In this fire regime, periodic wildfires typically perpetuate lodgepole pine cover types, with stands rarely reaching climax conditions dominated by shade-tolerant species. Fires in Group Seven are typically stand-replacing, occurring at intervals of less than 100 years to 500 years, with the longer return intervals occurring at higher elevations. The average frequency for lodgepole pine stands in Group Seven is 50 years. Such fires remove the overstory canopy, opening cones of lodgepole pine and releasing seeds that fall on an exposed seedbed to germinate.

Fire Group Six includes cool, dry Douglas-fir habitat types. Douglas-fir and lodgepole pine tend to be the dominant species on these habitat types, and fires vary from low-to-moderate severity fires that thinned stands to stand-replacing fires. The average return interval for fires on these habitat types is 42 years.

Fire Group Zero describes miscellaneous special habitats that experience fire but do not fit into Montana forest habitat type classifications. Aspen with the project area are included in this fire group. Fires in Group Zero types will not readily burn under normal weather conditions; however, fires that occur in aspen stands would maintain those stands by partially or completely removing the existing overstory canopy and stimulating suckering of aspen. In the absence of fire, conifer encroachment into aspen stands can gradually reduce the amount of aspen.

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Table V-4. Characteristics of fire groups occurring in the project area (summarized from Fischer and Clayton, 1983).

	FIRE GROUP		
	0	**6**	**7**
Habitat type group	Miscellaneous Special Habitats	Moist Douglas-fir habitat types	Cool types dominated by lodgepole pine
Mean Fire return interval/ Severity	variable/ mixed	42 years/ Mixed	50 years/ High
Average fuel loading (tons/ac.)	No data	13	15

Fire Groups 0, 6, and 7 also are found throughout the larger Palisades Landscape, along with Fire Groups 8, 9 and 10 that are not present in the project area. Fire Groups 8 and 9 occur on dry and moist lower subalpine habitat types, while Fire Group 10 describes cold and moist upper subalpine and timberline habitat types. Fire regimes of Groups Eight and Nine are mixed, including low-to-moderate severity fires that favor development of Douglas-fir, lodgepole pine, and Engelmann spruce, to stand-replacing fires that favor lodgepole pine. Return intervals average 90 to 130 years, and sometimes 300 years or more in moist drainages or higher elevation sites. Group 10 sites are found at high elevations where cold climatic conditions limit the frequency and extent of fires. Because of this, fires in Group 10 are highly variable in the extent of damage caused to a stand; however, in areas where contiguous forests exist, fires tend to be infrequent (return intervals typically greater than 200 years) and stand-replacing. Due to a short growing season, re-establishment of conifers on these sites can take decades following fire.

Fuel Loads and Potential Fire Behavior

Estimated fuel loading is summarized in *Table V-5*. The estimated average surface fuel load consisting of dead coarse material (greater than 3 inches diameter) in the project area is 13.1 tons per acre, with values for individual stands ranging from 9.3 to 14.8 tons per acre. Local areas within stands may have higher or lower coarse surface fuel loads. The estimated average total surface fuel loading, including litter, duff, dead fine (less than 3" diameter) material, dead coarse material, and live herbaceous and shrub material is 30.7 tons per acre, with values for individual stands ranging from 23 to 34.8 tons per acre. Standing fuels (dead and live) average 48.1 tons/acre, with values for individual stands ranging from 30 to 64 tons per acre.

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Table V-5. **Comparison of estimated fuel loading over a 100-year period for the No Action and Action Alternatives.**

Year	Coarse Fuels >3" diameter (tons/acre)		Total Surface Fuels (tons/acre)		Total Standing Fuels (tons/acre)	
	No Action	Action	No Action	Action	No Action	Action
2011	13.1	6.9	30.7	26.3	48.1	10.5
2021	12.8	7.4	30.1	20.3	55.3	12.4
2031	12.9	7.6	31.1	19.0	62.6	19.0
2041	12.6	6.8	31.5	18.5	70.6	25.7
2051	12.5	6.1	32.0	18.4	78.6	33.8
2061	12.6	5.8	32.3	18.8	86.4	42.5
2071	12.9	6.0	33.0	19.6	94.3	52.1
2081	13.4	6.4	33.6	20.8	102.4	61.9
2091	14.1	7.2	34.7	22.3	110.5	72.1
2101	14.7	8.0	35.6	23.9	118.8	82.7

Table V-6 shows potential fire behavior for stands in the project area under the weather and fuel moisture conditions previously mentioned. The expected surface flame length of a potential fire in the project area averages 4.1 feet, with values for individual stands ranging from 2.7 to 7.6 feet. The expected total flame length averages 29.1 feet, with values for individual stands ranging from 3 feet to 51 feet. The average torching index (the wind speed at which a surface fire would be expected to ignite the crown layer) is 69 mph, with values for individual stands ranging from 3 to 210 miles per hour. The average crowing index (the wind speed necessary to support an active or running crown fire) is 21 miles per hour, with values for individual stands ranging from 14 to 31 miles per hour.

Fuel loads and potential fire behavior were not evaluated for the areas of the Palisades Landscape outside of the project area. However, aerial photographs show similarity between forests existing in the project area and those in the broader landscape, and for that reason some similarity in fuel loads and potential fire behavior to those found in the project area could be expected.

Table V-6. **Comparison of potential fire behavior over a 100-year period for the No Action and Action Alternatives.**

Year	Surface Flame Length (feet)		Total Flame Length (feet)		Torching Index (mph)		Crowning Index (mph)	
	No Action	Action	No Action	Action	No Action	Action	No Action	Action
2011	4.1	7.7	29.1	10.0	69	17	21	81
2021	3.3	6.6	30.9	8.5	122	14	21	58
2031	3.4	1.8	36.4	2.2	95	86	21	35
2041	3.5	1.5	38.1	8.4	100	95	21	29
2051	3.6	1.1	40.0	12.9	57	113	22	26
2061	3.5	1.1	40.9	13.9	57	125	22	23

2071	3.6	1.2	42.5	18.0	46	156	22	21
2081	3.6	1.3	43.3	30.4	35	141	21	20
2091	3.7	1.7	45.2	32.2	31	132	20	19
2101	3.8	1.9	46.2	37.6	31	116	20	19

-Environmental Effects

--Direct, Indirect, and Cumulative Effects of the No-Action Alternative

With no action, surface and standing fuels in the project area would be expected to increase over time (*Table V-5*). Expected surface flame lengths of potential fires in the project area would be expected remain at or slightly below current predicted levels; however, total flame lengths would be expected to increase over time (*Table V-6*). The torching index of stands in the project area would generally decrease over time, indicating that slower wind speeds compared to current conditions could lift surface fires into the crown layer. The crowning index would be expected to remain at current levels.

Treatments associated with the GRLA project could alter fuels and potential fire behavior on 1,304 acres (3 percent) of the Palisades Landscape. Amounts of surface and standing fuels would be expected to decrease in treated areas. Surface and total flame lengths would be expected to decrease as a result of treatment, and torching and crowing indexes would be expected to increase, meaning that higher wind speeds would be required to lift a surface fire to the crown layer and sustain a running crown fire. Impacts in untreated stands within the Palisades Landscape would be expected to be similar to the effects of no action on stands within the project area.

--Direct, Indirect, and Cumulative Effects of the Action Alternative

Harvesting treatments would alter fuels and fire behavior on 789 acres of the project area. Amounts of surface and standing fuels left after treatment would be less than pre-treatment levels (*Table V-5*). An average of nearly 7 tons per acre of dead coarse fuels would be left following treatment, with expected values for individual stands ranging from 5 to 10 tons per acre. Over time, the amounts of surface and standing fuels would be expected to increase.

Compared to no action, surface flame lengths would be expected to initially increase following treatment due to improved air flow at the surface; however, total flame lengths would be expected to decrease due to reduction in standing fuels (*Table V-6*). Over time, as stands regenerate, the surface flame length in treated stands would be expected to decrease from initial post-treatment levels, and the total flame length would be expected to increase as standing fuels re-accumulate.

For the first 40 years following treatment, torching index would decrease compared to no action due to the growth form of regenerating trees where branches are present on the lower stem and near the ground surface (*Table V-6*). In that stand condition, the lower portion of the crown layer essentially extends to the ground surface; therefore, relatively low wind speeds would be expected to readily facilitate spread from the surface to the crown layer. After 40 years, the torching index in treated stands would be substantially higher compared to no action; at that

point of stand development, the distance from the ground surface to the lower crown has increased to the point that higher wind speeds are needed to lift a surface fire into the crown layer.

Harvesting treatments would substantially increase crowning index compared to no action, meaning that higher wind speeds would be necessary to support a running crown fire (*Table V-6*). As regenerating stands grow over time, the crowning index of treated stands would decrease to levels similar to no action.

Forest management activities associated with this project and the GRLA project could cumulatively alter fuel loads and potential fire behavior on 2,093 acres (approximately 6 percent) of the Palisades Landscape. Treatments associated with the GRLA project would be expected to have effects similar to treated stands within the project area, although to varying degrees depending on the intensity of the treatment (lower levels of effect would be expected for less intensive treatments). In untreated stands within the Palisades Landscape, effects on fuel loading and potential fire behavior would be expected to be similar to the effects of no action.

Threatened, Endangered, and Sensitive Plants

Issues Addressed

- Forest management activities associated with this project may adversely affect populations of threatened, endangered, or sensitive plant species.

Analysis Methods

The Montana Natural Heritage Program (MTNHP) was used to identify the presence of Species of Concern, including threatened, endangered, or sensitive plant species, in the project area and Palisades Landscape. Species of Concern are native species that are considered at risk of extirpation in Montana due to declining populations, threats to their habitats, restricted distribution, or other factors. Designation as a Montana Species of Concern is not a statutory or regulatory classification (MTNHP 2013). MTNHP reports for sensitive plants were queried for each township that intersects or is contained within the Palisades Landscape.

Affected Environment

No plant Species of Concern were identified in the project area. MTNHP identified two plant Species of Concern, Meesia moss and angled paludella moss, that have been found in the western portion of the Palisades Landscape (T.7S, R.18E). These mosses belong to the same family (Meesicacae), and occur on similar habitats of open fens with underlying limestone.

One observation of Meesia moss (*Meesia triquetra*) was recorded over 20 years ago in T.7S R.18E. Globally, this species is common and not vulnerable, but in Montana it is considered at risk of extirpation. Most of the mapped observations of Meesia moss in Montana are in the northwestern part of the state in Flathead and Lincoln counties. Only three observations have occurred east of the Continental Divide, in Glacier, Teton, and Carbon counties.

One observation of angled paludella moss (*Paludella squarrosa*) was recorded over 20 years ago in T.7S, R.18E. Globally, this species may range from being common and widespread to at risk

of extirpation in some areas. In Montana, it is considered to be at high or very high risk of extirpation due to very or extremely limited population, range, or habitat. The other observations of angled paludella moss in Montana were in Flathead and Glacier counties.

-Environmental Effects

--Direct, Indirect, and Cumulative Effects of the No-Action Alternative

Because no plant Species of Concern were identified in the project area, there are no anticipated impacts on plant Species of Concern. Within the Palisades Landscape, no impacts to Meesia moss or angled paludella moss would be expected from the implementation of other proposed projects, since both species occur in habitats that are unsuitable for forest management activities.

--Direct, Indirect, and Cumulative Effects of the Action Alternative

The expected effects of the Action Alternative on plant Species of Concern are the same as for no action.

Noxious Weeds

Issues Addressed

- Timber harvesting and road building may introduce or spread noxious weeds in the project area.

Analysis Methods

The presence of noxious weeds in the project area was determined through field observation and evaluation of current grazing activities.

Affected Environment

The following species are included on the Montana Noxious Weed List (MDA 2013) and have been observed in the project area and Palisades Landscape: Canada thistle (*Cirsium arvense*), houndstongue (*Cynoglossum officinale*), leafy spurge (*Euphorbia esula*), meadow hawkweed (*Hieracium* spp.) and spotted knapweed (*Centaurea stoebe* or *maculosa*). Each of these species, with the exception of meadow hawkweed, are classified as priority 2B, meaning that they are abundant in Montana and widespread in many counties. Their distribution in the project area is limited to isolated, small patches, typically along existing roads or trails, or non-forest areas where grazing occurs. Meadow hawkweed is classified as a priority 2A species, meaning that it is a common weed in isolated areas of Montana.

In addition to the listed noxious weeds, the following regulated plants exist have been observed in the project area and Palisades Landscape: cheat grass (*Bromus tectorum*). Regulated plants have the potential for significant negative impacts to native flora, and may not be intentionally spread or sold other than as a contaminant in agricultural products (MDA 2013). Cheat grass has a limited distribution in the project area and typically occurs in isolated, small patches.

Carbon County has also identified species that are not listed on the Montana Noxious Weed List as County Weeds of Concern (CCWD 2013). Absinth wormwood (*Artemisia absinthium*) is a County Weed of Concern that has been observed in the project area and Palisades Landscape.

-Environmental Effects

--Direct, Indirect, and Cumulative Effects of the No-Action Alternative

In the project area, existing noxious weed populations would be expected to remain at or near current levels. Recreational use and grazing activity that currently occurs in the project area has the potential to introduce new species or aid in the spread of existing species in the project area. Lessees of State land for grazing activity are required to monitor and manage noxious weed populations on their leased parcels. Monitoring and management of existing populations would continue.

Proposed forest management activities associated with the GRLA project have the potential to facilitate the spread of and increase noxious weed populations on 1,304 acres of the Palisades Landscape.

--Direct, Indirect, and Cumulative Effects of the Action Alternative

Forest management activities associated with this project and GRLA project have the potential to facilitate the spread of existing species or introduce new species to the project area and Palisades Landscape due to soil disturbance and reduction of canopy cover associated with timber harvesting. Harvesting operations in the project area would affect approximately 789 acres, and proposed forest management activities in the Palisades Landscape could potentially affect 2,093 acres. Recreational use and grazing activity could also introduce new species or aid in the spread of existing noxious weeds in both the project area and Palisades Landscape.

In the project area, the following measures would be taken to minimize the potential spread and introduction of noxious weeds:

1. Required washing of equipment before entering the site
2. Limiting the extent and magnitude of soil disturbance within harvested areas
3. Sowing grass seed on roads after harvesting has been completed
4. Spot application of herbicide along roadsides and other identified areas with noxious weeds prior to and after harvesting operations.

The combination of project-level measures to prevent noxious weed spread or introduction and ongoing monitoring and management by grazing lessees would be expected to maintain or minimally increase noxious weed populations compared to current levels.

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Water Resources and Fisheries

Water Resources-Introduction

This section describes the existing conditions as well as the anticipated effects of the No-Action and Action Alternates on water resources within the proposed project area.

Issues and Assessment Criteria

The following bulleted issues statements listed below summarize both the internal and public concerns that will be analyzed in the Water Resources section.

- Timber harvesting and related road activities may impact surface water-quality through increased erosion and sediment delivery to streams.
  Assessment criteria: inventory and evaluation of existing sediment sources, evaluation and risk assessment of proposed harvest areas, evaluation and risk assessment of proposed road activities, and evaluation of site-specific mitigation measures and BMP designs.
- Timber harvest and associated road activities may affect the timing, distribution and amount of water yield in the affected watersheds. There is concern that increases in water yield resulting from the proposed timber harvest could increase the risk of flooding and may impact stream channel stability.
  Assessment criteria: existing harvest acres, cumulative proposed harvest acres, equivalent clearcut area (ECA), stream reach (and irrigation ditch) inventory and channel stability evaluations
- There is concern that the proposed timber harvest and associated road activities may impact wetlands.
  Assessment criteria: field reconnaissance and mapping of wetlands, evaluation and risk assessment of proposed harvest activities, evaluation and assessment of site-specific mitigations measures and design of wetland management zone (WMZ) buffers.

Analysis Area

The Palisades Timber Sale Project Area consist of approximately 4,755 acres of state owned land located in an area commonly referred to as the Beartooth Face just south of Luther, Montana. The proposed project area is located within the watershed areas of the Burnt Fork of the East Fork of West Red Lodge Creek, Hogan Creek, Thiel Creek, and Harney Creek. All of these streams are located in the Clarks Fork of the Yellowstone River Basin. Four watershed analysis areas were identified to evaluate the potential direct, indirect and cumulative effects of implementing either the No-action or Action Alternatives on water resources (see Figure W–1. Watershed Analysis Areas).

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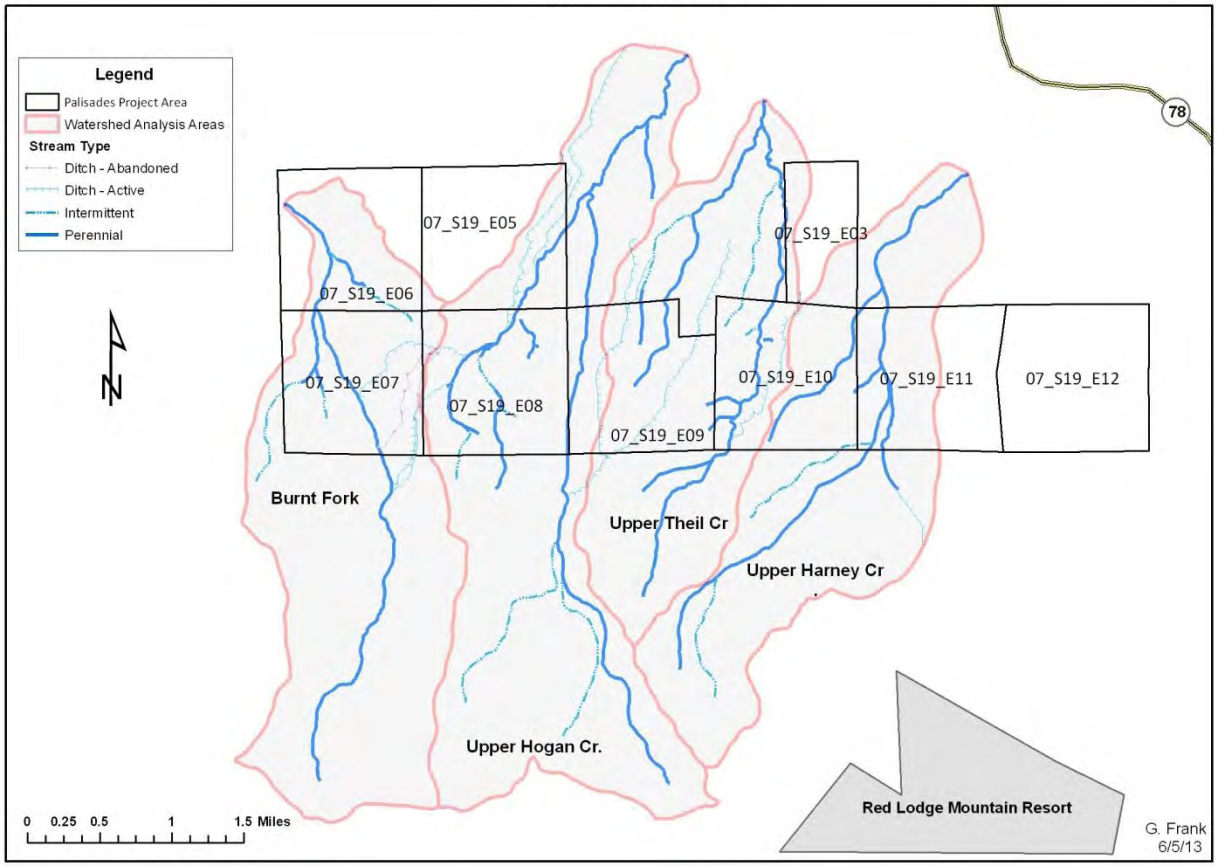
Figure W-1. Watershed Analysis Area
Palisades Timber Sale



These analysis areas include: 1) The entire drainage area for the Burnt Fork of the East Fork of West Red Lodge Creek; 2) The upper reaches of Hogan Creek; 3) The upper reaches of Thiel Creek; and 4) The upper reaches of Harney Creek. The proposed project area is located in the lower elevations of these watershed analysis areas. Elevations within these watersheds range from approximately 5,300 feet to 9,300 feet. Elevations within the project area ranged from approximately 5,500 feet to 6,400 feet. Average annual precipitation within the project area is approximately 25 inches. See Soil and Geology section for more information on precipitation within the project area.

The scale chosen for the watershed analysis areas was selected by considering the extent of proposed actions in each watershed, the existing conditions and the beneficial uses of each watershed, and the predominate land use surrounding the proposed project area. The choice of scale balances the need to accurately communicate watershed conditions and the inherent problems with measuring effects of large scale analysis. In large scale analysis, potential effects may not be measurable or may be masked by impacts resulting from agricultural practices and residential development that are outside of the scope of the analysis. The upper segments of Hogan, Thiel and Harney Creek were selected because those portions of each watershed are predominately forested and land-use downstream of the analysis area is primarily agricultural

(grazing and irrigated pasture) and residential development. These watershed analysis areas were selected because they are the scale that is appropriate for completing the most accurate prediction of effects and that measurable responses to the proposed actions could be completed.

Analysis Methods

Methods for assessing existing and potential impacts to water resources relied on information from numerous data sources and extensive field evaluations. These sources included internal DNRC data and reports, water rights data, published scientific literature, and information from the USFS. Evaluating direct, indirect and cumulative effects included field reviews of sediment sources from existing roads, stream crossings and motorized trails, historic timber harvest, current and historic grazing practices and irrigation water management, and natural sources. A risk assessment of the potential erosion and sediment delivery from proposed road locations and stream crossing sites were also completed during field reviews. The potential for erosion and sediment delivery from proposed harvest areas were also evaluated using a risk assessment of potential upland soil disturbance, erosion and delivery to drainage features. This risk assessment used information provided in Chapter 3 – Geology and soils and the results from soil monitoring on past DNRC timber sales (DNRC 2011a). Both of these assessments were based on professional training, judgment and extensive experience in synthesizing information and observations made in the field to forecast the potential impacts of forest management activities.

Assessments of impacts from livestock grazing were limited to observations made on State trust parcels occurring within the project area. Assessments were not made on private land due to the lack of legal access. Assessments were not made on USFS ownership instead this analysis relied on the assessments completed by the USFS and information contained in a working draft of an EA being completed for the USFS grazing allotments located within the project areas (USFS 2013).

The potential for detrimental increases in water yields were estimated using the Equivalent Clearcut Area (ECA) method as outlined in Forest Hydrology, Part II (Haupt et al, 1976). Stream channel forms and function are described using geomorphic characterizations adopted form Rosgen stream types (Rosgen 1996). Channel stability was assessed utilizing principle and concepts contained in the USFS channel inventory procedures (Pfankuch 1975).

Relevant Agreements, Laws, Plans, Permits, Licenses, and Other Authorizations

The following agreements, laws, plans, permits, etc. are in addition to those mentioned at the beginning of the chapter under "Relevant Agreements, Laws, Plans, Permits, Licenses, and Other Authorizations".

Water Quality Standards

This portion of the Yellowstone River Basin, including East Fork Red Lodge Creek, Hogan Creek, Thiel Creek and Harney Creek, is classified as B-1 by the DEQ, as stated in *ARM 17.30.609*. The water-quality standards for protecting beneficial uses in B-1 classified

watersheds are located in *ARM 17.30.623*. Water in B-1 classified waterways is suitable for drinking, culinary and food processing purposes after conventional treatment, bathing, swimming and recreation, growth and propagation of salmonid fishes and associated aquatic life, waterfowl and furbearers, and agricultural and industrial water supply. State water-quality regulations limit any increase in sediment above the naturally occurring concentration in water classified B-1. Naturally occurring means condition or materials present from runoff or percolation over which man has no control or from developed land where all reasonable land, soil, and water conservation practices have been applied (*ARM 17.30.602 [17])*. Reasonable land, soil, and water conservation practices include "methods, measures or practices that protect present and reasonably anticipated beneficial uses" (*ARM 17.30.602 [21])*. The State of Montana has adopted BMPs through its non-point source management plan as the principle means of meeting the *Water Quality Standards.*

Water Rights and Beneficial Uses

Numerous surface water rights exist within and downstream of the project area for domestic use, irrigation, livestock watering, lawn and garden, and fish and wildlife. There are also numerous active and inactive irrigation ditches that divert and/or deliver surface flows from or to most of the larger main stem streams within the proposed project area.

Water Quality Limited Water Bodies

None of the streams located within the proposed project water resource analysis areas are listed as water quality limited water bodies in the State of Montana 2012 303(d) list (DEQ 2013). However, the main stem of West Red Lodge Creek downstream of the confluence of the Burnt Fork with the East Fork West Red Lodge Creek has been included on the 2012 303(d) list. This segment of West Red Lodge Creek is the receiving water for that portion of the analysis area contained in the Burnt Fork of the East Fork of West Red Lodge Creek watershed. The 303(d) list is compiled by DEQ as required by Section 303(d) of the Federal Clean Water Act and the Environmental Protection Agency (EPA) Water Quality Planning and Management Regulations (40 CFR, Part 130). Under these laws, DEQ is required to identify water bodies that do not fully meet water-quality standards, or where beneficial uses are threatened or impaired. Under these laws, DEQ is required to identify water bodies that do not fully meet water quality standards, or where beneficial uses are threatened or impaired. These water bodies are then characterized as "water quality limited" and thus targeted for Total Maximum Daily Load (TMDL) development. The TMDL process is used to determine the total allowable amount of pollutants in a water body or watershed. Each contributing source is allocated a portion of the allowable limit. These allocations are designed to achieve water quality standards.

The Montana Water Quality Act (MCA 75-5-701-705) also directs the DEQ to assess the quality of state waters, insure that sufficient and credible data exists to support a 303(d) listing and to develop TMDL for those waters identified as threatened or impaired. Under the Montana TMDL Law, new or expanded nonpoint source activities affecting a listed water body may commence and continue provided they are conducted in accordance with all reasonable land, soil and water conservation practices.

West Red Lodge Creek was included in the 2012 303(d) list because the aquatic life beneficial uses are only partially supported. The probable causes for impairment have been identified by DEQ as sedimentation/siltation. The probably sources of impairment are listed as natural and unknown sources. DEQ has determined that a Total Maximum Daily Load (TMDL) is required for this segment of West Red Lodge Creek but it has not yet scheduled the development of the TMDL. DNRC will comply with the Law and interim guidance developed by DEQ through implementation of all reasonable soil and water conservation practices, including Best Management Practices and Forest Management Rules (ARM 36.11.401 through 36.11.450).

Streamside Management Zone Law

By the definition in *ARM 36.11.312* (*3*), most of the major streams in the project area such as Burnt Fork, Hogan Creek, Thiel Creek, Harney Creek, are considered to be Class 1 streams. All of these streams and many of their tributaries support fish, or have flow for more than 6 months each year and contribute surface flow to another stream or other body of water. Some of the smaller first-order tributaries may be classified as Class 2 or 3 based on site-specific conditions. A Class 3 stream is defined as a stream that does not support fish; normally has surface flow during less than 6 months of the year; and rarely contributes surface flow to another stream, lake or other body of water (*ARM 36.11.312* (*5*)). According to ARM 36.11.312 (4), a Class 2 stream is a portion of a stream that is not a Class 1 or class 3 stream segment.

Stream Preservation Act Permit

Montana Department of Fish, Wildlife, and Parks (FWP) has jurisdiction over the management of fisheries and wildlife in the project area. A Stream Preservation Act Permit (124 Permit) is required for activities that may affect the natural shape and form of any stream or its banks or tributaries.

Short-Term Exemption from Montana's Water Quality Standards

Montana Department of Environmental Quality (DEQ) has jurisdiction over water quality standards within the project area. A Short-Term Exemption from Montana's Water Quality Standards (318 Authorization) may be required if temporary activities would introduce sediment above natural levels into streams or if FWP deems a permit is necessary after reviewing the mitigation measures in the 124 Permit.

Affected Watersheds – Existing Conditions

Burnt Fork

The Burnt Fork watershed analysis area includes the entire 2,983 acre watershed area drained by the Burnt Fork of the East Fork of West Red Lodge Creek. The analysis area contains the main stem Burnt Fork as well as several unnamed perennial and intermittent tributaries to the Burnt Fork. All of these streams have contiguous channels that are connected to main stem Burnt Fork. Approximately 2,443 acres or 82% of the watershed is forested (both conifer and deciduous tree species) and approximately 540 acres or 18% of the watershed area is non-forested. The non-forested area primarily consists of rangeland, grass parks, rangeland and open hillsides. This analysis area is entirely under DNRC and USFS ownership.

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The proposed harvest area, and existing and new road stream crossing locations include segments of perennial Class 1 stream, and both intermittent and perennial segments of Class 2 stream. A majority of the main stem Burnt Fork stream channel is classified as B3 and B4 channel types (Rosgen 1996). Smaller tributaries contain both B3/B4 and E3/E4 channel types. A majority of the reaches of stream channel are considered relatively stable with functional riparian areas consisting of primarily coniferous forest cover and hardwood shrubs. Historic channel migration is evident in the NW ¼ of Section 7 where the main stem has radically changed it course over time as it down cut through a broad alluvial fan. While long-term channel migration is likely, the current occupied channel is considered relatively stable (Pfankuch 1975).

Flow regimes within the Burnt Fork watershed are typical of snow dominated systems with a majority of runoff and peak flows following snowmelt in April through May. Stream flows from the Burnt Fork are substantially diverted into 2 active irrigation ditches at two different locations within this watershed analysis area. Both of these ditches re-route water from the Burnt Fork to the West Fork of Hogan Creek. One of these diversions is located on State ownership within the proposed project area. The other diversions is located upstream of the project area on USFS ownership. There are also several inactive and/or abandoned ditches that historically diverted water from the Burnt Fork to the West Fork of Hogan Creek. Despite these irrigation withdrawals, the Burnt Fork remains perennial throughout the project area with continuously flowing and connected channel to its confluence with the East Fork of West Red Lodge Creek.

There are also numerous "adjacent wetlands" within the proposed project area that are associated with streamside management zones. These are primarily located along several segments of the Burnt Fork and its tributaries in Section 7. There are also several "isolated wetlands" that are not associated with SMZs located in that portion of the proposed project area that lies within this watershed analysis area. The largest of these isolated wetlands is a 9 acres hardwood shrub/sedge meadow and forested spruce/subalpine fir wetland complex located in the NE ¼ of section 7, T7S,R19E and the SE ¼ of section 6 , T7S, R19E (see Figure W-2 for a map of wetlands occurring in the project area).

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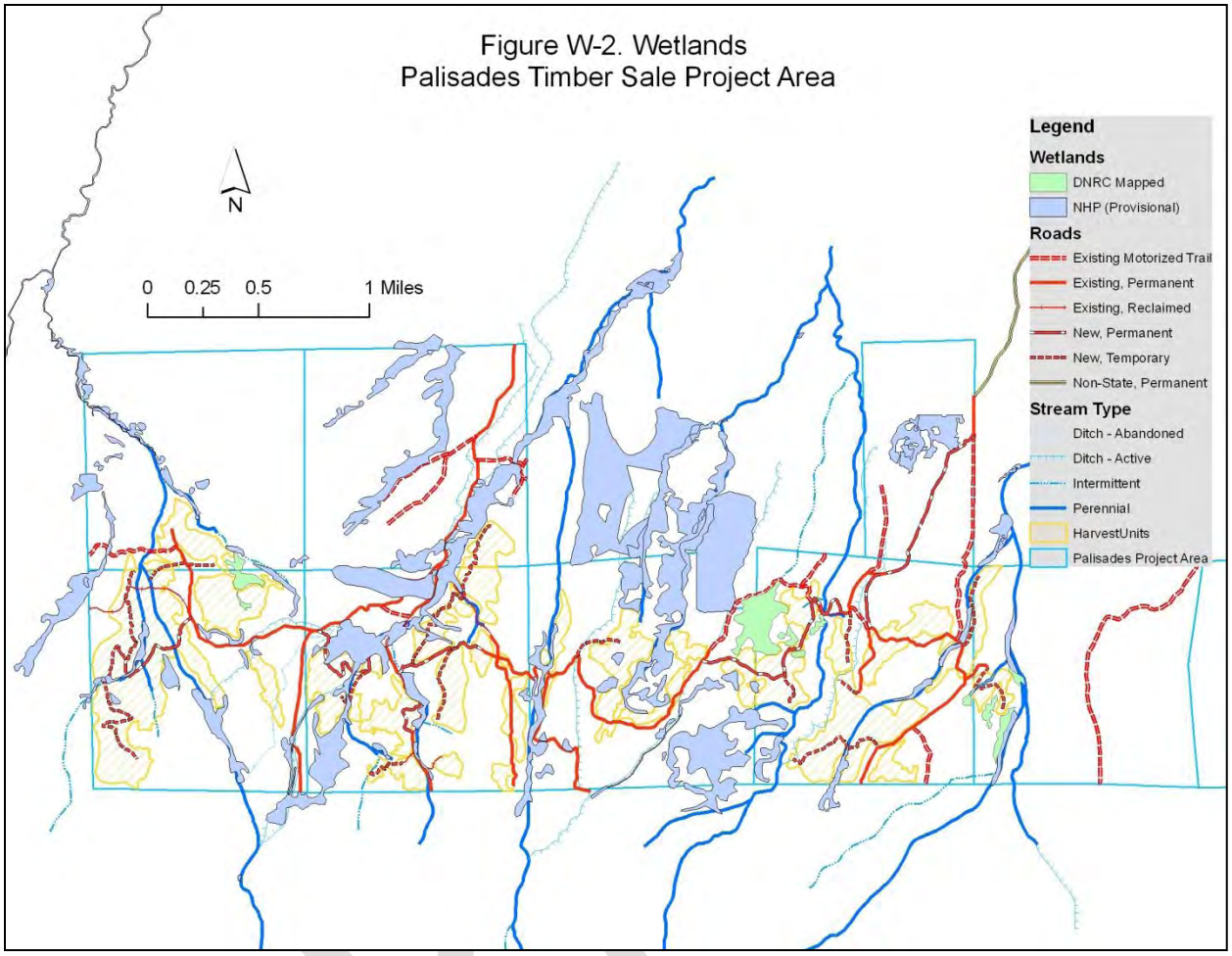

There are approximately 2.66 miles of existing road and motorized trail within the Burnt Fork analysis area. The existing road density is considered relatively low at 0.57 miles of road or motorized trail per square mile or watershed area. All of the existing roads and motorized trails within this analysis area are low standard and several of these segments do not currently meet minimum BMPs. Most of the existing travel routes consist of non-excavated and partially vegetated travel ways that are located on gentle terrain that is well buffered from streams. However, the existing motorized trail system does include three ford crossings of the Burnt Fork and several ford crossings of active irrigation ditches that have return flows to streams. The unimproved stream fords are causing localized channel instability and low levels of chronic sediment delivery to these streams. However, the volume and frequency of the use of these fords limits the impacts to localized, short duration and low levels.

Existing timber harvests within the Burnt Fork watershed are limited to low levels of historic selective harvest. Those areas harvested appear to be fully stocked and regenerated. Extensive tree encroachment into areas historical supporting range and grassland vegetation is also evident.

Approximately 615 acres of State Section 6, T7S, R19E including the 346 acres lying within the Burnt Fork watershed analysis area, are currently under lease for livestock grazing of 137 AUMs. Even though the entire parcel is classified as suitable for grazing, most of the grazing occurs in the lowlands below the steep SW exposures of Sheep Mountain. The most recent field evaluation completed for renewal of this lease noted that the riparian area in this section were in good conditions and overall forage utilization was slight or 0-20%. The remainder of the State ownership in the Burnt Fork watershed is included in the DNRC-USFS cooperatively managed Hogan Creek On/Off Grazing Allotment. The grazing management of this allotment is discussed in more detail later in this section. Approximately 170 acres of USFS land located within this watershed analysis area in Section 12 & 13 T7S, R18E is included in the USFS Burnt Fork Grazing Allotment. However, only about 1 acres of that portion of the USFS allotment lying within the Burnt Fork Watershed Analysis Area is considered suitable for grazing (USFS 2013).

Impacts to streams channel stability and water quality due to livestock grazing within that portion of the proposed project area located within the Burnt Fork watershed are considered relatively minor. Impacts are limited to localized areas of stream bank trampling where the streamside riparian areas are dominated by sedge communities with fine-textured soils that are more susceptible to impact and where the stream channel is also readily accessible to livestock. Most of the streamside riparian areas within this watershed are dominated by dense conifer forest and hardwood shrubs. Channel types are primarily B3 (Rosgen 1996) with cobble dominated stream banks and substrate that relatively resistant to hoof shear and trampling. Overall, the amount of stream channel impacted by livestock on State trust lands within this watershed analysis area is considered relatively minor.

There is low risk of existing cumulative watershed impacts due to increases in water yield. Existing levels of timber harvest appear to be limited to low levels of historic selective harvest. Those areas harvested are fully stocked and regenerated. No appreciable level of stand replacement wildfire has occurred within the watershed in the recent past. Forest encroachment into area historical supporting range and grassland vegetation is also evident. A substantial portion of the stream flow from the Burnt Fork, including peak flows is diverted into the Breck-Harrison Ditch. There is no head gate controlling the season or rate of flow at this diversion.

There is also low risk of existing cumulative watershed impacts due to increases in sediment yield in this watershed analysis area. This is due to the low density of existing roads, lack of riparian or stream bank disturbance, and the fact that identified sources of sediment are limited to localized stream channel instability and sediment delivery occurring at low volume and frequency of use ford crossing sites.

Cumulative impact to water quality and quantity, and beneficial uses both within and downstream of the proposed project area within this watershed are likely limited to those

impacts associated with chronic de-watering of streams due to irrigation diversions (see fisheries analysis for more information regarding these impacts).

Upper Hogan Creek

This 3,613 acres watershed analysis area contains the main stem of the Hogan Creek and an unnamed perennial tributary to Hogan Creek commonly referred to as the West Fork of Hogan Creek. Hogan Creek is a tributary to West Red Lodge Creek. Approximately 692 acres or 19% of the watershed area is under private ownership. The remainder of the watershed is under DNRC or USFS ownership. Approximately 2,801 acres or 78% of the watershed area is forested (both conifer and deciduous tree species) and approximately 812 acres or 22% is non-forested. The non-forested area includes approximately 300 acres of irrigated pasture and hayfields located on private land in the lower portion of the watershed. The remaining 512 acres of non-forested area consists of grass parks and hillsides, and sagebrush rangeland.

Both the main stem and the West Fork of Hogan Creek are perennial Class 1 streams channels and both streams contain several unnamed intermittent and perennial Class 2 tributaries. Some of these Class 2 stream segments have intermittent flow with direct channel connectivity to the receiving stream, while others have perennial flow regimes but are discontinuous with no direct channel delivery to downstream Class 1 stream channels. Most reaches of the main stem of Hogan Creek are classified as B2 and B3 stream types (Rosgen 1996). These reaches are relatively stable with functional riparian areas. Reaches of the West Fork of Hogan Creek are predominately B3 and B4 stream types. Flow regimes within the Upper Hogan Creek watershed are typical of snow dominated systems with a majority of runoff and peak flows following snowmelt in April through May.

While, the upper reaches of the West Fork have relatively stable channels, the lower reaches of the stream are largely unstable due to flow augmentation from irrigation ditches which divert water from the Burnt Fork. Both the Breck-Harrison Ditch and the Wiest Ditch are actively routing flows from the Burnt Fork directly into the West Fork. There are also several inactive ditches that historically routed water from the Burnt Fork into the West For, but they both appear to be abandoned at this time. The active Breck-Harrison Ditch and the inactive Hogan-Hogan Ditch share a common diversion point located just upstream of the project area on USFS land in section 18, T7S R19E. The diversions for the active Wiest Ditch and the other inactive ditch are both located on State land within the proposed project area in section 7, T7S, R19E . The increased water yield and sediment yield from these ditches has caused substantial levels of stream channel instability.

The West Fork of Hogan Creek is subsequently dewatered from withdrawals of several irrigation ditch diversions located 0.75 miles and 0.90 miles downstream in the NW1/4 NE1/4 of section 8, T7S, R19E and the NE1/4 SE1/4 of section 5, T7S, R19E. The lower segment of the West Fork below these diversions was observed to be dry during field evaluations conducted in October 2011 and October 2012.

The main stem Hogan Creek has perennial flow throughout the proposed project area although base flow appears to be very low. Stream flows in Hogan Creek are occasionally diverted into an irrigation ditch used to flood irrigate pastures located downstream of the proposed project area on private land in the east ½ of section 4, T7S, R19E and the west ½ of section 3, T T7S ,R19E. The diversion is located upstream of the project area USFS ownership in section 17, 7S, R19E. Flow regimes in the main stem of Hogan Creek on private land downstream of the proposed project area are not known. This segment of stream channel was not accessible for field evaluation. Based on -aerial photos there are numerous irrigation ditch diversions. Therefore, it is likely that the lower main stem Hogan Creek is also chronically de-watered to the same extent that was observed and described earlier for the lower segments of the West Fork Hogan Creek.

There are numerous "adjacent wetlands" that are associated with streamside management zones located along the upper headwaters of the West Fork Hogan Creek. There are also several small "isolated wetlands" that are not associated with SMZs that are located within the proposed project area in the SW ¼ of section 8, T7S R19E (see Figure W-2 for a map of wetlands occurring in the proposed project area).

The largest identified sources of existing impact to water quality in this watershed analysis area is the increased water yield, chronic sediment delivery and channel instability associated with the routing of irrigation ditch flows down steep valley side slopes and subsequent direct discharge into the West Fork of Hogan Creek. This practice has lead to the creation of large, steep erosive gullies which historically delivered massive volumes of sediment to the West Fork during the initial gully formation and down cutting process. An estimated 28,640 cubic yards of material has been eroded from this gully system and delivered into the West Fork of Hogan Creek. While the head cutting of the irrigation ditch gully features has slowed over time the amount of chronic sediment delivery occurring due to the unstable gully side slopes is still considerable when compared to natural background levels. The combination of this sediment load and the increased flows from the direct discharge of the irrigation ditches into the West Fork has caused and contributed dramatically to the increased levels of channel instability observed directly downstream.

There are approximately 6.6 miles of existing road and motorized trail within Upper Hogan Creek watershed. Existing road density is approximately 1 .18 miles of road per square mile of watershed. Most of the existing roads and motorized trails within this analysis area are low standard and do not currently meet BMPs. Several segments of existing road are contributing direct sediment delivery to streams. For example, one segment of road, commonly referred to as the Pine Ridge road, is located immediately adjacent to Class 2 and Class 3 segments of an unnamed tributary to the West Fork of Hogan Creek. There is inadequate buffer between the

road prism and the stream channel to effectively filter sediment delivery. This road also contains sustained steep segments that are severely eroding resulting in direct sediment delivery to an existing stream crossing of the West Fork of Hogan.

The existing road system on State trust lands within the Hogan Creek watershed analysis area contains 8 stream crossings. These include three existing stream crossing of the West Fork of Hogan Creek, two crossings of an unnamed perennial but discontinuous tributary to the West Fork Hogan Creek, two crossings of an intermittent Class 2 tributary to the West Fork, and one crossing of the main stem Hogan Creek. None of the existing stream crossings sites meet BMPs and several of them are chronic sources of low levels of sediment delivery or impacting channel stability. Several crossing sites have already failed or are at high risk for catastrophic or eventual failure.

For example, one stream crossing site located on the West Fork of Hogan Creek constructed with a 24" salvaged round steel pipe and a 30' diameter corrugated metal pipe (CMP) was completely washed out during the 2011 spring runoff (see adjacent photo). The failed structures are currently impeding flows and impacting downstream channel stability. The north approach to the crossing site has a sustained steep grade with inadequate surface drainage which is concentrating road surface runoff and causing direct sediment delivery to the crossing site. The impromptu ford utilized at the failed crossing site is over steepened and unstable.

Another crossing site that is also located on the West Fork of Hogan Creek is at high risk for imminent failure. The crossing was constructed with 2- 24" diameter CMPs installed side by side. The culverts appear to be under capacity to accommodate peak flows and has recently been overtopped which partially washed out the road fill and most of the bedding material surrounding the culverts. In addition, over 1000 feet of unrelieved road surface drainage is routed to the stream crossing site resulting in chronic low to moderate levels of direct delivery of sediment to the stream.

Approximately 642 acres of State land in section 5, T7S, R19E, including 241acres located in the Upper Hogan Creek Watershed Analysis area, are under lease for the grazing of 138 AUMs. A two pasture rest-rotation system was implemented on this tract in the recent past. The pasture were created by constructing a cross fence between the Barlow Creek portion and Hogan Creek portion of the section. A grazing lease renewal field evaluation was completed by DNRC in the fall of 2010. During that evaluation it was noted that conditions in riparian areas were good and that the tract has been showing an improving trend since the 2 pasture system had been implemented. The remainder of the State ownership in the Upper Hogan Creek watershed is

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included in the DNRC-USFS cooperatively managed Hogan Creek On/Off Grazing Allotment. The grazing management of this allotment is discussed in more detail later in this section. Impacts to stream banks and channels due to livestock trampling are limited to localized areas that are accessible to livestock and where the stream channel flow through more susceptible fine textured soils and substrate. Overall, the amount of stream channel impacted by livestock on State trust lands within this watershed analysis area is considered relatively minor.

Cumulative watershed impacts due to increases in water yield, chronic de-watering of streams, and increased levels of sediment delivery are occurring in this watershed analysis area. The increased water yield and chronic de-watering of streams are both entirely attributable to irrigation ditches and the management of irrigation flows. A substantial portion of the discharge of Upper Burnt Fork is diverted into a series of ditches and routed to the West Fork of Hogan Creek. Chronic de-watering of the West Fork and the main stem Hogan Creek is evident in the lower watershed due to several irrigation diversions and withdrawals. The long-term disruption of natural flow regimes has caused cumulative impacts to water quality; channel stability and aquatic/cold-water fisheries habitat (see the Fisheries section for a discussion and assessment of the cumulative impacts of stream de-watering in this watershed analysis area).

Approximately 66 acres of regeneration harvest were conducted on state ownership within the analysis area during 1995 and 1996. The existing harvest areas are regenerating and are well stocked sapling age class trees. No appreciable level of stand replacement wildfire has occurred within the watershed in the recent past. The existing harvest area only represents about 1.8% of the total watershed area. This level of timber harvest is well below those levels of harvest normally associated with detectable increases in water yield. Numerous studies have examined the impacts of timber harvest on water yield (Hibbert 1966, Bosch and Hewlett 1982, and Stednick 1996). These findings generally agree that increased water yield is only detectable after 20% to 30% of a watershed has been harvested (Hubbart 2007). Therefore, there is currently a very low risk that detrimental changes in water yield are occurring in this watershed analysis area due to recent or historic timber harvest or wildfires.

The routing of irrigation flows down steep slopes has resulted in massive amounts of historic and chronic sediment delivery to the West Fork. While other road and stream crossing sources of sediment delivery have been identified, their relatively minor contribution is largely masked by the large scale chronic erosion and sediment delivery occurring on the irrigation ditches where they flow through unstable gully features. The increased flows and sedimentation in the West Fork caused by the irrigation ditches flow augmentation is also contributing to downstream channel instability.

Increased water yield, increased sediment yield, increased channel insatiability and stream de-watering are contributing to detrimental cumulative impact to water quality and quantity in this watershed analysis area. These impacts are historic and chronic within and downstream of the proposed project areas. Cumulative impact to water quality and quantity, and beneficial uses both within and downstream of the proposed project area within this watershed are likely

limited to those associated impacts associated with chronic de-watering of streams due to irrigation diversions (see fisheries analysis for more information regarding these impacts).

Upper Thiel Creek

This 2,258 acre watershed analysis area includes the drainage area for the upper main stem of Thiel Creek as well the entire drainage area of Ellis Creek. Approximately 1,451 acres or 64% of the watershed area is forested (both conifer and deciduous tree species) and approximately 807 or acres or 36% is non-forested. The non-forested area includes approximately 385 acres of irrigated pasture and hayfields located primarily on private land and to lesser extent State ownership in the lower portion of the watershed. The remaining 422 acres of non-forested area consists of grass parks, and hillsides and sagebrush rangeland. Approximately 1,550 acres or 69% of the watershed area is under DNRC and USFS ownership. The remaining 708 acres is under private ownership.

Thiel Creek is a Class 1 perennial tributary to East Red Lodge Creek and Ellis Creek is a 2nd order, Class 1 perennial tributary to Thiel Creek. The analysis area also includes several unnamed Class I perennial and Class 2 intermittent tributaries to Thiel Creek and Ellis Creek. A majority of the main stem of Thiel Creek flowing through the proposed project area is classified as a B3 stream type. Ellis Creek and an unnamed tributary contain both B3/B4 and E3/E4 stream types (Rosgen 1996). Flow regimes within the Upper Thiel Creek watershed are typical of snow dominated systems with a majority of runoff and peak flows following snowmelt in April through May.

Within the proposed project area stream flows from Thiel Creek are diverted into an irrigation ditch used to flood irrigate pastures located on State land in the east ½ of section 3, T7S, R19E and private lands located within the lower portions of the watershed. Withdrawals at the diversion are controlled by 12" cement tile head-gate. Despite this irrigation diversion the main stem of Thiel Creek remains perennial as it flows through the project area.

There are numerous "adjacent wetlands" that are associated with the streamside management zone for large segments of the main stem of Thiel Creek on State land in section 10, T7S, R19E and USFS ownership in section 16, T7S, R19E. There are several large wetland complexes (sedge meadow/alder shrub and sedge/aspen) located on State land within this watershed analysis area that are drained by 2 perennial class 1 tributaries and one Class 2 perennial tributary to Thiel Creek. These large wetland complexes are located on the west Side of Thiel Creek in the west ½ of section 10, T7S, R19E and the east ½ of Section 9, T7S, R19E. A smaller sedge wetland drained by an unnamed perennial but discontinuous Class 2 stream is located on State land on the east side of Thiel Creek within section 10, T7S, R19E. There are also several "isolated wetlands" that are not associated with SMZs that are located on State land on the west side of Thiel Creek in Section 10, T7S, R19E (see Figure W-2 for a map of wetlands occurring in the project area).

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There are approximately 2.91 miles of existing road and motorized trail within the Thiel Creek analysis area. Existing road density is approximately 0.83 mi/mi^2. These roads include 2 culvert crossing of Thiel Creek, 1 culvert crossing of an unnamed intermittent tributary, 1 ford crossing of an intermittent tributary, and 2 ford crossings of active irrigation ditches located within this watershed analysis area. The existing roads are all low standard and several road segments do not currently meet BMPs. Two of these road segments have been identified as contributing or at high risk of contributing direct sediment delivery to Thiel Creek. These include both road approaches to the culvert crossing of Thiel Creek which have steep sustained grades that lack adequate surface drainage resulting in road surface runoff being routed directly to the stream crossing site. Low levels of direct sediment delivery have occurred at this site in the recent past and low levels of chronic sediment delivery will continue into the foreseeable future unless this situation is corrected. In addition, approximately 450 feet of this road approaching the crossing from the east is located immediately adjacent to unnamed perennial stream that is tributary to Thiel Creek. This road segment is also sub-irrigated and constructed from soils with poor bearing capacity making it prone to severe rutting and erosion. There is there inadequate buffer between this segment of road and this stream making it high risk for sediment delivery. Sediment delivery is currently not occurring on this segment because the road surface and fill is completely vegetated with grass and sedge species. The other road related sediment sources identified is a segment of motorized trail used to access a utility/power line easement. This route also contains also contains steep approaches to the stream crossing of Thiel Creek. The culvert utilized at this crossing site was undersized and recently it was completely washed out. The failed structure is obstructing flows and causing localized channel instability.

The largest source of sediment delivery and impact to water quality and downstream beneficial uses within the Thiel Creek analysis area is a large slump-earth flow that occurred during the spring of 2012. This slump occurred on a moderately steep hillside located immediately adjacent to Thiel Creek on State land in Section 10. The slump delivered approximately 3,472 cubic yards of fine textured material and scores of whole mature trees directly into Thiel Creek and the adjoining floodplain. The slope failure does not appear to be related to past forest or road management activities. There are no roads, or timber harvest associated with the mass failure and the toe of the slope that failed was not undercut by the stream channel. An active irrigation ditch located just upslope of the top of the failure may have been a contributing factor. Subsurface seepage from the ditch may have caused or likely contributed to the failure (see Geology and Soils portion of this document for more information regarding slope stability). To date, only a small fraction of the material deposited in the stream and floodplain has been carried downstream. The slump deposits buried the stream channel and adjoining floodplain in approximately 3-5 feet of debris. The stream has since down cut a relatively straight channel with unstable and vertical banks down through the deposited

material. The stream will eventually migrate laterally through the deposited material in order to re-establish it original grade and sinuosity (meandering pattern). Therefore, the large supply of unstable sediments and anticipated stream channel adjustments are expected to produce long-term high levels of sedimentation to Thiel Creek during peak flows and other runoff producing events. The massive sediment load and large supply of woody debris from trees carried into the stream channel also pose a high risk to the existing undersized culvert utilized at the existing stream crossing located approximately 1,500 feet downstream of the failure and deposition area.

The mass delivery of sediment to Thiel Creek has drastically impacted water quality, channel stability, channel form, aquatic habitat, and placed the stream crossing structure on the existing access road at high risk for failure. These high level impacts and risks to the existing infrastructure are not expected to be reduced to low or background levels for a period of time ranging from 5-15 years.

Timber harvests within this watershed analysis area are limited to low levels of historic harvest or incidental selective harvest or removal of post and pole material. Those areas historically harvested are fully stocked and regenerated. Forest encroachment into area historical supporting range and grassland vegetation is also evident.

The State ownership in this watershed analysis area is included in the DNRC-USFS cooperatively managed Hogan Creek On/Off Grazing Allotment. The grazing management of this allotment is discussed in detail later in this section. Impacts to stream banks and channels due to livestock trampling are limited to localized areas that are accessible to livestock and were the stream channel flow through more susceptible fine textured soils and substrate. Overall, the amount of stream channel impacted by livestock on State trust lands within this watershed analysis area is considered minor.

There is low risk of existing cumulative watershed impacts due to increases in water yield. Stream flows from Thiel Creek are frequently diverted for flood irrigation purposes. Historic timber harvests are not substantial and are fully regenerated. No appreciable level of stand replacement wildfire has occurred within the watershed in the recent past. Forest encroachment into area historical supporting range and grassland vegetation is also evident.

There are high levels of existing cumulative watershed impacts due to long-term increases in sediment yield occurring in this watershed analysis area. These impacts are almost entirely due to occurrence of a large slump and the massive amount of sediment delivery that were previously described. There is low likelihood that historic timber harvest, existing grazing managements or the existing road system are contributing substantially to the cumulative impacts of increased sediment yield. The large long-term increases in sediment delivery caused by the slump masks the low level localized impacts caused by the existing roads and grazing practices. All of the identified sources of sediment delivery from roads and grazing practices are limited to low levels at localized sites. Cumulative impact to water quality and beneficial

uses both within and downstream of the proposed project area within this watershed are likely limited to those impacts associated with the large slump.

Upper Harney Creek

This 2,518 acre watershed analysis area includes the upper main stem Harney Creek as well as several unnamed Class 1 perennial tributaries to the main stem. Harney Creek itself is a Class 1 perennial tributary to East Red Lodge Creek. Approximately 1,608 acres or 64% of the watershed area is forested (both conifer and deciduous tree species) and approximately 910 acres is non-forested. The non-forested area includes approximately 202 acres of irrigated pasture and hayfields located on private land in the lower portion of the watershed.

Stream flows in Harney Creek are augmented with flows diverted from Cole Creek. Never less, both the main stem Harney and its unnamed tributaries largely exhibit stable flow regimes originating from springs. The streams do not appear to be subject to "flashy" runoff or large changes in the stream flow more typical of small mountain streams and other streams within the project area. Streams within this analysis area are primarily B3/B4 and E3/E4 stream types (Rosgen 1996).

There are numerous wetlands that are associated with streamside management zones (adjacent wetlands) along most if not all of the streams segments mentioned above. Isolated wetlands that are not associated with SMZs are also located throughout that portion of the project area lying within this analysis area (see Figure W-2 for a map of wetlands occurring in the project area).

There are approximately 3.23 miles of existing road and motorized trail within the Upper Harney Creek watershed. The existing road densities within this analysis area are 0.82 mi/mi^2. All of the existing roads within this analysis area are low standard and some segments do not currently meet BMPs. Most of the existing road consists of non-excavated motorized trail that are located on gentle terrain that is well buffered from streams. There are two existing road stream crossing structures present within this watershed. One of the crossings is located immediately downstream of the project area on private land. This crossing of the main stem of Harney Creek is evident on aerial photos but was not accessible for field evaluation. The other existing stream crossing is on a road accessing a utility easement located on State trust land in Section 10, T7S, R19E. This crossing is located on an unnamed perennial Class 1 tributary to Harney Creek. The crossing does not meet BMPs and subsequent erosion is resulting in direct sediment delivery to the stream. The culvert utilized at this crossing site is too short which results in over steepening of the road fill over the culvert. The road approach from the east side of the stream crossing has a long sustained steep grade with inadequate surface drainage. This results in large concentrations of road surface runoff being routed directly to the over steepened fill at the stream crossing site. The unstable road fill is eroding directly into the stream at both ends of the culvert. The culvert is at high risk for failure because it is also poorly bedded and has inadequate capacity. Chronic low levels of sediment delivery can be expected to continue at this site unless the culvert is removed or replaced, and road surface drainage is improved.

Approximately 320 acres of State ownership in section3, T7S, R19E is under a grazing lease for 160 AUMs. Only about 68 of these 320 acres actually lie within the Upper Harney Creek Watershed Analysis area. There are no stream channels or notable wetlands in this portion of the analysis area. In addition, 640 acres of state section 11, T7S, R19E including 348 acres in the Upper Harney Creek watershed analysis area, are currently leased for grazing of 204 AUMs. A grazing inspection conducted in the fall of 2011 noted a concern with overuse in some riparian areas with high levels of forage utilization. The evaluation recommended a reduction of stocking levels. Impacts to stream banks and stream channel stability are evident in the lower portions of the watershed due to heavy livestock grazing of sedge dominated riparian areas. The remainder of the State ownership in the Upper Harney Creek watershed is included in the DNRC-USFS cooperatively managed Hogan Creek On/Off Grazing Allotment. The grazing management of this allotment is discussed in more detail below.

Approximately 54 acres of regeneration harvest have occurred on state and private ownership within the watershed analysis area in the recent past. No timber harvests have occurred on USFS ownership in the headwaters of the watershed in the recent past and no appreciable level of stand replacement wildfire has occurred within the watershed in the recent past. In addition, the existing harvest areas on State and private ownership are currently well stocked with regeneration. The level of existing timber harvest represents approximately 2.2% of the watershed area. These levels are well below those levels of timber harvest associated with detrimental increases water yield (Hubbert 2007). Therefore, it is highly unlikely that detrimental cumulative watershed effects are occurring in Harney Creek due to water yield increases resulting from timber harvest or wildfire.

Hogan Creek On/Off Grazing Allotment

Most of the proposed project area is grazed by a single leasee under a cooperative management plan between the DNRC and the USFS. Approximately 4,034 acres of DNRC and USFS are included in the Hogan Creek On/Off Grazing Allotment. Approximately 1,203 acres of this allotment are considered suitable for livestock grazing. This includes approximately 2,512 acres of State land of which 988 acres are suitable for livestock grazing, and 1,522 acres of USFS land of which 214 acres area suitable for livestock grazing. Most of the suitable rangeland in the allotment is located in scattered mountain meadows, riparian meadows located along streams and in grazable woodland.

Between 1964 and 2007 the allotment was managed under a continuous season-long (up to 122 days) grazing without divided pastures. Cow/calf pairs numbered between 220 and 400 head and actual use ranged from 409 to 1,610 AUMs. In 2008 separate pastures were created with the construction of new fences as part of a new deferred-rotation grazing system as directed by DNRC. In addition to rotating the use of pastures a shorter season of use (48-73 days) and a reduced number of AUMs were implemented under this change in grazing management. Between 2008 and 2010 actual use averaged about 677 AUMs.

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The allotment is currently made up of three separate pastures. The Burnt Flat Pasture includes all of State section 7, T7S R19E and most of State section 8, T7S, R19E, as well as USFS land in the North ½ of section 18, T7S, R19E and the NW1/4 of section 17, T7S, R19E. The Triangle pasture includes most of State Section 9, T7S, R19E and USFS ownership in the NE1/4 of section 17, T7S, R19E and NW ¼ Section 16, T7S, R19E. The Fingers Pasture includes State ownership in E1/2E1/2 Section 9, T17S, R19E and all of Section 10, T7S, R19E and USFS ownership in the NE 14 section 16 and the N1/3 of section 15, T7S, R19E. These pastures are separated by fences on the north, east and west, and a natural barrier consisting of steep rugged densely forested land to the south.

The USFS recently completed an analysis of livestock capacity using an allowable forage use GIS model. The results of that analysis indicate the estimated carrying capacity for the allotment is 773 AUMs (105 AUMs on USFS and 668 AUMs on state. These estimates are 33% lower than what is permitted by the state lease. Future plans for the allotment include converting ½ of existing electric fence separating the Triangle pasture from the Fingers pasture to permanent barb wire fence.

Environmental Consequences

--Direct and Indirect Effects of No-Action Alternative

Under this alternative no timber harvesting or road construction activities would be implemented in any of the watershed analysis areas. No BMP improvements to existing roads, road relocation, reclamation of existing high risk roads segments, or replacement of failed or high risk stream crossing structures would occur.

Irrigation practices causing or contributing direct impact to water quality, channel stability and stream flow regimes would continue in the Upper Hogan Creek and Burnt Fork watershed analysis areas. Grazing practices would continue on individual state leases and on the cooperative DNRC/USFS grazing allotment throughout the project area. Localized sites would continue experience low to moderate levels of bank trampling and associated low level impacts of sediment delivery and channel instability.

Minor increases in water yield can be expected as continued mortality of lodgepole pine due to mountain pine beetle contributes to an overall loss of canopy cover through the proposed project area. This natural rate of water yield increase is not expected to destabilize stream channels or impact downstream beneficial uses

--Direct and Indirect Effects of the Action Alternative

Table W-1 below lists the timber harvest and associated road activities included in the proposed action alternative for each of the watershed analysis areas:

Table W-1. Proposed DNRC Activities by Watershed Analysis Area

Watershed Analysis Area	Proposed Timber Harvest	Proposed Permanent Road Construct	Proposed Temp Road Construction	Proposed Existing Road Reclamation	Net Permanent Road Increase
Burnt Fork	266 acres	0.67miles	1.57 miles	0.49 miles	0.18 miles
Upper Hogan	219 acres	1.32 miles	1.80 miles	1.00 miles	0.32 miles
Upper Thiel	170 acres	1.30 miles	0.96 miles	0.18 miles	1.12 miles
Upper Harney	134 acres	0.61 miles	0.90 miles	0 miles	0.61 miles
Totals	789 acres	3.90 miles	5.23 miles	1.67 miles	1.51 miles

Burnt Fork

Under the Action Alternative approximately 266 acres of timber would be harvested and 0.67 miles of permanent road and 1.57 miles of temporary road would be constructed within this watershed analysis area. The 0.67 miles of new permanent road is necessary in order to relocate 0.49 miles of existing road that is poorly suited and is not feasible to bring it up to BMPs standards in its current location. This segment of road contains sustained steep grades and two unimproved and unstable ford crossings of Class 1 streams supporting cold-water fisheries. The relocated road and fords crossings will be reclaimed as part of the proposed action. The road will be reclaimed by ripping, grass seeding and stabilizing the road surface with drainage features. Reclamation of the existing stream fords is expected to result in a long-term decrease in erosion and sediment delivery to the Burnt Fork.

The proposed new road construction would include three new permanent stream crossings and one temporary stream crossing. BMPs would be applied and maintained on all newly constructed road segments, stream crossings and existing roads not fully meting BMPS. The three new permanent stream crossing structures would be designed for a minimum 50-year flow event and the new crossing of the mainstream Burnt Fork would also be designed to accommodate fish passage. All three of the proposed crossing sites would have low grade approaches and would require minimal amounts of fill. Short-term low levels of increased sediment delivery can be expected during construction and up to 2 years following the installation of the stream crossing structures. Risk of sediment delivery would be low after this initial period of time following construction once the crossing site has stabilized and the road fills are re-vegetated.

After completion of the project the 1.57 miles of temporary road, including the temporary stream crossing would be reclaimed by ripping, slashing and seeding with grass. The temporary crossing structures would be designed for a 25-year flow event and would remain in-stream during only one spring runoff event. These crossing would be permanently removed upon project completion to eliminate any long-term risks of sedimentation or failure. Activities

associated with temporary culvert installation and removal are expected to result in some low level, short-term impacts to water quality due to increased sediment delivery to stream. Risk of increased sediment delivery would be low 1-2 years after reclamation activities once the road surface and crossing sites have been stabilized and re-vegetated.

There is low risk of impacts to water quality due to increased sediment delivery resulting from harvest operations. BMPs would be applied concurrently with all harvest and skidding operations to reduce the potential of water quality impacts (Rashin et al., 2006). Upland ground disturbance would be limited to 15 percent or less of a unit and no harvest would be conducted within the SMZs established adjacent to stream channels. Some minor amount of harvest (less than 1 acre) will occur within the SMZ established adjacent to the Wiest irrigation ditch. Harvest is planned adjacent to this ditch to remove dead, dying and at risk lodgepole pine that poses a maintenance hazard to ditch operations. The Wiest ditch is classified as another body of water under the SMZ Law because it has direct return flow to a stream. Ground based equipment operation would be prohibited within 50′ of the ditch.

SMZ will be extended to include all wetlands located immediately adjacent to streams and wetland management zones (WMZ) will be established around all isolated wetlands not associated with SMZs. No timber harvest or ground based equipment operation will be conducted within WMZs. There is low risk of impacts to wetlands due to the harvest buffers and equipment operation restrictions planned.

Considering all of activities described above, some short-term low level impacts to water quality are expected to result from road construction, road reclamation, and installation and removal of stream crossing structures. However, the risk of long-term adverse direct or indirect impacts to water quality or downstream beneficial uses is low. Long-term risks of sediment delivery are expected to be lower than existing conditions due to BMP upgrades to existing roads, and reclamation of high risk road segments and ford crossings.

The 266 acres of timber harvest planned represent approximately 8.9% of the watershed area. This level of harvest is well below those normally associated with detectable or measurable increases in water yield (Hubbart 2006). Therefore, no detrimental increases in water yield, including magnitude or duration of peak flows, or flood risks are anticipated. This amount of proposed forest canopy removal is likely within the natural range of variability considering historic insect and disease outbreaks and wildfire disturbances. A study of the historical vegetation of Montana estimated that the forest cover in this region of the state during 1900 consisted of approximately 33% in non-stocked and seed/sapling age stands (Losensky 1997). The proposed harvest would target lodgepole pine that is at high risk of mortality due to mountain pine beetle. Due to the observed rates of natural mortality in lodgepole pine stands, the potential for water yield increases under this alternative would likely be similar to the No-Action alternative within this watershed regardless of forest management activities. Therefore, there is low risk of even low level impacts to water yield, including increased duration, increased magnitude or timing of peak flows resulting from the Action Alternative.

Upper Hogan Creek

Under the Action Alternative, approximately 219 acres would be harvested and 1.32 miles of permanent road and 1.8 miles of temporary road would be constructed. The new permanent road is necessary to relocate three segments of existing road (totally approximately 1.0 miles) that are poorly suited and are not feasible to bring it up to BMPs standards in the current locations. The existing roads do not meet BMPs and are located immediately adjacent to segments of Class 2 and Class 3 stream channel. One of these road segments contains two failed stream crossing culverts. The washed out culverts are impacting channel stability and the improvised ford crossing at the site does not meet BMPs. Another existing road, the Pine Ridge Road, contains sustained steep grades with inadequate surface drainage resulting in direct delivery of sediment to the West Fork of Hogan Creek. This road also contains two culvert crossings of small intermittent tributaries and a large culvert crossing of the West Fork Hogan Creek that is at high risk for failure. All of these relocated segments of road would be reclaimed as part of the proposed action. The roads will be reclaimed by ripping, grass seeding and stabilizing the road surface with drainage features. The culverts utilized at the failed and failing crossing sites on the West Fork of Hogan Creek will be removed and the sites would be reclaimed and re-vegetated. Some short-term low level increases in sediment delivery can be expected during and shortly after reclamation activities and removal of stream crossing culverts. These increases are only expected to last for approximately 1-2 years then subside to low risks once the sites are stabilized and re-vegetated. Reclamation of this existing road segment and stream crossing is expected to result in a long-term decrease in erosion and sediment delivery risks to the West Fork of Hogan Creek Fork.

Approximately 350 feet of the relocated Pine Ridge Road would be constructed across a landform that is potentially prone to mass failure. However, construction mitigations such as fill slope stabilization, minimizing vegetation removal within clearing limits, and minimizing cut slope excavation will be employed to reduce the risk of slope instability (see Geology and Soils section for a more detailed discussion and assessment). The risk of actual failure is low to moderate. If a slope failure were to occur along this segment of road a series of springs located just down slope that feed a small perennial Class 2 tributary to West Hogan Creek could be moderately to highly impacted. This Class 2 stream does not have channel connectivity or direct surface delivery to the West Fork of Hogan Creek. Therefore, fisheries, livestock watering, irrigation and other downstream beneficial uses in West Fork Hogan Creek would not be at risk.

BMPs would be applied and maintained on all newly constructed road segments, stream crossings and existing roads not fully meting BMPS. The proposed new road construction would include two new permanent stream crossings and two temporary stream crossing. The permanent stream crossing are necessary to relocated the segments of road containing a stream crossing that has already failed and one that is in the process of failing. The new crossing locations are much better suited for meeting BMPs and providing for long-term stability. The new crossing sites are considered low risks with a greatly reduced risk when compared to the existing crossings they would replace. The new permanent stream crossing structures would be

designed to fully meet BMPS and with adequate capacity to accommodate at a minimum a 50-year flow event. Both of these crossing have been designed with low gradient approaches and would require minimal amounts of fill. Short-term low levels of increased sediment delivery can be expected during and shortly after the installation of the stream crossing structures. Risk of sediment delivery would be low 1-2 years after the initial construction once the crossing sites have stabilized and road fills are re-vegetated.

After completion of the project the 1.8 miles of temporary road, including the two temporary stream crossing would be reclaimed by ripping, slashing and seeding with grass. The temporary crossing structures would be designed for a 25-year flow event and would remain in-stream during only one spring runoff event. These crossings would be permanently removed upon project completion to eliminate any long-term risks of sedimentation or failure.

Activities associated with temporary culvert installation and removal are expected to result in some low level, short-term impacts to water quality due to increased sediment delivery to stream. Risk of increased sediment delivery would be low 1-2 years after reclamation activities once the road surface and crossing sites have been stabilized and re-vegetated.

There is low risk of impacts to water quality due to increased sediment delivery resulting from harvest operations. BMPs would be applied concurrently with all harvest and skidding operations to reduce the potential of water quality impacts (Rashin et al., 2006). Upland ground disturbance would be limited to 15 percent or less of a unit and no harvest would be conducted within the SMZs established adjacent to stream channels. An SMZ would also be established adjacent to Breck-Harrison Irrigation ditch. The ditch is classified as another body of water under the SMZ Law because it has direct return flow to a stream. No timber harvest or ground based equipment operations would occur within 50' of this ditch.

SMZ will be extended to include all wetlands located immediately adjacent to streams and wetland management zones (WMZ) will be established around all isolated wetlands not associated with SMZs. No timber harvest or ground based equipment operation will be conducted within WMZs. There is low risk of impacts to wetlands due to the harvest buffers and equipment operation restrictions planned.

Considering all of activities described above, some short-term low level impacts to water quality are expected to result for increased sediment delivery associated with new road construction, road reclamation, and installation and removal of stream crossing structures. However, the risk of long-term adverse direct or indirect impacts to water quality or downstream beneficial uses is low. Short-term risks of increased sediment delivery are expected to be negligible when compared to existing impacts and long-term risks associated with operation of irrigation ditches within this watershed analysis area. Long-term risks of sediment delivery are expected to decrease when compared to existing conditions due to BMP upgrades to existing roads, and relocation and reclamation of high risk road segments and high risk stream crossings.

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The 219 acres of timber harvest represent approximately 6.1% of the total watershed area. This level of harvest is well below those levels normally associated with detrimental increases in water yield (Hubbart 2007). This amount of proposed forest canopy removal is likely within the natural range of variability considering historic insect and disease outbreaks and wildfire disturbances. A study of the historical vegetation of Montana estimated that the forest cover in this region of the state during 1900 consisted of approximately 33% in non-stocked and seed/sapling age stands (Losensky 1997). The proposed harvest would target lodgepole pine that is at high risk of mortality due to mountain pine beetle. Due to the observed rates of natural mortality in lodgepole pine stands, the potential for water yield increases under this alternative would likely be similar to the No-Action alternative within this watershed regardless of forest management activities. Therefore, there is low risk of impacts from increased water yield, including increased magnitude, increased duration, or timing of peak flows, or increased flood risks, resulting from the Action Alternative.

Upper Thiel Creek

Under the Action Alternative, approximately 170 acres would be harvested and 1.30 miles of permanent road and 0.96 miles of temporary road would be constructed, and 0.18 miles of existing road reclaimed. The new permanent road is necessary to relocate 0.18 miles of existing road and 1.0 miles of motorized trail that are poorly suited for logging traffic and currently do not meet BMPs. These segments are currently located immediately adjacent to several Class 2 streams, constructed in wet areas with poor bearing capacity, and contains sustained steep approaches to the existing stream crossing of Thiel Creek. While part of the motorized trail will be retained for infrequent low-volume use for grazing management, it is not feasible to bring these roads and trails up to BMPs standards for log hauling in their current locations. Approximately 0.18 miles of the relocated segment of existing road would be reclaimed as part of the proposed action. The road will be reclaimed by ripping, slashing, grass seeding and stabilizing the road surface with drainage features. After completion of the project the 0.93 miles of temporary road would also be reclaimed by ripping, slashing, grass seeding, and installation of road drainage features.

The existing culvert crossing of Thiel Creek also does not currently meet BMPs and it is at high risk of failure. The culvert is poorly bedded, has inadequate capacity and inadequate length, and is not likely to be able to accommodate the anticipated large loads of slump deposited sediment and woody debris expected to be transported downstream during the next high runoff event. A tremendous volume of sediment and large woody debris was deposited immediately upstream of the crossing site by a slump that occurred during the spring 2012. Under the proposed action alternative this culvert would be replaced with a bridge designed with adequate capacity to accommodate a minimum of a 50-year flood and the large loads of sediment and woody debris anticipated.

No road construction would occur in the immediate vicinity of the recent slump, or on adjacent slopes or similar landtypes as those where the slump occurred. The proposed new road

construction would include one new permanent crossing and one replaced crossing of an active irrigation ditch. The crossings are located on a ditch that is used to flood irrigate pasture and does not have direct return flow to a stream. The ditch crossing will be designed to accommodate a 25-year flow and to fully comply with minimum BMPs. The crossings have low grade approaches and will require minimal excavation and fill. These crossing are considered low risks.

BMPs would be applied and maintained on all newly constructed road segments, replaced stream crossings and existing roads not fully meting BMPS. Some short-term low level increases in sediment delivery can be expected during and shortly after construction, reclamation, and stream crossing removal and replacement activities. These increases are only expected to last for approximately 1-2 years then subside to low risks once the sites are stabilized and re-vegetated. Relocation and reclamation of problem road segments and replacement of the Thiel Creek culvert with a bridge structure is expected to result in long-term improvements in watershed conditions and a decrease in erosion and sediment delivery risk to the Thiel Creek.

There is low risk of impacts to water quality due to increased sediment delivery resulting from harvest operations. BMPs would be applied concurrently with all harvest and skidding operations to reduce the potential of water quality impacts (Rashin et al., 2006). Upland ground disturbance would be limited to 15 percent or less of a unit and no harvest would be conducted within the SMZs established adjacent to stream channels. No harvest is proposed in the immediate vicinity of the slump, or on landtypes prone to mass failure within the watershed analysis area.

SMZ will be extended to include all wetlands located immediately adjacent to streams and wetland management zones (WMZ) will be established around all isolated wetlands not associated with SMZs. No timber harvest or ground based equipment operations will be conducted within WMZs. There is low risk of impacts to wetlands due to the harvest buffers and equipment operation restrictions planned.

Considering all of activities described above, some short-term low level impacts to water quality are expected to result for increased sediment delivery associated with new road construction, road reclamation, and installation and removal of stream crossing structures. However, the risk of long-term adverse direct or indirect impacts to water quality or downstream beneficial uses is low. Short-term risks of increased sediment delivery are expected to be negligible when compared to existing impacts and long-term risks associated with the large slump that recently occurred within this watershed analysis area. Long-term risks of sediment delivery are expected to decrease when compared to existing conditions due to BMP upgrades to existing roads, and relocation and reclamation of high risk road segments and high risk stream crossings.

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The 170 acres of timber harvest represent approximately 7.6% of the total watershed area. This level of harvest is well below those levels normally associated with measurable or detectable increases in water yield (Hubbart 2007). This amount of proposed forest canopy removal is likely within the natural range of variability considering historic insect and disease outbreaks and wildfire disturbances. A study of the historical vegetation of Montana estimated that the forest cover in this region of the state during 1900 consisted of approximately 33% in non-stocked and seed/sapling age stands (Losensky 1997). The proposed harvest would target lodgepole pine that is at high risk of mortality due to mountain pine beetle. Due to the observed rates of natural mortality in lodgepole pine stands, the potential for water yield increases under this alternative would likely be similar to the No-Action alternative within this watershed regardless of forest management activities. Therefore, there is low risk of impacts from increased water yield, including increased magnitude or increased duration, or timing of peak flows, or increased flood risks resulting from the Action Alternative.

Upper Harney Creek

Under the Action Alternative approximately 134 acres of timber would be harvested and 0.61 miles of permanent road and 0.90 miles of temporary road would be constructed within the Upper Harney Creek watershed analysis area. The 0.61 miles of permanent new road is necessary in order to relocate 0.90 miles of existing motorized trail that is poorly located and not suitable for log hauling purposes. This motorized trail contains sustained steep grades, inadequate surface drainage and is located on soils with poor bearing capacity. It is also located immediately adjacent to a private residence. The new road will be located on more suitable slopes where surface relief drainage is feasible and away from private residence. The existing motorized trail will be retained for infrequent low-volume use for grazing management.
The proposed new road construction does not include any new permanent stream crossings. It does include several permanent irrigation ditch crossings and two temporary stream crossing of small perennial Class 1 tributaries to Harney Creek. All of these crossings would be designed for a minimum 25-year flow event and all have low grade approaches which would require minimal amounts of fill. The irrigation ditches do not have return flow to streams.

The proposed transportation plan also includes replacing one existing stream crossing of a perennial Class 1 tributary to Harney Creek. The existing culvert and approach grades do not currently meet BMPs. The culvert is undersized and poorly bedded. The approach from the east contains a steep sustained grade with inadequate surface relief drainage. The new culvert would be designed with adequate capacity and length to accommodate a 50-year flow event, constructed with stable fill slopes, and provide for fish passage.

After completion of the project the 0.90 miles of temporary road, including the two temporary stream crossing would be reclaimed by ripping, slashing and seeding with grass. The temporary crossing structures would be designed for a 25-year flow event and would remain in-stream during only one spring runoff event. These crossing would be permanently removed upon project completion to eliminate any long-term risks of sedimentation or failure.
BMPs would be applied and maintained on all newly constructed road segments, all stream and ditch crossings, and reclaimed road segments. Activities associated with the installation and

removal of temporary culverts and the replacement of an existing culvert are expected to result in some low level short-term increases of sediment delivery to streams. These increases can be expected for 1-2 years following installation and removal of stream crossing structures. After this period of time, risk of sediment delivery would be low as road surfaces and fills at crossing sites are stabilized and re-vegetated.

There is low risk of impacts to water quality due to increased sediment delivery resulting from harvest operations. BMPs would be applied concurrently with all harvest and skidding operations to reduce the potential of water quality impacts (Rashin et al., 2006). Upland ground disturbance would be limited to 15 percent or less of a unit and no harvest or equipment operations would be conducted within the SMZs established adjacent to stream channels. SMZ will be extended to include all wetlands located immediately adjacent to streams and wetland management zones (WMZ) will be established around all isolated wetlands not associated with SMZs. No ground based equipment operation will be conducted within WMZs. No timber harvest or ground based equipment operations will be conducted within WMZs. There is low risk of impacts to wetlands due to the harvest buffers and equipment restrictions planned.

Considering all of activities described above, some short-term low level impacts to water quality are expected to result from road construction, road reclamation, and installation and removal of stream crossing structures. However, the risk of long-term adverse direct or indirect impacts to water quality or downstream beneficial uses is low. Long-term risks of sediment delivery are expected to be lower than existing conditions due to road relocation, BMP upgrades to existing roads, and replacement of an existing high risk stream crossing structure.

The 134 acres of timber harvest represent approximately 5.3% of the watershed area. This level of harvest is well below those normally associated with detectable or measurable increases in water yield (Hubbart 2007). Therefore, detrimental increases in water yield, including magnitude or duration of peak flows, or flood risks are anticipated. This amount of proposed forest canopy removal is likely within the natural range of variability considering historic insect and disease outbreaks and wildfire disturbances. A study of the historical vegetation of Montana estimated that the forest cover in this region of the state during 1900 consisted of approximately 33% in non-stocked and seed/sapling age stands (Losensky 1997). The proposed harvest would target lodgepole pine that is at high risk of mortality due to mountain pine beetle. Due to the observed rates of natural mortality in lodgepole pine stands the potential for water yield increases under this alternative would likely be similar to the No-Action alternative within this watershed regardless of forest management activities. Therefore, there is low risk of even low level impacts to water yield and the timing, duration and magnitude of peak flows resulting from the Action Alternative.

--Direct/Indirect Effects Summary

The proposed timber harvests are low risk for impact to water quality resulting from increased levels of sediment delivery. Short-term low level increases in sediment delivery are expected in

all of the watershed analysis areas during road constructions, culvert installation, replacement and removal, and road reclamation activities. These low level increases are only expected for 1-2 years following completion of these activities. After this time period the risks would decrease to low levels as road surfaces and fills stabilize and become re-vegetated. No actual impacts to downstream beneficial uses are expected to result from these anticipated short-term low level increases in sediment delivery. BMP upgrades and maintenance of existing roads, relocation of poorly suited road segments, removal or replacement of failed or high risk stream crossing are expected to improve overall watershed conditions and decrease long-term risks and actual levels of sediment delivery in all of the watershed analysis areas. No impacts to wetlands are anticipated due to the harvest buffers and equipment operation restrictions that would be utilized. Potential increases in water yield resulting from the proposed harvest activities are well below those levels associated with detectible or detrimental levels.

--Cumulative Effects of the No-Action Alternative (All Watershed Analysis Areas)

Because no timber harvesting or associated road activities would occur under this alternative, cumulative effects would be limited to the natural progression of the existing conditions. Existing stream crossing and road segments not meeting BMPs and currently delivering sediment or at high risk would not be addressed and would remain long-term chronic sources of low level cumulative impacts to water quality. High levels of sediment delivery resulting from eroding irrigation ditches would continue to contribute high levels of cumulative impacts to water quality and channel stability in West Fork Hogan Creek. Large sediment loads from slump deposition in Thiel Creek are expected to continue high levels of long-term cumulative impact to water quality and channel stability.

Low level increases in water yield can be expected as tree mortality increases and progresses throughout all of the watershed analysis areas. These increases would be natural and progress and recover slowly over the next stand rotation. These water yield increases are not expected to impact stream channel stability. Cumulative impacts to flow regimes due to irrigation diversion and augmentation will continue as described under existing conditions.

--Cumulative Effects of the Action Alternative

Table W-2. Cumulative Harvest Activities by Watershed Analysis Area

	Exist Harvest (acres)	Exist ECA (acres)	Proposed DNRC Harvest (acres)	Proposed DNRC ECA (acres)	Proposed USFS Harvest (acres)	Proposed USFS ECA (acres)	Total Cumul. Harvest (acres)	Total Cumul. ECA (acres)	%WS in ECA
Burnt Fork	0	0	266	213	122	52	388	265	8.9
Upper Hogan	66	40	219	175	47	20	332	235	6.5
Upper Thiel	0	0	170	136	130	56	300	192	8.5

Upper Harney	54	32	134	107	117	50	305	189	7.5

Burnt Fork

The Action Alternative would result in only a 0.18 miles net increase in the amount of permanent road located within the Burnt Fork watershed. The road density of 0.61 miles of road or motorized trail per square mile of watershed area resulting from implementation of the Action Alternative is considered relatively low level of road development. The proposed installation of stream crossing structures, removal of temporary stream crossing structures, and reclamation of existing ford crossings is expected to result in low level, short-term and temporary impacts to water quality. However, the relocation of the existing access route and reclamation of existing stream crossing fords is expected improve watershed conditions and decrease long-term risks to water quality. Cumulatively these activities present a moderate risk of low level short-term impacts. These impacts are considered relatively minor and localized in this watershed analysis area and not impacting beneficial uses. The grazing practices described under the existing conditions section would continue to occur under this alternative. Therefore, low levels and localized impacts of increased sediment delivery and channel instability can be expected to continue. However, there is low risk of any measurable long-term cumulative increases in sediment delivery or long-term impacts to water quality in this watershed as a result of the proposed action alternative.

No cumulative watershed impacts due to increases in water yield are expected in this analysis area. The cumulative levels of timber harvests resulting from existing harvest and both the DNRC and USFS proposals are well below those levels normally associated with detrimental increases in water yield. Estimated cumulative increases in Equivalent Clearcut Area (ECA) following both proposals would be approximately 265 acres or 8.9% of the watershed area for the Burnt Fork (see Table W-2. for a summary of cumulative harvest activities). This level of harvest is well below those levels normally associated with detrimental increases in water yield (Hibbert 1966, Bosch and Hewlett 1982 and Stednick 1996). Numerous studies have found that that about 20 to 30% of a watershed has to be harvested in order for a detectable increases in water yield to occur (Hubbart 2007). The general conclusion is that approximately 20% of the basal area of vegetation within a watershed must be removed before a statistically significant change in annual runoff can be detected (Elliot 2010). In addition, this amount of forest canopy removal is likely within the natural range of variability considering historic insect and disease outbreaks and wildfire disturbances. A study of the historical vegetation of Montana estimated that the forest cover in this region of the state during 1900 consisted of approximately 33% in non-stocked and seed/sapling age stands (Losensky 1997). The proposed harvest would target lodgepole pine that is at high risk of mortality due to mountain pine beetle. Due to the observed rates of natural mortality in lodgepole pine stands the potential for water yield increases under this alternative would likely be similar to the No-Action alternative within this watershed regardless of forest management activities. Therefore, there is low risk of impacts from increased water yield, including increased magnitude or increased duration or altered timing of peak flows, or increased flood risks resulting from the Action Alternative.

Upper Hogan Creek

Irrigation practices would continue to occur under this alternative including the chronic massive erosion and sediment delivery associated with the large head-cut gullies occurring on the Wiest, Hogan-Hogan and Beck-Harrison irrigation ditches. No additional cumulative watershed impacts to water quality due to increases in sediment delivery are expected to result from the proposed action alternative. The Action Alternative would result in only a 0.32 miles net increase in the amount of permanent road located within the Upper Hogan Creek watershed. The road density of 0.98 miles of road or motorized trail per square mile of watershed area resulting from implementation of the Action Alternative is a low level of road development. Some short-term delivery of sediment is anticipated during the installation and shortly following installation and removal of stream crossing structure, and reclamation of relocated roads and stream crossing sites. However, these increases are expected to result in long-term improvements to watershed conditions and reduced sediment delivery to streams. The low level short-term increases expected to result from the proposed Action Alternative would be negligible when compared to erosion and sediment delivery caused by the operation and management of irrigation ditches in the watershed. Because of these factors, no long-term cumulative effects to water quality from increased sediment delivery are expected to occur in the watershed as a result of the proposed action.

Existing cumulative impacts due to increased water yield and chronic de-watering of the West Fork Hogan Creek due to irrigation diversions are expected to continue as described under existing conditions. However, no additional cumulative impacts due to increases in water yield resulting from the proposed timber harvest are expected in this analysis area. The cumulative levels of timber harvest resulting from the existing and proposed DNRC and USFS timber sales are below those levels that normally result in detectable increases in actual stream flow. Estimated cumulative increases in ECA are 235 acres or approximately 6.5% of the watershed area in the Upper Hogan Creek Watershed (see Table W-2. for a summary of cumulative harvest activities). This level of harvest is well below those levels normally associated with detectable increases in water yield. Numerous studies have indicated that generally at 20% to 30% of a watershed must be harvested for detectable increases in water yield (Hubbart 2007, Elliot 2010). This amount of forest canopy removal is likely within the natural range of variability considering historic insect and disease outbreaks and wildfire disturbances (Losensky 1997). The proposed harvest would target lodgepole pine that is at high risk of mortality due to mountain pine beetle. Due to the observed rates of natural mortality in lodgepole pine stands, the potential for water yield increases under this alternative would likely be similar to the No-Action alternative within this watershed regardless of forest management activities. Therefore, there is low risk of additional cumulative impacts from increased water yield, including increased magnitude or increased duration of peak flows, or increased flood risks resulting from the Action Alternative.

Upper Thiel Creek

The existing slump and resulting sediment deposits are expected to continue to cause chronic high levels of sediment delivery and transport in Thiel Creek. No additional cumulative watershed impacts to water quality due to increases in sediment delivery are expected to result

from the proposed Action Alternative. The Action Alternative would result in only a 1.12 mile net increase in the amount of permanent road located within the Upper Thiel Creek watershed. The road density of 1.15 miles of road or motorized trail per square mile of watershed area resulting from implementation of the Action Alternative is a moderate level of road development. Some short-term low level increases sediment delivery are anticipated due to the replacement of the existing culvert stream crossing in Thiel Creek and reclamation of relocated roads. However, these increases are expected to result in long-term improvements to watershed conditions and reduced sediment delivery to streams. The low level short-term increases expected would be negligible when compared to levels of sediment delivery caused by erosion of the existing slump deposits. Because of these factors, no long-term cumulative effects to water quality are expected to occur in the watershed as a result of the proposed action.

No cumulative impacts due to increases in water yield resulting from the proposed DNRC and USFS harvest are expected in this analysis area. The cumulative levels of timber harvest resulting from existing and proposed harvest are well below those levels associated with detrimental increases in water yield. Estimated cumulative increases in ECA following completion of both proposals would be approximately192 acres or 8.5% for the Upper Thiel Creek watershed (see Table W-2. for a summary of cumulative harvest activities). This level of harvest is well below those levels normally associated with detrimental increases in water yield. Numerous studies have indicated that generally at 20% to 30% of a watershed must be harvested for detectable increases in water yield (Hubbart 2007, Elliot 2010). This amount of forest canopy removal is likely within the natural range of variability considering historic insect and disease outbreaks and wildfire disturbances (Losensky 1997). Therefore, there is low risk of cumulative watershed impacts from increased water yield, including increased magnitude, increased duration, or timing of peak flows, or increased flood risks resulting from the Action Alternative.

Upper Harney Creek

The grazing practices described under the existing conditions section would continue to occur under this alternative. Therefore, low to moderate levels of impact due to livestock bank trampling and the associated channel instability and sediment can be expected to continue. These impacts are relatively minor and localized in this watershed analysis area and only causing low level impacts to beneficial uses.

The Action Alternative would result in only a 0.61 mile net increase in the amount of permanent road located within the Upper Harney Creek watershed. The road density of 0.98 miles of road or motorized trail per square mile of watershed area resulting from implementation of the Action Alternative is considered relatively low level of road development. The proposed installation of stream crossing structures, removal of temporary stream crossing structures, and reclamation of temporary roads expected to result in some additional low level, short-term and temporary impacts to water quality. However, BMP improvements to the existing road system, including the replacement of an existing stream crossing at high risk for failure, is expected improve watershed conditions and decrease long-term risks to water quality. Cumulatively these activities present a moderate risk of low level short-term cumulative impacts to water

quality. However, no long-term cumulative impacts to water quality are expected to occur in this watershed as a result of the proposed action alternative.

No cumulative impacts due to increases in water yield due to the proposed harvest are expected in this analysis area. The cumulative levels of timber harvest resulting from existing and proposed DNRC and USFS harvests are well below those levels associated with detrimental increases in water yield. Estimated cumulative increases in ECA following completion of both proposals would be approximately 189 acres or 7.5% of the watershed area in Upper Harney Creek (see Table W-2. for a summary of cumulative harvest activities). This level of harvest is well below those levels normally associated with detrimental increases in water yield. Numerous studies have indicated that generally at 20% to 30% of a watershed must be harvested for detectable increases in water yield (Hubbart 2007, Elliot 2010). This amount of forest canopy removal is likely within the natural range of variability considering historic insect and disease outbreaks and wildfire disturbances (Losensky 1997). Therefore, there is low risk of cumulative impacts from increased water yield, including increased magnitude or increased duration of peak flows, or increased flood risks resulting from the Action Alternative.

Cumulative Effects Summary

There is low risk of additional adverse cumulative watershed effects occurring as a result of the Action Alternative in all watershed analysis areas. Levels of road density are low to moderate levels in all of the affected watersheds. Impacts from the proposed activities are limited to short-term low level increases in sediment delivery associated with installation and removal of culverts, reclamation of temporary roads, and reclamation of relocated existing roads. The large level existing impacts to water quality resulting from irrigation ditches and slump deposit are not likely to be affected by the proposed activities. These large sources of sediment delivery would mask the any potential short-term low level increases that might result from the proposed actions. BMP upgrades, road maintenance, and reclamation of existing high risk road segments and high risk stream crossings are expected to result in improved watershed conditions and reduced levels of sediment delivery. No cumulative impacts to wetlands are anticipated due the lack of existing impacts, and the proposed use of effective harvest buffers and equipment operation restrictions. Potential increases in water yield resulting from the proposed harvest activities are well below those levels associated with detectible or detrimental levels. It is unlikely that the proposed actions would substantially affect the existing cumulative watershed impacts resulting from irrigation ditch flow augmentation and stream de-watering.

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Fisheries-Introduction

The purpose of this assessment is the analysis of foreseeable environmental effects to fisheries and related habitat resources associated with the proposed Palisades Timber Sale project area.

Project Area

The Palisades Timber Sale project area includes proposed harvest on State Trust Lands within Sections 3, 5, 6, 7, 8, 9, 10 and 11, T7S, R19E. Other project area lands include State Trust Lands and private lands that intersect proposed forest road haul routes.

Species of Concern

Yellowstone cutthroat trout are classified as S2 Montana Animal Species of Concern. Species classified as S2 are considered to be at risk due to very limited and/or potentially declining population numbers, range and/or habitat, making the species vulnerable to global extinction or extirpation in the state. The Department of Natural Resources and Conservation has also identified Yellowstone cutthroat trout as a sensitive species (ARM 36.11.436).

Issues Raised During Scoping

Issues, with respect to this environmental analysis, are not specifically defined by either the Montana Environmental Policy Act or the Council on Environmental Quality. For the purposes of this environmental analysis, issues will be considered actual or perceived effects, risks, or hazards as a result of the proposed alternatives. Issues raised internally include: the proposed actions may adversely affect fisheries species presence or absence and fisheries habitat features, including channel forms, stream temperature, and connectivity. Four issues statements directly or indirectly related to fisheries resources were received from the public during project scoping (see Chapter 2 - Issues Studied in Detail and Issues Eliminated from Further Analysis).

Alternatives and Analysis Methods

Proposed Action Alternative and Mitigations

Up to 789 acres of total harvest area is proposed through 32 different harvest units. New, permanent road construction would total 4.1 miles, and new, temporary road construction would total an additional 5.2 miles. Two existing road-stream crossings would be re-constructed on fish-bearing streams to improve fisheries connectivity and water quality, and two new, permanent road-stream crossings would be constructed on other fish-bearing streams. Six existing road-stream crossings would be permanently removed on fish-bearing streams to improve fish passage and water quality. No riparian timber harvest would occur within the Streamside Management Zone (SMZ) (or within 50 to 100 feet) of any perennial or intermittent stream.

Fisheries-related resource mitigations that would be implemented with the proposed Action Alternative include: (1) applying all applicable Forestry BMPs and Forest Management Administrative Rules for fisheries, soils, and wetland and riparian management zones (RMZ) (ARMs 36.11.425 and 36.11.426) and (2) monitoring all road-stream crossings for sedimentation.

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Analysis Methods

The *EXISTING CONDITIONS* of fisheries resources will be described for each analysis area. The *ENVIRONMENTAL EFFECTS* section will compare the existing conditions to the anticipated effects of the proposed No-Action and Action Alternatives to determine the foreseeable impacts to associated fisheries resources.

Analysis methods are a function of the types and quality of data available for analysis, which varies among the different analysis areas. The analyses may either be quantitative or qualitative. The best available data for both populations and habitats will be presented for the analysis area. In order to adequately address the issues raised in Issues Raised during Scoping the existing conditions and foreseeable environmental effects to fisheries in the analysis area will be explored using the following outline of variables. Sedimentation will be addressed through an analysis of effects to channel forms.

- Fisheries Populations – Presence/Absence
- Fisheries Habitat – Channel Forms
    - Fisheries Habitat – Sediment
    - Fisheries Habitat – Flow Regimes
    - Fisheries Habitat – Woody Debris
- Habitat – Stream Temperature
    - Fisheries Habitat – Stream Shading
- Habitat – Connectivity
- Cumulative Effects

All project area lands were evaluated in the field by a DNRC fisheries resource specialist during 2012. In addition to assessing existing and potential direct and indirect effects, these site-specific surveys also serve as a resource subsample to extrapolate foreseeable effects across analysis areas.

In terms of the risk that an impact may occur, a low risk of an impact means that the impact is unlikely to occur. A moderate risk of an impact means that the impact may or may not (50/50) occur. A high risk of an impact means that the impact is likely to occur. Unless otherwise noted, impacts that do occur are expected to be moderate to long-term in duration.

A very low impact means that the impact is not likely to be detectable or measurable, and the impact is not likely to be detrimental to the resource. A low impact means that the impact is likely to be detectable or measurable, but the impact is not likely to be detrimental to the resource. A moderate impact means that the impact is likely to be detectable or measurable, and the impact is likely to be moderately detrimental to the resource. A high impact means that the impact is likely to be detectable or measurable, and the impact is likely to be highly detrimental to the resource.

Cumulative impacts are those 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 (75-1-220, MCA). The potential cumulative impacts to fisheries in the analysis areas are determined by assessing the collective anticipated direct and indirect impacts, other related existing actions, and future actions affecting the fish-bearing streams.

Initial Analysis Areas

Four separate analysis areas were initially identified to evaluate the existing and potential impacts to fisheries and fisheries resources associated with the proposed actions. The selected analysis areas include: East Fork West Red Lodge Creek (includes Burnt Fork), Hogan Creek, Thiel Creek, and Harney Creek.

The four analysis areas were chosen because they include (1) the watershed of current or historic fish-bearing streams and (2) the proposed harvest units and/or forest road haul routes that could have potential measurable or detectable impacts to those fish-bearing streams.

No streams or waterbodies within the analysis areas are identified on the 2012 Montana 303(d) list as having impairments to aquatic life and coldwater fisheries; West Red Lodge Creek immediately downstream of the Burnt Fork analysis area is identified as an impaired stream due to sedimentation. Surface waters in all analysis areas are classified as B-1 in the Montana Surface Water Quality Standards (ARM 17.30.610). For more details on these regulations, water quality standards, and beneficial uses please see the Water Resources analysis.

Analysis Areas Dismissed From Further Analysis

After considering the issues raised during scoping and the extent of the proposed actions, the East Fork West Red Lodge Creek watershed (excluding Burnt Fork) and lower portions of the Hogan Creek, Thiel Creek, and Harney Creek watersheds are dismissed from further analysis.

The only proposed activity in the East Fork West Red Lodge Creek watershed is the reclamation of approximately 500 feet of existing forest road near the divide separating East Fork West Red Lodge Creek and Burnt Fork. This action would occur more than 400 feet away from any stream and would not affect any fisheries resources.

The lower portions of the Hogan Creek, Thiel Creek, and Harney Creek watersheds are dismissed from the further analysis of fisheries resources due to: (1) the spatial and physiographic separation of landtypes that are broadly characteristic of those found within and adjacent to the project area; (2) the prevalence of private lands, associated access issues and the inability to effectively evaluate existing and potential effects in the lower portions of watersheds; and (3) the rapidly decreasing magnitude of any potentially measureable or detectable effects to fisheries resources in downstream waterbodies well away from the project area. Approximately 1.4 miles of existing road and approximately 0.2 miles of new road across grasslands in the lower Thiel Creek watershed would be used as part of the proposed actions. This action would occur more than 600 feet away from any stream and would not affect any fisheries resources.

Final Analysis Areas

The final analysis areas include: Burnt Fork, Upper Hogan Creek, Upper Thiel Creek, and Upper Harney Creek (see Map F-1). These analysis areas are generally representative of the landtypes and physiographic processes occurring within the project area, and they are expected to allow a more accurate and conservative assessment of fisheries resources potentially affected by the proposed actions.

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MAP F-1 – Fisheries resource analysis areas.

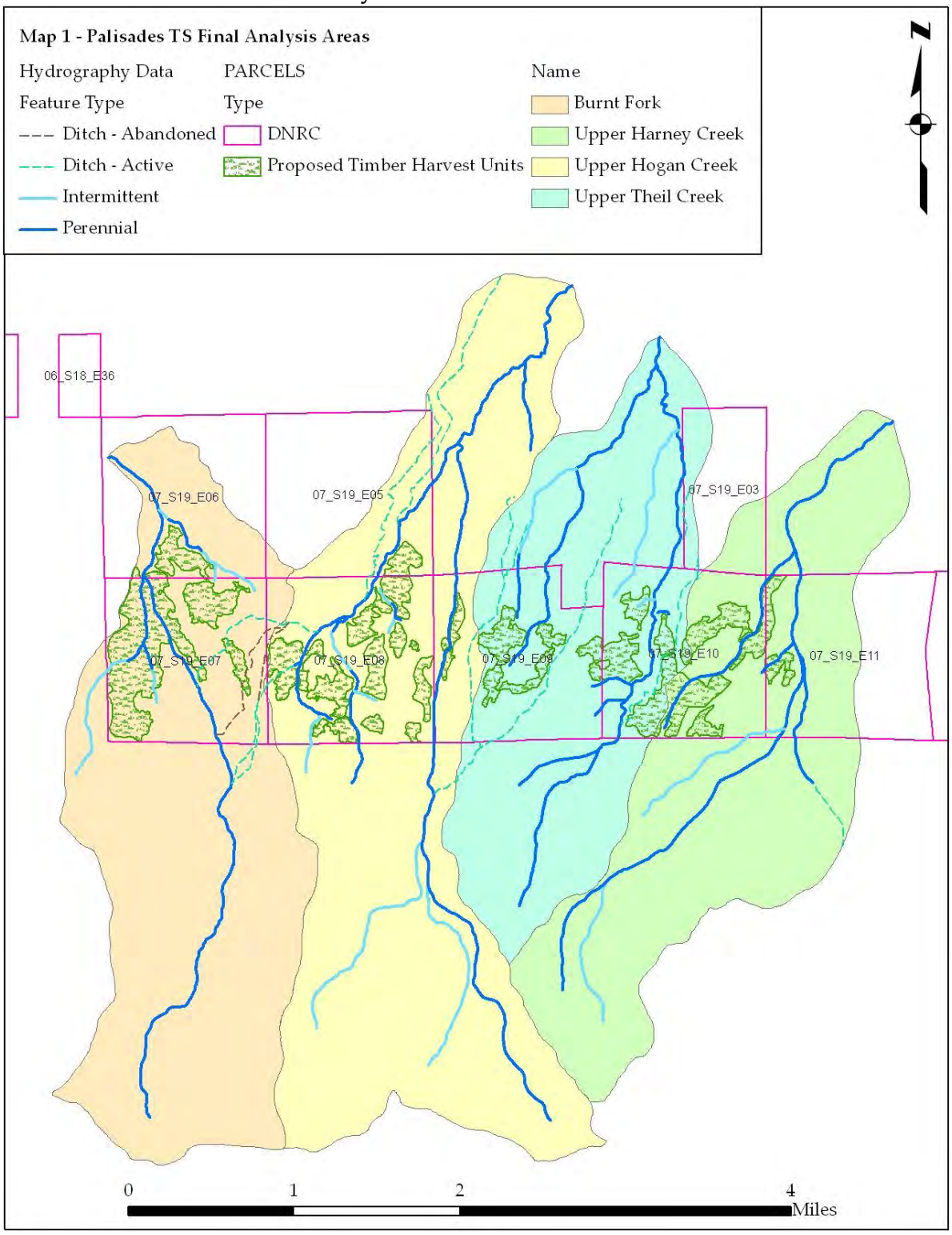

TABLE F-1 – Current and historic fish species distribution across analysis areas.

			ANALYSIS AREAS			
			Burnt Fork	Upper Hogan Creek	Upper Theil Creek	Upper Harney Creek
SPECIES	native	Yellowstone cutthroat trout	X [1]	X [1]	X [1]	X [1]
		white sucker		X		
		mottled sculpin			X	
	nonnative	eastern brook trout	X	X	X	X
		brown trout		X		X

[1] Recent surveys have not found species present in analysis area; analysis area is presumed to be part of species' historic distribution.

Existing Conditions

All Analysis Areas

The proposed activities that may affect fisheries resources in all of the analysis areas include: riparian and upland timber harvest; forest road construction, maintenance, and reclamation; and forest road utilization for timber hauling and equipment transportation. The fisheries resource variables potentially affected by the proposed actions are species presence/absence, channel forms, sediment, flow regime, woody debris, stream shading, stream temperature, and connectivity.

Current and historic fisheries distribution within the analysis areas are identified in Table F-1. Recent surveys by DNRC and Montana Fish, Wildlife and Parks indicate that Yellowstone cutthroat trout are not known to presently occur in any of the analysis areas; however, the species is presumed to have occupied all suitable habitats throughout all four analysis areas prior to settlement. Competitive displacement by eastern brook trout, and to a lesser degree brown trout, is likely the primary mechanism by which Yellowstone cutthroat trout have been driven out of all four analysis areas. This event has had a profound impact to the native assemblage and biodiversity of fisheries throughout the analysis areas and is considered a high adverse impact.

Channel forms comprise the primary spatial component of fisheries habitat and include the frequency and volume of different slow and fast water features. Stream temperature is the primary thermal component of fisheries habitat and typically includes watershed-specific seasonal and daily fluctuations. Although channel forms and stream temperature are a function of numerous environmental processes, the variables of sediment, flow regime, woody debris and stream shading are major contributors that are also potentially affected by the proposed actions. Furthermore, the ranges of conditions of all of these variables throughout a watershed

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are highly varied, and the mechanisms by which they are naturally affected are also numerous and complex. For the purposes of this environmental assessment, a matrix of potentially measureable effect mechanisms to these variables will be used to evaluate existing conditions and the foreseeable effects of the proposed actions. Site-specific surveys within project area lands serve as a resource subsample to extrapolate foreseeable effects across analysis areas.

Roads and road-stream crossings adjacent to stream channels and active irrigation ditches with return flow to stream channels may be major sources of existing direct and indirect effects to the sediment component of fisheries habitats. Table 2 shows the number of all road-stream crossings and the cumulative length of all roads within 300 feet of all streams and active irrigation ditches in the different analysis areas. The number of road-stream crossings ranges from 2 in the Upper Harney Creek analysis area to 12 in the Upper Hogan Creek analysis area; however, considering active irrigation ditches with return flow to streams, the Upper Hogan Creek analysis area effectively has 16 road-stream crossings. This is the equivalent of 0.5 to 2.8 road-stream crossings per square mile, respectively. The length of all roads within 300 feet of all streams ranges from 0.2 miles in the Burnt Fork and Upper Harney Creek analysis areas to 3.7 miles in the Upper Hogan Creek analysis area (including active irrigation ditches with return flow to streams). The density of adjacent roads ranges from <0.1 miles per square mile in the Burnt Fork analysis area to 0.7 miles per square mile in the Upper Hogan Creek analysis area (including active irrigation ditches with return flow to streams). While the precise level and extent of impact from each individual road-stream crossing or adjacent road is known in many locations, but unknown on most adjacent private land ownerships, the expected existing direct and indirect impact to sediment from road sources is low in the Burnt Fork and Upper Harney Creek analysis areas. Impacts are moderate to high in the Upper Hogan Creek analysis area, where relatively high frequencies of road features occur and four road-stream crossings on fish-bearing reaches have either partially or completely failed. Existing impacts are moderate in the Upper Thiel Creek analysis area due to the failure of a culvert crossing with large amounts of fill on a power line utility easement.

[Data used to derive the information in Tables F-2 and F-3 include: site-specific field survey data, December 2012 National Hydrography Dataset, March 2013 DNRC Pre-enterprise Geodatabase, 2013 ESRI 1-meter photo imagery, and 2013 Montana Fish, Wildlife and Parks MFISH.]

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TABLE F-2 – Fisheries Resources: Existing Conditions Assessment Criteria

		ANALYSIS AREAS			
		Burnt Fork	Upper Hogan Creek	Upper Theil Creek	Upper Harney Creek
GENERAL	Area (acres).	**2,983**	**3,613**	**2,258**	**2,518**
	Total length of perennial and intermittent streams (miles).	**7.4**	**9.8**	**23.5**	**9.0**
	Total length of contributing 'other bodies of water' (miles).	**--**	**2.5**	**--**	**--**
	Total length of fish-bearing streams (miles).	**4.6**	**4.0**	**5.7**	**6.1**
	Total riparian area within 65 feet of perennial streams (acres).	**92**	**170**	**125**	**117**
	Total area within 65 feet of contributing 'other bodies of water' (acres).	**--**	**32**	**--**	**--**
EXISTING CONDITIONS ASSESSMENT CRITERIA	Number of road crossings on perennial and intermittent streams.	**3**	**12**	**4**	**2**
	Number of road crossings on contributing 'other bodies of water'.	**--**	**4**	**--**	**--**
	Total length of roads within 300 feet of perennial and intermittent streams (miles).	**0.2**	**2.7**	**0.5**	**0.2**
	Total length of roads within 300 feet of contributing 'other bodies of water' (miles).	**--**	**1.0**	**--**	**--**
	Flow regime departure from historic range of conditions (see Water Resources Analysis).	major departures	major departures	minor departures	minor departures
	Approximate riparian area within 65 feet of perennial streams with detrimental effects to riparian canopy cover (acres).	**<1**	**12**	**11**	**3**
	Approximate area within 65 feet of contributing 'other bodies of water' without background levels of riparian canopy cover (acres).	**--**	**15**	**--**	**--**

Other unique, point-sources of sedimentation include erosion from irrigation ditches with return flow to streams. This existing condition is primarily limited to the Upper Hogan Creek analysis area and includes two separate active irrigation ditches – one with unregulated flows

and one with regulated flows (see Water Resources analysis.) These poorly located ditches have led to severe and chronic erosion problems with consequent high impacts to fisheries resources. Also, a recent large slump in the Upper Thiel Creek analysis area, which is likely associated with leakage from a poorly sealed irrigation ditch (see Geology and Soils analysis), has caused severe erosion and sediment delivery problems with consequent high impacts to fisheries resources.

Flow regime components include total annual water yield and peak seasonal flow timing, duration and magnitude. In addition to the physical geography of a watershed, this variable is also greatly affected by both natural disturbances and land management activities. The Water Resources analysis indicates that existing water yields and associated seasonal variables in all analysis areas are expected to be within the historic range of variability. In spite of this, diversions for irrigation ditches and consequent flow augmentation from return flow in different watersheds has had profound impact on flow regimes. Major impacts occur in the Burnt Fork and Upper Hogan Creek analysis areas where the complete dewatering of streams has high impacts to fisheries resources. Furthermore, flow augmentation to the West Fork of Hogan Creek negatively increases the otherwise normal effects of peak flow magnitude and duration by exacerbating in-stream sedimentation. Low impacts from dewatering and flow augmentation occur throughout the Upper Thiel Creek and Upper Harney Creek analysis areas.

Riparian zone vegetation heavily influences the delivery and in-channel frequency of woody debris, a major component of channel forms. The riparian zone is also a major regulator (shading) of stream temperature, since direct solar radiation is an important driver of stream thermal regimes, especially during peak seasonal periods. Throughout the analysis areas, riparian vegetation within 65 feet of perennial streams is the primary influence on these two fisheries resource variables. [The average height of dominant and co-dominant riparian trees in the project area at 100 years is 65 feet. This measure typically corresponds to the maximum delivery distance of woody debris away from the stream. Riparian vegetation within 25 to 50 feet of a stream tends to provide the bulk of shading of direct solar radiation during the peak seasonal period of mid-June through late-August.] Table F-2 shows the estimated acreage within 65 feet of perennial streams that has been affected by roads and land management activities. (These acre values do not include area affected by natural disturbances.) The estimated proportion of existing affected riparian zone areas ranges from 1 percent in the Burnt Fork analysis area to 9 percent in the Upper Thiel Creek analysis area. Most of the affected areas include locations with road-streams crossings and riparian vegetation removal due to grazing effects or pasture development. While the level of impact from each affected riparian zone is known in many locations, but unknown on adjacent private land ownerships, the expected existing direct and indirect impact to both woody debris and stream temperature is low in all analysis areas, except Upper Hogan Creek. The Upper Hogan Creek analysis area likely exhibits elevated impacts due to two major irrigation ditches located across approximately two miles of sage brush cover types. The lack of shading (comparable to surrounding riparian forest types) to the ditches and consequent stream temperature increases in the return flows to fish-bearing streams is likely a moderate impact to fisheries resources.

While a range of low to high direct and indirect existing impacts are likely occurring to channel forms, stream temperature and the fisheries associated with these resources, it is uncertain the extent to which these specific stressors are affecting fish species distribution or presence. A further assessment of the data in Table F-2 evaluates the relationship between the miles of fish-bearing streams per 1,000 acres and the percent of perennial and intermittent stream that are fish-bearing with three separate land management variables: (1) density of road-stream crossings per square mile, (2) adjacent road miles per square mile, and (3) percentage of affected riparian zone areas. A general trend among the analysis areas may indicate lower fisheries distribution as values for the three land management variables increase, although a statistically significant relationship does not occur. This coarse assessment does not compare the analysis areas to nearby reference conditions, which is outside the scope of this environmental assessment.

Fisheries connectivity is known to be adversely affected by culverts at one road-stream crossing in all analysis areas, except in the Burnt Fork analysis area. The structures are expected to provide passage to adult fish during most low to moderate flows, but the structures likely do not allow passage for juvenile fish at any flows. This existing condition is a low to moderate impact to fisheries resources in the Upper Hogan Creek, Upper Thiel Creek, and Upper Harney Creek analysis areas.

Other existing impacts to fisheries resources in all of the analysis areas include: grazing impacts that may exacerbate in-stream sedimentation, adverse effects to riparian vegetation, and nutrient inputs; recreational fishing pressures; and off-road vehicle impacts. (Past potential effects from forest management activities performed on all land ownerships are included in the assessment of existing direct and indirect effects.) The existing physical impacts to fisheries habitats are variable across all analysis areas. For instance, sediment impacts in Upper Hogan Creek and Upper Theil Creek are severe, and dewatering effects in Burnt Fork are severe, while these and other habitat-related resources are less affected in the Upper Harney Creek analysis area. However, the combination of all direct and indirect effects and other existing impacts are expected to have a high existing cumulative impact to fisheries resources across all analysis areas. The high existing cumulative impact is weighted in large part due to the profound impact on the native assemblage and biodiversity of fisheries in the analysis areas. As physical habitat impacts vary in magnitude and scale throughout the watersheds, the existing biological component of fisheries resources has been completely – and likely irreversibly – altered across the entire extent of all four analysis areas.

Environmental Effects

Descriptions of baseline impacts can be found under Existing Conditions.

No-Action Alternative

All Analysis Areas

As a result of implementing the No-Action Alternative, no additional direct or indirect effects to fisheries resources would occur within all analysis areas beyond those described in the Existing Conditions.

Future-related actions considered part of cumulative impacts include other forest management practices, various recreational activities, and ongoing displacement of native fisheries by nonnative fisheries. Forest management activities similar to those developed under the proposed actions, including upland and riparian harvest, new road construction, and existing road use, are likely to occur on adjacent land ownerships in the future (see Water Resources analysis). Roads open for administrative use in all analysis areas will continue to be utilized for forest and other land management purposes. Unapproved off road vehicle use will also likely occur within the analysis areas in the future. The future-related actions that do occur are expected to be low impacts to sediment, flow regimes, channel forms and stream temperature (see Water Resources analysis).

The future-related actions are not expected to appreciably different than those effects already occurring in the analysis areas. Consequently, if the No-Action Alternative is selected foreseeable cumulative impacts to fisheries resources are expected to be similar to those described in Existing Conditions.

Action Alternative

All Analysis Areas

The proposed actions and affected fisheries resources in all analysis areas are described in Proposed Action Alternative and Mitigations and Existing Conditions. Project-specific BMPs and road maintenance would be applied to all segments of the haul routes throughout the analysis areas (see Water Resources analysis).

Increased truck traffic can accelerate the mobilization and erosion of roadbed material at road-stream crossings and roads located adjacent to streams. However, through the implementation of project-specific BMPs and road maintenance, the associated road sites would be expected to deliver most mobilized sediment away from the stream and road prism and filter eroded material through roadside vegetation. Table 3 displays both the number of road-stream crossings and total length of roads within 300 feet of all streams that would be used for the proposed actions.

The number of road-stream crossings that would be used for administrative and truck traffic ranges from 1 in the Upper Thiel Creek analysis area to 7 in the Upper Hogan Creek analysis area. A high proportion of the existing amount of road-stream crossings would be utilized in the Upper Hogan Creek analysis area (including active irrigation ditches with return flow to streams), and an increase in the number of road-stream crossings utilized versus existing

amounts would occur in the Burnt Fork and Upper Harney Creek analysis areas. The miles of roads that would be used within 300 feet of all streams ranges from approximately twice the existing amount in the Upper Hogan Creek (including active irrigation ditches with return flow to streams) and Upper Thiel Creek analysis areas to five times the existing amount in the Burnt Fork analysis area. Although project-specific BMPs and road maintenance would be expected to substantially offset the risk of increased sediment delivery due to project-specific vehicle traffic, a considerable increase in road use at and adjacent to fish-bearing and non-fish-bearing streams would occur. A short-term risk of low to moderate impacts to sediment as a result of administrative and truck traffic is expected in all analysis areas.

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TABLE F-2 – Fisheries Resources: Environmental Effects Assessment Criteria

		ANALYSIS AREAS			
		Burnt Fork	Upper Hogan Creek	Upper Theil Creek	Upper Harney Creek
ENVIRONMENTAL EFFECTS ASSESSMENT CRITERIA	Number of road crossings on perennial and intermittent streams on proposed project routes, including new and temporary road crossings.	**6**	**9**	**1**	**3**
	Number of road crossings on contributing 'other bodies of water' on proposed project routes, including new and temporary road crossings.	**--**	**2**	**--**	**--**
	Net change in number of road crossings on perennial and intermittent streams and contributing 'other bodies of water', including reclaimed road crossings.	**2**	**-3**	**-1**	**0**
	Total length of roads on proposed project routes within 300 feet of perennial and intermittent streams, including new and temporary roads (miles).	**0.8**	**3.5**	**0.9**	**1.0**
	Total length of roads on proposed project routes within 300 feet of contributing 'other bodies of water', including new and temporary roads (miles).	**--**	**0.7**	**--**	**--**
	Net change in total length of roads within 300 feet of perennial and intermittent streams and contributing 'other bodies of water', including reclaimed roads (miles).	**0.2**	**-0.6**	**0.2**	**0.0**
	Net anticipated change in flow regime (see Water Resources Analysis).	negligible	negligible	negligible	negligible
	Total riparian area within 65 feet of perennial streams affected by the proposed actions (acres).	**4**	**1**	**<1**	**2**
	Total riparian area within 65 feet of contributing 'other bodies of water' affected by the proposed actions (acres).	**--**	**2**	**--**	**--**

Additionally, short-term, moderate impacts to sediment and channel forms will occur when new permanent and temporary road-stream crossing structures are installed as part of the proposed actions. The same impact will occur when existing structures are replaced or reclaimed. Four permanent or temporary road-stream crossings will be installed in both the Burnt Fork and Upper Hogan Creek analysis areas; two road-stream crossings will be installed

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in the Upper Harney Creek analysis area. One existing structure will be replaced in each of the Upper Hogan Creek, Upper Thiel Creek and Upper Harney Creek analysis areas.

Sediment impacts from proposed road use actions will be partially offset through long-term positive effects from reclaimed existing road-stream crossings sites and adjacent roads. These positive effects will be most pronounced in the Upper Hogan Creek analysis area, where three failed road-stream crossing sites on fish-bearing streams will be permanently reclaimed and 0.6 fewer road miles within 300 feet of streams will remain in the watershed. One major failed road-stream crossing site in the Upper Thiel Creek analysis area will be reclaimed.

Upland and riparian harvest may mobilize material that could be delivered to adjacent stream channels; however, the Water Resources and Geology and Soils analyses indicate that this action is low risk for low impacts. This effects assessment takes into consideration the implementation of the SMZ Law and Rules and supplemental ARMs for Forest Management on high risk of erosion sites.

As described in the Water Resources analysis, the levels of proposed timber harvest are not expected to lead to measureable increases in water yield or consequent changes in flow regime.

Riparian harvest of up to 100 percent of merchantable trees between 50 and 65 feet away from fish-bearing and non-fish-bearing perennial streams would occur in all analysis areas. [No riparian harvest would occur within 0 to 50 feet of any fish-bearing and non-fish-bearing perennial streams.] An analysis of this same riparian harvest prescription in the Environmental Impact Statement for the Forested State Trust Lands Habitat Conservation Plan indicates a low risk of impacts to woody debris and stream shading (and stream temperatures affected by direct solar radiation). The proportion of affected riparian area on perennial streams within each of the analysis areas ranges from <1 percent in Upper Thiel Creek to 4 percent in Burnt Fork. Due to the very limited magnitude and extent of this management action, a moderate risk of low impacts to woody debris and stream shading is expected in these analysis areas.

Due to the potential effects to riparian shading, a consequent low risk of low impacts to stream temperature is also expected in all analysis areas.

Positive effects to fisheries connectivity will occur in both the Upper Thiel Creek and Upper Harney Creek analysis areas. An existing under-sized culvert on Thiel Creek will be replaced with a bridge, and an existing under-sized culvert on an unnamed tributary to Harney Creek with be replaced with a larger culvert that meets fish passage BMPs. Both road-stream crossing replacements will provide full levels of fisheries connectivity. A new permanent road-stream crossing will be installed on a fish-bearing reach of West Fork Hogan Creek. This structure is expected to only provide partial levels of passage to adult fish. The affected length of upstream fish-bearing habitat is approximately 300 feet, and the overall anticipated impact to connectivity in the analysis area will be low. Another new permanent road-stream crossing will be installed

on a fish-bearing reach of Burnt Fork, although this action will meet fish passage BMPs and will not have a net change in fisheries connectivity in the analysis area.

Overall, short-term low to moderate direct and indirect impacts are expected to occur to sediment and channel forms; long-term low direct and indirect impacts are expected to occur to sediment and channel forms. Short- and long-term low direct and indirect impacts may occur to stream temperature. Adverse impacts are also expected to be offset by road reclamation and improved connectivity throughout different parts of the project area. These effects would be in addition to those direct and indirect effects already occurring. The Existing Conditions provides a coarse trend assessment of historic and ongoing effects by roads and riparian management to fisheries distribution or presence. However, the magnitude and extent of the proposed actions are not necessarily expected to have long-term, detectable or measurable effects to the trends in fish species distribution or presence among the analysis areas compared to the existing conditions.

As part of the consideration of cumulative effects, all direct, indirect and other related impacts described in the Existing Conditions and Environmental Effects for the No-Action Alternative would be expected to continue. Additionally, low to moderate direct and indirect impacts are expected to occur to sediment and channel forms, and low direct and indirect impacts may occur to stream temperature as a result of implementing the proposed actions. Adverse impacts are also expected to be offset by road reclamation and improved connectivity throughout different parts of the project area. Considering all of these impacts collectively, high cumulative impacts to fisheries resources are expected to remain across all analysis areas. The foreseeable cumulative effects to fisheries resources as a result of implementing the proposed actions are fundamentally unchanged from the existing conditions. Compared to the No-Action Alternative, no additional cumulative effects to fisheries resources would be expected, and they would remain elevated primarily due to the presence and consequent adverse impacts from nonnative fish species.

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Geology and Soils

Introduction

The following effects analysis will describe the geologic setting of the Palisades project area in concert with the dominant processes controlling landscape evolution, geomorphology, and soil properties of the area. These physical attributes ultimately control the many ecological processes we readily observe as well as the productive capacity of the area. By better understanding these processes and connections, a more accurate forecast of potential effects from a proposed action can be described and effective mitigation strategies can be designed to minimize potential effects.

Two alternatives will be analyzed for potential effects as outline in *CHAPTER 2 – ALTERNATIVES*. Action alternative proposes activities such as road construction, reconstruction, road maintenance, road reclamation, timber harvesting, log skidding and processing, burning slash piles, and site preparation activities. All of the actions mentioned above have been shown to result in a range of impacts to soil resources in both magnitude and spatial extent (DNRC, 2011a). The following document will analyze each alternative with respect to issues and concerns that were raised internally at DNRC and through public involvement as described in *CHAPTER 1*.

Analysis Area

The gross Palisades project area consists of 4,755 acres of State owned lands (*APPENDIX S1 – PROJECT AREA AND SOIL MAP UNITS*). The analysis area for direct and indirect effects to soil physical properties, nutrient cycling, and site productivity will be a subset of the gross project area and will include all harvest units, landings, the clearing limits within of new and temporary road construction and road reclamation activities. The proposed action alternative has the potential to affect slope stability and erosion on different spatial scales than the analysis area described above. Recognizing this, the analysis areas for issues concerning slope stability and erosion will include the gross project area.

Cumulative effects by definition are the collective impacts on the human environment of the proposed action(s) when considered in conjunction with other past, present and future actions related to the proposed action by location or association. For an impact to soil resources to be cumulative they must overlap a least twice in both time and space. Considering this constraint, the cumulative effects analysis area for all proposed alternatives will be the same as that described for direct and indirect impacts above except for issues relating to slope stability and erosion, in which case the project area will be the unit of analysis.

Analysis Methods

Methods for disclosing impacts to geologic and soil resources relied on information from numerous data sources. These data sources ranged from field evaluation, verification and measurement to professional published surveys including the Soil Survey of Carbon County Area, Montana (USDA, 1975, 2012) and the Red Lodge 30'x60' geologic quadrangle (Lopez, 2001). Professional training and judgment was intricate in synthesizing the information from

these various sources to describe the geologic structure and physical soil properties within the project area to forecast potential forest management limitations. Soil attributes gained from field interpretations and professional surveys used to forecast risk include soil texture, soil depth, percent coarse fragments, plasticity index, liquid limit, permeability, infiltration capacity and Unified classification.

It has been shown through DNRC soil monitoring (DNRC, 2011a) that past performance in timber sale contract administration, BMP design and implementation, and harvest design are good indicators of expected future results regarding impacts to soil resources from timber harvest. The following soil analysis was designed around this assumption which has been validated through 28 years of quantitative soil monitoring conducted by DNRC. The risk of adverse effects to soils resources resulting from the proposed action was qualitatively assessed using the above listed data sources as well as soil monitoring data collected on over 90 monitoring sites spanning 28 years of DNRC timber sales projects.

Effective risk management requires assessment of inherently uncertain events and circumstances, typically addressing two dimensions: how likely the uncertainty is to occur (probability), and the magnitude the effect would be if it happened (impact) (Hillson and Hulett, 2004). This method of risk management and communication is employed for all issues throughout this document.

Issues and Measurement Criteria

The following bulleted issue statements listed below summarizes both internal and public concerns that will be analyzed in this effects analysis.

- Traditional ground based harvest operations have the potential to compact and displace surface soils which can reduce hydrologic function, macro-porosity, and/or soil function.
- Areas of impacted soil function have the potential to increase rates of offsite erosion which may affect productive surface soils.
- Harvest activities associated with the proposed actions may cumulatively affect long term soil productivity
- Activities associated with the proposed actions such as timber harvest and road construction have the potential to affect slope stability through increased water yields and road surface drainage concentration resulting in the exceedence of resisting forces.
- The removal of large volumes of both coarse and fine woody material through timber harvest reduces the amount of organic matter and nutrients available for nutrient cycling possible affecting the long-term productivity of the site.

The measurement criteria that will be used to assess the direct, indirect and cumulative effects regarding the issues listed above are listed below in *TABLE S1 -MEASUREMENT CRITERIA*.

TABLE S1 - MEASUREMENT CRITERIA

Generalized Issue	Measurement Criteria	Units
Slope stability	Magnitude of activity proposed on unstable land forms	Feet, Acres
Soil Physical Properties	Displacement and Compaction Hazard, Harvest Unit Slope	Qualitative, %
Erosion	Slope, Vegetative cover, Soil Disturbance Rate, Precipitation Intensity and Soil Erosion Risk	%, inches/day, Qualitative
Site Nutrients	Volume of coarse and fine woody debris	Tons/Acre
Long Term Productivity	Amount of acres proposed for re-entry, detrimental Soil Disturbance, coarse and fine woody debris	Acres, % of area, Tons/Acre

Relevant Laws, Plans, and Mitigation Measures

Developed in 1996, the State Forest Land Management Plan (SFLMP) is a programmatic plan that outlines the approach and philosophy guiding land management activities on forested school trust lands throughout the state of Montana (DNRC, 1996). Within this plan, detrimental soil disturbance is defined and recommends that projects implemented by DNRC should strive to maintain the long-term soil productivity of a site by limiting detrimental soil impacts to 20 percent or less of a harvest unit and retain adequate levels of both coarse and fine woody material to facilitate nutrient retention and cycling.

To accomplish these goals and objectives contract stipulations and site specific BMPs are developed by resource specialist to provide protection for soil resources in a project area. The Forest Management Rules [ARM 36.11.422 (2) (2) (a)] state that appropriate BMPs shall be determined during project design and incorporated into implementation. ARM 36.11.414 mandates that adequate coarse woody debris shall be left on site to facilitate nutrient conservation and cycling guided the findings of (Graham et al., 1994). To ensure the incorporated BMPs are implemented and site productivity maintained, specific requirements are incorporated into the DNRC timber sale contracts. The following are some general BMP's and mitigations that would be incorporated into the proposed action to ensure adequate soil protection and long-term productivity of the site.

- Limit equipment operations to periods when soils are relatively dry, (less than 20% soil moisture), frozen or snow covered (12 inches packed or 18 inches unconsolidated snow) to minimize soil compaction and rutting, and maintain drainage features.
- Ground-based logging equipment (tractors, skidders, and mechanical harvesters) is limited to sustained slopes less than 40% and up to 45% on short pitches if impacts can be adequately mitigated.
- The Forest Officer shall approve a plan for felling, yarding and landings in each harvest unit prior to the start of operations in the unit. The locations and spacing of skid trails and landings shall be designated and approved by the Forest Officer prior to construction.

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- Levels of coarse and fine woody material will be retained on site as prescribed by the forest officer and recommended by the project soil scientist using guidance from the best available science (Graham et al., 1994). 5-15 tons/acre of material >3" is recommended for the Palisades project area with as many needles and fine material as possible which are typically retained during skidding operations.

These general BMPs along with site specific mitigations designed during contract development have been monitored for effectiveness by DNRC since 1988 and have repeatedly been shown to be an effective measure to achieve objectives described in the SFLMP (DNRC 2011a, 2011b).

Affected Environment

Geology

The structural geology within the landscape surrounding the project area is a result uplifting, tilting and depressing large crustal blocks of Precambrian crystalline rocks known today as the Beartooth Mountains. Local thrust and tear faulting in the Red Lodge area along the northern and northeastern portions of this uplifted block is evident adjacent to the project area through striking imbrications of Paleozoic sedimentary rocks along this thrust margin in the form of outcropping limestone palisades and hogbacks. None of these fault features show tectonic morphologies consistent with recent motion along these fault planes.

Parent materials within the project area consist of Paleocene and younger formations consisting of conglomerates, sandstones and surficial glacial deposits of Archean metamorphic rocks. These surficial deposits vary in thickness for 10 to 30 feet (Foose et al., 1961) and are a result of various glacial and erosion processes transporting bedrock material relatively short distances from the uplifted crustal blocks to low angle slopes along the mountain front. Weathering processes acting on these transported metamorphic materials has contributed to the clay loam soil texture observed throughout the majority of the project area.

Landscape Morphology

The structurally complex portions of the Beartooth front are largely located south of the project area which yields a morphological transition from range front faulting to a depositional environment which comprises a large portion of the project area. This depositional environment is dominated by pediment features exhibiting both low relief and local slope. Local alluvial and collluvial deposits are present adjacent to stream margins and terrace features. In general, the project area exhibits a rather undissected surface with linear drainage features which is typical for a landscape of its geologic position.

Variation in local slope is a meaningful descriptive statistics to describe dominant surface processes that are controlling the landscape morphology of a particular area. Landscapes with minimal slope variation and high average slopes are typically considered erosional surfaces whereas landscapes with low relative slopes are considered transitional or depositional. *TABLE S2 – SLOPE CLASS DISTRIBUTION* below shows both the acreage and percent of the project area within various slope categories. As depicted below, the majority of the project area is within or below the 30% slope category. Tables such as this further help to describe hillslopes

as well as many other physical attributes of the landscape such as erosion potential, runoff response, terrain complexity and slope stability hazard within both the project area and analysis area.

TABLE S2 – SLOPE CLASS DISTRIBUTION

Slope Category	Project Area			Analysis Area (Harvest Units)		
	Acres	% of Project Area	Cumulative Total	Acres	% of Analysis Area	Cumulative Total
0-10%	1988	42%	42%	240	31%	31%
11-20%	1516	32%	74%	350	44%	75%
21-30%	871	18%	92%	168	21%	96%
31-40%	332	7%	99%	27	3%	100%
41-50%	46	1%	100%	2	0%	100%
51-60%	5	0%	100%	0	0%	100%
>60%	0	0%	100%	0	0%	100%

Precipitation

The climate of the Palisades project area is highly seasonal. The average annual precipitation in the project area is approximately 25 inches with only slight variations observed in elevation which ranges from 5,400 to 6,500 feet. Approximately 28% of this precipitation is received as snow in winter months from late November to early April. Spring rains during the months of April, May and June comprise the largest portion of annual precipitation at approximately 43% while fall rains in October contribute 11% of the annual precipitation alone. This data is helpful when planning project implementation to avoid equipment operations during periods of high soil moisture.

Of equal importance is the intensity of precipitation events. *TABLE S3 – PRECIPITATION INTENSITY AND RECURRENCE* below provides storm recurrence intervals for the project area along with the associated 24-hour precipitation totals and the probability of such a storm happening in any given calendar year (Elliot et al., 1999). Intensive precipitation in short durations can be an analog to erosive events and can help highlight the limitation of BMP effectiveness during such events. It is assumed here that BMP effectiveness would be compromised to varying degrees during a storm with a 10-20% event probability.

TABLE S3 – PRECIPITATION INTENSITY AND RECURRENCE

Recurrence Interval (years)	24hr Precipiation (inches)	Event Probabilty of Occurrence per Year (%)
1	1.25	100%
2	1.59	50%
4	2.07	25%
5	2.26	20%
10	2.72	10%
20	3.00	5%
25	3.30	4%
50	3.60	2%

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Slope Stability

Slope stability is the ability of material on a slope to remain in equilibrium (stable) and therefore represents some balance between driving forces (shear stress) and resisting forces (shear strength). Many variables, both natural and/or anthropogenic, may affect either driving or resisting forces. For a slope to be considered unstable driving forces and resisting forces must be close to unity.

Factors that typically affect slope instability include: 1.) Excessive saturation, 2.) Steep slopes, 3.) Certain bedrock formations (shales, mudstones and sandstones) 4.) Dipslopes in harmony with hillslopes and 5.) History of mass failure.

Historic scarps and rotational failures have been documented within the Palisades project area during project review and were exclusively isolated to one or more of the landscape variables listed above. These historic failures are most likely attributed to stand replacing wildfires and erosional events following this disturbance. One recent failure was documented adjacent to Thiel Creek and was the result of excessive saturation resulting from an irrigation ditch. While mass failure hazard may be the most important limitation to road construction and harvest activities in the project area, simple mitigations such as avoidance and adequate drainage or road surfaces can reduce the likelihood of failure.

Soils

Soil development within the Palisades Project area can be directly correlated to vegetative cover, slope position and aspect. The Carbon County Area, Montana soil survey (NRCS, 2008) has identified nine individual soil map units where actions have been proposed (road construction and timber harvest). A description of these map units along with the risk of impacts associated with forest management activities is listed in *APPENRIX S2- SOIL MAP UNIT DESCRIPTIONS* at the end of this document.

The forest soils within the Palisades project area have many similarities with local variations in aspect, slope position, and depth to bedrock creating slight differences in physical properties that limit forest management activities. In general, soil depth is typically less 40 than inches before encountering impervious bedrock. Soils generally have a clay loam surface texture but grade to a more sandy clay loam along ridges and convex features. Deep soils with elevated clay contents, particularly on north aspects, typically remain moist well into summer months. Due to the fine texture of these soils, pore spaces are small and matrix water is bound tightly by capillary forces resulting in moderate infiltration capacities and drainage attributes. Main riparian soils adjacent to stream networks are poorly drained and have low bearing strengths. The amount of coarse rock fragments within the soil profile varies throughout the project area but typically is within the range of 5-15% by volume. With increasing coarse rock fragments, the bearing strength of the material increases thus decreasing the limitation of road construction and risk of compaction. The risk of compaction from forest management activities for each soil map unit can be found in *APPENDIX S2- SOIL MAP UNIT DESCRIPTIONS.*

Surface layers of organic matter form from needles and leaves from forest canopies, decomposition of plant material and roots as well as coarse and fine woody material. This organic layer is critical in providing habitat for microbial activity, regulating soil respiration,

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aeration and soil temperature. Throughout the project area surface organic layers or duff depths range from a few centimeters to a couple inches dependent upon habitat type, aspect and fire history.

While the organic surface layer of the forest floor is absolutely critical to soil function, this layer is also the most susceptible to surface displacement from equipment operations and log skidding. Factors affecting the risk of displacement from forest management activities include slope, amount of downed coarse woody material, equipment type, and operator skill. The risk of surface soil displacement for each soil map unit in the analysis area can be found in *APPENDIX S2- SOIL MAP UNIT DESCRIPTIONS.*

When surface soils become displaced and protective organic layers removed, bare mineral soil is exposed to surface processes, most notably erosion. Fluvial erosion of productive surface soils can entrain and transport nutrients offsite and expose more infertile subsoils. Factors effecting offsite erosion include the amount and magnitude of exposed surface soils, vegetative cover, intensity of precipitation (*TABLE S3 – PRECIPITATION INTENSITY AND RECURRENCE*), and local slope. Elevated clay contents within a majority of the Palisades soils provide significant bonds between clay particles due to Van der Waal forces. These attractive forces limit particle detachment and transport resulting in moderately erosive soil properties in the majority of the project area. Erosion on these materials can commonly be overcome with standard drainage practices, providing temporary vegetative cover with slash mats and limiting the areal extent of soil disturbance. The risk of soil erosion for particular soil map units can be found in *APPENDIX S2- SOIL MAP UNIT DESCRIPTIONS.*

All disturbed soils within previously harvested areas have naturally revegetated and are erosively stable. Rill and sheet erosion was documented on the surfaces of most existing roads and motorized trails within the project area. For more information regarding sediment production, transport and delivery from stream channels, roads or trails refer to the *WATER RESOURCE ANAYLSIS* in this document.

Nutrient Cycling and Soil Productivity

Coarse (CWD) and fine (FWD) woody debris provides many necessary functions to sustain soil productive which includes site moisture retention, soil temperature modification, physical soil protection, nutrient cycling as well as providing a long-term supply of soil wood which is paramount to soil microbial activity (Harmon et al., 1986). Volumes of coarse and fine woody debris throughout the Palisades project area are highly variable and range from as little as 5 tons/acre to upwards of 30 tons/acre. This variability is dependent on habitat type, magnitude of insect and disease mortality, fire and management histories. CWD and FWD are currently accumulating in trend within stands proposed for treatment as lodgepole pine mortality increases throughout the project area. Due to the low level of precipitation and high seasonality of the project area, soils have a low level of productivity when compared to other regions in Montana. Forest management activities have the potential to modify both amounts and trends of recruitable material and in turn the long-term productivity of the soil.

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Past Management Activities

Historic forest management activities have been implemented on approximately 77 acres within the project area which include commercial timber sales, timber permits and numerous firewood permits. No previously harvested areas have been proposed for management under the action alternative. Soil resource impacts from previous harvests have naturally ameliorated and stands of lodgepole pine have successfully regenerated. Timber permits and firewood gathering have exclusively employed hand felling and processing on site with chainsaws and resulted in no measureable physical soil impacts.

Seven grazing leases have been issued for summer grazing within the project area. During field review no detrimental soil impacts from these grazing related activities within the project area were documented besides minor cow trail development and isolated compaction around salting locations. For further information regarding these leases as they related to watershed resources, refer to the *WATER RESOURCE ANALYSIS* section of the document.

Environmental Consequences

--Direct and Indirect Effects – No Action

Under the no action alternative, none of the proposed actions outlined in *CHAPTER 2 – ALTERNATIVES* would be implemented. Soil physical properties would continue on a stable trend though the productivity, or ability of the land to produce biomass, would potentially decrease in the short-term as insect and disease mortality continued. Without any site disturbance, most lodgepole pine stands would remain relatively stagnant with increasing levels of mortality until historic disturbance patterns were restored.

Areas of margin slope stability would continue to exhibit attributes of instability with potential increases in local hillslope creep as evapotranspiration decreases with increased stand mortality. Small and localized slope failures would continue to be possible under convergent conditions previously mentioned as well as with continued seismic activity within the Yellowstone Ecosystem. Base erosion rates would remain constant.

Amounts of CWD and FWD would continue to increase as mortality increases and dead stems fall to the forest floor. Nutrient pools would potentially increase due to the massive additions of CWD and FWD available as organic sources of carbon and nutrient demand slows in the aging forest stands.

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--Direct and Indirect Effects – Action Alternative

Soil Physical Properties and Long-term Productivity

DNRC has been conducting quantitative soil monitoring studies on timber harvest projects since 1988 that cover a wide range of soil and equipment types, climates, geologies, and sivilcultural prescriptions throughout the State. This data, which is partially summarized in below, yields the ability to provide a more informed and thus more accurate forecast of potential impacts to soil resources from the proposed actions. Only a portion of the 90 plus soil monitoring sites DNRC has observed are applicable to the Palisades project area in terms of equipment type, soil texture, and slope class. When this dataset is filtered by these attributes for similarities within the proposed actions, a more representative dataset for the project area is defined. *TABLE S4 – MEADURED SOIL DISTRUBANCE RATES* below represents data from DNRC soil monitoring database for projects employing ground-based equipment on clay loam soils with slopes (TABLE S3) similar to those within the project area.

TABLE S4 – MEASURED SOIL DISTRUBANCE RATES

Stratum	Sites (n)	Sample Area (acres)	Displacement (%)	Slight Compaction* (%)	Severe Compaction (%)	Erosion (%)	Total Detrimental Disturbance (%)
Ground Based Equipment	75	3,884	8.5	5.1	4.5	0.1	13.2
Clay Loam Soil Texture	18	586	5.5	3.7	4.2	0.0	9.7
Slope Class (10-30%)	54	2,990	9.1	4.9	4.1	0.1	13.3
**Slight compaction is considered non-detrimental and maintains physical, chemical and biological attributes within 15% of native soil conditions.*							

The equipment used to harvest timber and the slopes that the equipment operates on typically are the best indicators for potential soil impacts with increased levels of impacts as slopes increase with traditional ground based equipment. Understanding these controls on soil disturbance, a weighted average can be calculated to estimate a potential rate of soil disturbance within the Palisades analysis area. This weighted rate, expressed as a percentage of area disturbed, was calculated at 12.9% (Equipment: 0.5, Slope: 0.4 and Soil Texture: 0.1). Applying this soil disturbance rate to the acres proposed for timber harvest and road construction shows that approximately 135.6 acres of land will have varying ranges of detrimental soil disturbance if the action alternative is selected as presented in *TABLE S5- DETRIMENTAL SOIL DISTURBANCE FOR THE ACTION ALTERNATIVE* below. When this data is paired with observation within previously harvested areas within the project area, it can confidently be forecasted that harvest related impacts will remain for approximately 10-30 years dependent upon the magnitude of impacts. The land use within the road prism of new, permanent road construction (14.9 acres) will permanently be converted from forest products to transportation and will facilitate administrative access to these lands in the future. The area within the road prism of new, temporary road construction (18.9 acres) will be severely impacted and will mostly likely never return to a forest products landuse, though the area will revegetate and become erosively stable within 3-5 years.

The level of soil disturbance forecasted from harvest activities are below that recommended within the SFLMP (DNRC, 1996) and presents a high probability of low to moderate level impacts to soil physical properties within the analysis area. The long-term soil productivity

within harvested areas is expected to be maintained at levels described in the existing conditions.

TABLE S5 – DETRIMENTAL SOIL DISTURBANCE FOR THE ACTION ALTERNATIVE

Analysis Area	Total Area (acres)	Disturbance Rate (%)	Affected Area (acres)
Harvest Units (including landings)	789.0	12.9%	101.8
New, Permanent Road*	14.9	100%	14.9
New, Temporary Road*	18.9	100%	18.9
** The area estimated for new and temporary road construction assumes an affected area (clearing limt) of 30 feet which includes a 12 foot road prism.*			

Nutrient Cycling

The amount of coarse and fine woody material retention within the Palisades analysis area is recommended at 5-15 tons/acre dependent upon habitat type and aspect (Graham et al., 1994). This volume of coarse woody debris is present throughout a majority of the project area and retention targets should be easily achievable. More importantly, fine woody debris retention during harvest activities in habitat types similar to those in the project area typically resulting in an additional 30-40% by volume (DNRC, 2011a). This additional 2-4 tons/acre of fine woody material contains critical foliar nutrients within needles and returns important macro and micro nutrient to the soil profile. Retention of fine woody material is typically achieved through felling and skidding activities and can also be return skidded if necessary. Coupling this retention with the natural rate of woody material accumulation presented in the *VEGETATION ANALYSIS* (Table V-5), implementation of the action alternative will result in a low risk of low level impacts to site nutrient.

Erosion

In addition to distributing slash within all harvest units for nutrient cycling and physical soil protection during operations, slash will also be heavily scattered on primary skid trails, log landing sites, and reclaimed road segments. Slash provides temporary vegetative cover, erosion control and an input of organic matter for future soil formation. Temporary cover from slash will help to limit soil particle detachment and transport during intense rain events and minimize the erosion potential of disturbed areas (Wynn et al., 2000). It also provides a much needed organic environment for soil microorganisms responsible for primary decomposition and restoration of soil hydrologic function. This mitigation measure is designed to be temporary until grass seed takes and provides more permanent cover. Due to the described mitigations, low to moderate erosion risk soils, low to moderate local slopes where disturbed soils are expected (Table S3) and BMPs/mitigations that will be implemented to limit the extent and magnitude of soil disturbance, there is a moderate probability of low level impacts from upland erosion to soil productivity.

Slope Stability

Three new road segments totaling approximately 800 feet would be constructed across landforms that are potentially prone to mass failure. The length of new road construction noted above are on materials with low bearing strengths, have evidence of hillslope creep and require properly located and functional drainage features to eliminate localized concentration of water

and potential mass failure. It is paramount in these areas that road surface drainage is tightly space to avoid hyperconcentrated runoff and subsequent slope instability. Construction mitigations such as fill slope stabilization, minimal vegetation removal within clearing limits around areas of marginal stability, and minimal cutslope excavation will also be employed in these areas. If such mitigations are achieved, slope stability issues can largely be avoided in areas of marginal stability.

Notwithstanding, the action alternative present a moderate probability of low impacts to soil resources as a result of slope failure. If road construction activities and to a lesser extent, harvest activities, destabilize local slopes resulting in slope release, infertile subsoils will be exposed. These areas typically take long periods of time to revegetate, can remain unstable until revegetation occurs, and become potential sediment sources if located in proximity to streams.

--Cumulative Effects

No Action

Under the no action alternative, none of the proposed actions outlined in *CHAPTER 2 – ALTERNATIVES* would be implemented. A low risk of low level cumulative effects to soil resources resulting from continued fire wood permits and grazing leases and licenses would be expected. Trends of soil physical properties, nutrient cycling, long-term productivity, erosion, and slope stability would continue as described within *Direct and Indirect Effects of No Action Alternative*.

Action Alternative

Cumulative effects as defined in the Analysis Area section require multiple entries into a harvest unit for an impact to be cumulative to a spatial static soil resource. Under the action alternative, no previously harvest area is proposed for reentry. Because of this constraint, no cumulative effects are expected to soil physical properties, nutrient cycling or long-term soil productivity.

No chronic upland erosion affecting soil productive was documented within the project area. Due to this observation and a moderate probability of low level impacts from erosion resulting from direct and indirect effects of the proposed action, there is a low risk of low level cumulative effects to soil resources from erosion within project area.

Small slumps and rotational failures noted in the project area most likely evolved after historic stand replacing wildfire events, but are now revegetated and are both hydrologically and erosional stable. The active landslide adjacent to Thiel creek was a direct response of hillslope saturation from an upslope irrigation ditch and does not represent an inherently unstable landform. Considering these observations in conjunction with the potential direct and indirect effects, there is a moderate probability of low to moderate level cumulative effects to soil resources from slope instability within the project area.

Wildlife

Introduction

The following sections disclose the anticipated direct, indirect, and cumulative effects to wildlife resources from the proposed action in the project area and cumulative-effects analysis areas described for each resource category. Past and ongoing activities on all ownerships, as well as planned future agency actions, have been taken into account in each cumulative-effects analysis for each resource topic.

Analysis Areas

The discussions of existing conditions and environmental effects within each subsection pertain to land areas of 2 different scales. The first scale of analysis is the Project Area (4,755 acres), which is comprised of the relevant subset of DNRC lands where activities are being proposed. The second scale is the cumulative-effects analysis area, which refers to a broader surrounding landscape useful for assessing cumulative effects to wildlife and habitat. For this proposed project, two distinct cumulative-effects analysis areas were identified. The primary cumulative effects analysis area identified and used for the majority of the species of concern surrounds the project area and comprises 37,310 acres. This area was identified as an appropriate adjacent land area of similar vegetation and topography where potential cumulative impacts would be most likely to be realized and detectable in relation to proposed activities and most of the issues raised pertaining to wildlife and habitat. This area also approximates the home range size of species such as grizzly bears and Canada lynx. Land ownership of this area consists of USFS Lands 49%, Private Lands 35%, and DNRC State Trust Lands 16%. The second area for analyzing cumulative effects is the Butcher Creek Elk Herd Unit, which totals 124,029 acres and includes a 12,846-acre wintering area (USFS 2012). This elk herd unit also encompasses the project area and it was delineated as the best approximation of the local elk herd home range. This area was identified as the most appropriate area to consider cumulative impacts associated with road densities and forest cover on elk. Land ownership of this 124,029-acre area consists of Private Lands 69%, USFS Lands 25%, DNRC state trust lands 7%, and BLM Lands <1%.

Issues and Measurement Criteria

Several issues regarding wildlife species and their habitat were identified through public and internal scoping. These issues are listed in TABLE I–1–ISSUES STUDIED IN DETAIL (CHAPTER 2) and are reiterated at the beginning of the following sections. Different measurement criteria were used to evaluate the effects of the alternatives on wildlife resources, depending on the resource or habitat need specified. The measurement criteria used for evaluation of impacts are described under each issue below.

Analysis Methods

For each species or habitat issue, existing conditions of wildlife habitats are described and compared to the anticipated effects of the no-action alternative and the proposed action alternative to determine the foreseeable effects to associated wildlife habitats.

To assess the existing condition of the project area and surrounding landscape and related impacts associated with the proposed action alternative, a variety of techniques were used. Field visits, scientific literature, SLI data, review of aerial photographs, review of current MNHP data, and consultations with other professionals provided information for the following discussion and effects analysis. Specialized methodologies, where applicable, are discussed under the species or issue in which they occur. Species were dismissed from further analysis if habitat did not exist in the project area or if the habitat would not be appreciably modified by any alternative. Throughout this analysis effects associated with mature forest cover are evaluated using a 40% canopy cover threshold. The >40% value was selected because it serves as a useful minimum at a point which stands begin to provide snow interception, hiding cover and security for many species of wildlife. To assess cumulative effects associated with the USFS GRLA project each proposed treatment prescription was evaluated using professional judgment and assigned to one of two post-treatement cover classes (i.e., >40% canopy cover, <40% canopy cover). By assigning proposed USFS treatment stands to one of these two classes, we were able to derive estimates for post-treatment cover and associated effects on habitat.

Road amounts and densities were calculated using DNRC SLI road data (2013) and the Greater Red Lodge Forest and Habitat Management Project GIS geodatabase (February 2013). Data limitations limited our ability to precisely determine open versus restricted road status on non-agency lands. Therefore, at the scale of both cumulative effects analysis areas, total road amounts and densities were used to quantify effects of the proposed activities.

Relevant Agreements, Laws, Plans, Permits, Licenses, and Other Requirements

Various legal documents dictate or recommend management direction for terrestrial wildlife species and their habitats on state trust lands. The documents most pertinent to this project include DNRC Forest Management Rules, the Endangered Species Act, the Migratory Bird Treaty Act, and the Bald and Golden Eagle Protection Act.

Coarse Filter

DNRC's principal means of managing for biodiversity is by taking a 'coarse-filter approach', which favors an appropriate mix of stand structures and compositions on state lands (ARM 36.11.404). Appropriate stand structures are based on ecological characteristics (e.g., landtype, habitat type, disturbance regime, unique characteristics). A coarse-filter approach assumes that if landscape patterns and processes are maintained similar to those endemic species evolved with, the full complement of species will persist and biodiversity will be maintained. This coarse-filter approach supports diverse wildlife populations by managing for a variety of forest structures and compositions that approximate historic conditions across the landscape. DNRC cannot assure that the coarse-filter approach will adequately address the full range of biodiversity; therefore, DNRC also employs a 'fine-filter' approach for threatened, endangered, and sensitive species (ARM 36.11.406). The fine-filter approach focuses on a single species' habitat requirements and helps ensure that special habitat needs of these rare or sensitive species are not overlooked.

Issue -- Habitat Fragmentation/Linkage

There is concern that logging, and road construction and use, could fragment habitat and adversely affect wildlife linkage and an important habitat corridor for large free-ranging species, such as elk, deer, grizzly bears, black bears, moose, mountain lions and wolves.

Measurement Criteria

The management criteria used to evaluate impacts related to the following issues included: the timing of proposed activities, location of proposed activities, scale of activities, quantified amounts of mature forest cover with >40% canopy closure, quantified road amounts, visual assessments of aerial photography for visual evaluation of cover and topography as related to potential linkage areas and movement corridors.

For the portion of the cumulative effects analysis pertaining to roads and motorized access, the "total road" metric was used to quantify relative changes in access and potential disturbance to wildlife. This metric was selected and used because data for all restricted and open road classes was incomplete for our analysis area. For the purpose of depicting changes associated with the alternatives considered, the "total road" lengths and density metrics were deemed appropriate and reasonable.

Affected Environment -- Habitat Fragmentation/Linkage

Introduction

The Project Area is situated along the northerly foothills portion of the Beartooth Face and is comprised of cool, dry forest types interspersed with open grass and shrub communities. Elevations range from 5,500 to 6,400 feet. Slopes range from 0 to 20% along fringe agricultural lands and pastures up to 65% on steeper mountainous terrain. The project area provides forested and non-forested habitats used by many terrestrial wildlife species, and it is used to varying degrees by moose, elk, mule deer, white-tailed deer, grizzly bears, black bears, mountain lions and wolves, as well as many other terrestrial species.

There are 3,099 acres of forested land and 1,656 acres of non-forest land in the project area (Table V-1). Of the forested acres, lodgepole pine is the most common cover type 28% (1,321 acres) (Table V-1). Sands classified as lodgepole pine are typically pure lodgepole pine stands or mixed-species stands containing at least 60 percent lodgepole pine and lesser amounts of Douglas-fir, Engelmann spruce, subalpine fir, and/or quaking aspen. The hardwood cover type is found on 28% of the project area (1,314 acres). The hardwood type is comprised of pure stands of quaking aspen or aspen-mixed conifer stands with at least 50 percent aspen. Douglas-fir stands, those with greater than 60 percent Douglas-fir, are found on 7% (335 acres) of the project area. Minor amounts (<5%) of limber pine, juniper, and mixed conifer forests dominated by Engelmann spruce and subalpine fir are also present. Non-forested cover types in the project area include grasslands, meadows, agricultural and ranch land, sagebrush steppe, wetlands, and shrub-dominated riparian areas. Of those types, sagebrush steppe is the most

common, occurring on 24% (1,135 acres) of the project area. Fire has historically played an important role in shaping vegetation community types in the Beartooth Mountains and areas around Yellowstone National Park (Losensky 1997 -- Climatic Section M331a). Often, large scale stand-replacing fires were the predominant disturbance type in this area. Lodgepole pine stands in these types generally regenerate back into young lodgepole stands and may occupy very large acreages due to large catastrophic events.

Connectivity of forest cover between adjacent patches is important for promoting movements of species that are hesitant to cross nonforested expanses (Hilty et al. 2006). Generally, the more effective corridors are those that are relatively wide, unfragmented, diverse, and associated with riparian areas (Fischer and Fischenich 2000). Dense patches of mature forest are present in the project area and cumulative effects analysis area. Approximately 1,682 acres of the 4,755-acre project area (35%) currently possess greater than 40% overstory canopy cover in mature forest patches. Approximately 16,319 acres (44%) of the 37,310-acre cumulative effects analysis area currently possess greater than 40% overstory canopy cover in mature forest patches. Existing patches have variable tree density and comprise a diverse mosaic of habitat conditions. Existing patch shapes and sizes in the project area have been influenced by past logging, roads, and natural disturbances that have likely occurred during the past 150 years. Within the project area there are currently no open roads present with general public motorized access allowed. However, approximately 18.1 miles of low standard roads and motorized trails used for administrative uses and ranch access are present. Thus, the density of restricted roads in the project area is 2.4 miles per square mile. Mature forest stands in the project area and cumulative effects analysis area are relatively linear along the forest/grassland ecotone and tend to be centered along stream courses. However, they are generally well connected and provide a suitable network of cover capable of facilitating movements of many terrestrial species across the local landscape (including those listed above). Mature forest patches of several hundred acres are present in the project area, and many extend onto adjacent national forest lands contributing to effective patches of cover that are several thousand acres. Due to past timber harvest design and natural disturbance types, hard forest/non-forest edges that would pose greater risk to wildlife species sensitive to edge effect and associated predation are not abundant in the project area or cumulative effects analysis area.

Linkage zones are defined as "the area between larger blocks of habitat where animals can live at certain seasons and where they can find the security they need to successfully move between these larger habitat blocks" (Servheen et al. 2003). Linkage zones differ from corridors in that the area is not just used for travel. Areas appropriate for linkage zones can occur at different spatial scales, particularly when considering the species of concern. 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 (Hilty et al. 2006, USFS 2005, Servheen et al. 2003, Craighead et al. 2001). Maintaining linkage and connectivity between isolated populations can benefit wildlife species in several ways by: (1) allowing immigrant individuals 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.

The project area lies approximately 4.2 miles northwest of Red Lodge, Montana and forest lands are discontinuous to the east across the Red Lodge valley. Agricultural lands, and several homes occur within one mile of the project area. Stands of mature forest on the project area likely provide localized travel areas and corridors, particularly along streams and riparian areas, which extend into grassland areas and irrigated pastures to the north. These stands also likely facilitate movements of wildlife across the Beartooth Face from east to west between Willow Creek and the West Fork of Red Lodge Creek across approximately 11 miles of mature forest and broken forest/aspen/grassland habitats. While mature conifer stands on the project area likely facilitate travel by wildlife, DNRC is not aware of any formal designation of the project area or neighboring lands as a linkage zone or wildlife corridor.

-Environmental Consequences -- Habitat Fragmentation/Linkage

--Direct and Indirect Effects of the No Action Alternative

Under this alternative, no logging or road construction or use would occur. Thus, there would be no changes in forest cover, patch characteristics, habitat connectivity or habitat linkage within the 4,755-acre project area. Over time and in the absence of natural disturbance events, the abundance of dense mature forest would be expected to increase. No adverse direct or indirect effects to large free-ranging species such as elk, deer, grizzly bears, black bears, moose, mountain lions and wolves would be anticipated under this alternative.

--Direct and Indirect Effects of the Action Alternative

Under the proposed action, habitat connectivity associated with riparian areas would not be appreciably altered as no riparian timber harvesting would occur in the project, with the exception of trees along irrigation ditches. Across the project area, dense patches of mature forest cover would be present and remain relatively well connected. Of the 4,755-acre project area, 1,035 acres (22%) would remain in mature forest cover with >40% overstory canopy closure (Table W-1). Following logging, forest patches on the project area would continue to have variable tree density and would continue to provide a mosaic of habitat conditions. Overall, stand density would be reduced on all 789 acres of mature forest proposed for harvest. Tree density would be reduced most on 700 acres where lodgepole pine is abundant, so remaining cover would be sparse on these affected acres. Remaining mature forest stands in the project area would generally be well connected following logging and provide a suitable network of cover capable of facilitating movements of terrestrial species across the local landscape. Within harvested stands, individual trees and patchy tree retention would remain, but these would provide limited escape cover and visual screening compared to the existing condition. There are also approximately 1,233 acres of aspen stands of various ages on the project area that provide hiding cover and foraging sites (Table W-1). Following logging, approximately 1,181 acres (96%) would remain. The acreage of both conifer stands and aspen stands combined after logging would total approximately 2,216 acres -- representing 47% of the project area.

Currently, there are 13 miles of restricted roads and approximately 5.1 miles of restricted motorized trails in the project area, resulting in a motorized access route total of 18.1 miles and a density of 2.4 miles/sq. mile. To conduct the project, 5.2 miles of temporary road would be constructed and reclaimed after use. An additional 4.1 miles of road would be constructed and would be permanent, but would remain restricted to motorized public use. Following completion of activities, 14.4 miles of restricted roads would remain as well as 6.1 miles of motorized trails, resulting in an increase of 2.4 miles of restricted motorized access routes, to be used primarily for future administrative purposes. The post project motorized access route total would be 20.5 miles and density would be 2.8 miles/sq. mi., which would be an increase of 0.4 miles/sq. mi. (17%) from the existing condition. During road construction, decommissioning of some segments, and during logging, the disturbance could directly displace temporarily the large ungulates and carnivores of concern. Given that the relative amount of new roads and trails would increase slightly, but public motorized access would remain restricted, minimal additional risk of long-term displacement and/or habitat avoidance by large ungulates and carnivores would be anticipated in association with the presence of motorized roads and trails.

Following timber harvest, large species such as moose, elk, deer, grizzly and black bears, mountain lions, and wolves may alter the way they move through and use habitat and individual forested stands in the project area due to anticipated reductions in mature forest cover. However, given that: 1) 1,035 acres of conifer forest with >40% canopy cover would remain on the project area (comprising 22% of project area); 2) 1,181 acres of aspen stands of various ages would remain on the project area (comprising 25% of project area); 3) a mosaic of habitat conditions would remain following harvest and cover along riparian areas would be retained; 4) linear road amounts would increase by 2.4 miles on the project area resulting in a density increase of 0.4 miles/sq. mi., but public motorized use would be restricted, which would limit long-term disturbance; 5) disturbance could occur on the project area for up to 4 years; and 6) that there would be no permanent high use human developments associated with the project; -- there would be low risk of adverse affects to wildlife linkage or future linkage potential associated with this project. Overall, timber harvesting associated with the proposed action would have a moderate adverse impact on species that prefer well-connected mature forest cover and the species of concern could all be displaced temporarily during project activities. Tree density in harvested patches would be reduced, which would improve habitat conditions for species that prefer open forest conditions, but would reduce security and habitat quality for species that benefit from large expanses of mature forest cover.

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Table W-1. Acreages by alternative of non forest, sparse forest, moderate to dense forest, and aspen/deciduous forest based on overstory forest canopy cover classes on the DNRC Palisades Timber Sale Project Area (Data sources USGS 2003 and MSDI 2010).

Forest Structural Classes	No Action Alternative Acres (%)	Action Alternative Acres Post Harvest (%)
Non-Forest (0 to 5% Canopy Cover)	1,713 (36%)	1,765 (37%)
Sparse Forest (6 to 39% Canopy Cover)	127 (3%)	774 (16%)
Moderate to Dense Forest (40 to 100% Canopy Cover)	1,682 (35%)	1,035 (22%)
Aspen/Deciduous Forest	1,233 (26%)	1,181 (25%)
Total	4,755	4,755

--Cumulative Effects of the No Action Alternative

Under this alternative, no logging or road construction or use would occur. Thus, there would be no changes in forest cover, patch characteristics, habitat connectivity or habitat linkage within the 37,310-acre cumulative effects analysis area. Over time and in the absence of natural disturbance events, the abundance of dense mature forest would be expected to increase. No adverse direct or indirect effects to large free-ranging species such as elk, deer, grizzly bears, black bears, moose, mountain lions and wolves would be anticipated under this alternative.

--Cumulative Effects of the Action Alternative

Under the proposed action, habitat connectivity associated with riparian areas would not be appreciably altered as no riparian timber harvesting would occur in the project, with the exception of trees along irrigation ditches. Across the 37,310-acre cumulative effects analysis area, moderate to dense patches of mature forest cover would be present and remain well connected. Of the 37,310-acre cumulative effects analysis area, 15,605 acres (42%) would remain in mature forest cover with >40% overstory canopy closure (Table W-2). Following logging, forest patches on the cumulative effects analysis area would continue to provide a mosaic of habitat conditions, and aspen stands post treatment would remain on approximately 3,617 acres (10%) of the cumulative effects analysis area. Stand density would be reduced on all 789 acres of mature forest proposed for harvest. Tree density would be reduced most on 700 acres where lodgepole pine is abundant, so remaining cover would be sparse on these affected acres.

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Considering both the DNRC Palisades project and the USFS GRLA Project, should both occur, moderate to well-stocked stands would remain on approximately 14,609 acres (39% of cumulative effects analysis area). Remaining mature forest stands in the project area would generally be well connected following logging, habitat enhancement treatments, and prescribed burning, and would provide a suitable network of cover capable of facilitating movements of terrestrial species across the local landscape. Cover in very large forested blocks would remain intact south of the DNRC project area that would continue to facilitate use and habitat connectivity for approximately 11 miles along the Beartooth Face from Willow Creek to West Fork Red Lodge Creek. However, moderate to well-stocked conifer stands would be reduced at the 37,310-acre scale overall by approximately 5%. Under the USFS GRLA Project proposal, 1,023 acres could receive aspen enhancement treatments, which could temporarily reduce standing amounts of sapling to mature age class stands for approximately 10 to 30 years. Thus, if both the DNRC and USFS projects occur, existing standing aspen stands could be reduced temporarily from 3,669 acres to 2,594 acres (Table W-2). Up to approximately 1,075 acres could be treated and converted to younger-aged stands. Within harvested and treated stands, individual trees and patchy tree retention would remain on most acres, but these would provide limited escape cover and visual screening compared to the existing condition for 1 to 2 decades. The acreage of both moderate to well-stocked conifer stands and aspen stands combined that would remain following logging and vegetation treatments proposed under both projects would total approximately 17,203 acres (46% of the cumulative effects analysis area). Given the types of treatments proposed, the location where treatments would occur and the scale of treatments proposed, habitat connectivity would not likely be substantially altered where the DNRC and USFS projects would occur.

Within the cumulative effects analysis area there are currently approximately 50.8 miles of existing roads at an overall total road density of 0.9 miles/sq. mi. Following the DNRC project alone, road miles (and motorized trails) would increase by 2.4 miles for a total of 53.2 miles, which would result in a minimal change in density that would remain at 0.9 miles/sq. mi. Under the USFS GRLA proposal, 8.0 miles of temporary road could be constructed and decommissioned following use, and an additional 5.4 miles of existing road in the cumulative effects analysis area would be decommissioned as a part of project activities. Thus, should the USFS GRLA project occur, there would be a net reduction of 3 miles of roads in the cumulative effects analysis area overall. Thus following both projects total road miles would equal 47.8 and density would drop slightly to 0.8 miles/sq. mile in the cumulative effects analysis area. During road construction, decommissioning of segments in both projects, the disturbance could directly displace temporarily the large ungulates and carnivores of concern and could influence their movement patterns while projects are active. Such disturbance could be present for up to 6 years within portions of the cumulative effects analysis area if both the DNRC and USFS project occur. Given that the relative amount of new roads and trails would decrease slightly overall, but public motorized access would remain restricted, minimal additional risk of long-term displacement and/or habitat avoidance by large ungulates and carnivores would be anticipated in association with the presence of motorized roads and trails compared to the existing

condition. Following completion of USFS and DNRC project activities, continued year-round use would be expected at the scale of the cumulative effects analysis area.

Following timber harvest, large species such as moose, elk, deer, grizzly and black bears, mountain lions, and wolves may alter the way they move through and use habitat and individual forested stands in the cumulative effects analysis area due to anticipated reductions in mature forest cover, and temporary reductions in aspen. However considering the potential effects of both the DNRC and USFS projects combined, given that: 1) 14,609 acres (39% of cumulative effects analysis area) of mature conifer forest with >40% canopy cover would remain on in the cumulative effects analysis area; 2) 2,594 acres of aspen stands of various ages would remain in the cumulative effects analysis area (comprising 7% of cumulative effects analysis area); 3) a mosaic of habitat conditions that would be relatively well connected would remain following harvest and cover along riparian areas would generally be retained; 4) linear road amounts would potentially decrease overall by approximately 3 miles in the cumulative effects analysis area, resulting in a density decrease of 0.1miles/sq. mi., and public motorized use would be restricted at current or greater levels on DNRC and USFS lands, which would limit long-term disturbance; 5) project-related disturbance associated with both the DNRC and USFS project could occur for up to 6 years; and 6) that there would be no permanent high use human developments associated with either project; -- there would be low risk of adverse affects to wildlife linkage or future linkage potential associated with this project, and timber harvesting associated with the proposed action would have minor adverse cumulative effects on species that prefer well-connected mature forest cover. However, the species listed above of concern could all be displaced temporarily during project activities and some local usage of habitats could be altered for up to several decades.

Table W-2. Acreages by alternative of non forest, sparse forest, moderate to dense forest, and aspen/deciduous forest based on overstory forest canopy cover classes in the DNRC Palisades Timber Sale Cumulative Effects Analysis Area (Data sources: USGS 2003, MSDI 2010, USFS 2013). The second column depicts cumulative changes if only the DNRC Palisades Timber Sale would take place. The last column depicts cumulative estimated changes if both the DNRC Palisades Timber Sale and the USFS GRLA Project were to occur.

Forest Structural Classes	No Action Alternative Acres (%)	Action Alternative Acres Post Harvest DNRC Project Only (%)	Action Alternative Estimated Acres Post Harvest DNRC Project and USFS GRLA Proposed Alternative (%)
Non Forest (0 to 5% Canopy Cover)	15,609 (42%)	15,661 (42%)	16,684 (45%)
Sparse Forest (6 to 39% Canopy	1,780 (5%)	2,427 (6%)	3,423 (9%)

Cover)			
Moderate to Dense Forest (40 to 100% Canopy Cover)	16,252 (43%)	15,605 (42%)	14,609 (39%)
Aspen/Deciduous Forest	3,669 (10%)	3,617 (10%)	2,594 (7%)
Total	37,310	37,310	37,310

Issue -- Snags and Coarse Woody Debris

There is concern that the abundance of snags and coarse woody debris would be reduced by the proposed activities, which could cause adverse effects to species that depend upon these habitat attributes for feeding sites and shelter.

Measurement Criteria

Visual field estimates and assessments of the abundance of snags and coarse woody debris. Evaluate estimated levels using professional judgment, considering results of 10 years of DNRC snag and coarse woody debris monitoring data to predict post-harvest retention levels and effects to wildlife.

Affected Environment -- Snags and Coarse Woody Debris

Snags, downed logs and defective trees (eg. partially dead, spike top, broken top etc.) are used by a wide variety of terrestrial species for nesting, denning, roosting, feeding, and cover (Bull et al. 1997). The quantity, quality, and distribution of snags affect the presence and population size of many of these species. Snags provide foraging sites for insectivorous species and sites for nesting and roosting birds and animals. Primary excavators of nest cavities (i.e. woodpeckers) create holes and nest sites for secondary cavity users, which include many other birds and mammals. Snags and defective trees can also provide nesting sites for cavity-using species where cavities are formed by broken tops and fallen limbs. Without trees and snags that provide for cavities or substrate for cavity excavation, primary and secondary cavity species would not be able to survive and/or reproduce (Bull et al. 1997). Primary risk factors for snags and large defective trees include loss to legal and illegal firewood cutting, prescribed burning, removal for wood fiber, purposeful felling for human safety during timber harvesting operations, and incidental loss during logging due to equipment operation and yarding activities. Given various tree mortality agents, it can take at least 40 years to grow a small tree capable of becoming a small snag, whereas it often takes 100 to several hundred years to grow large trees capable of becoming large snags.

Coarse woody debris provides structural diversity and promotes biological diversity by providing habitat for many wildlife species (Bull et al. 1997). Many small mammals require coarse woody debris to survive. In turn, these species distribute fungi that are beneficial for seedling establishment and tree growth (Graham et al. 1994). Additionally, coarse woody debris can provide feeding substrates for species such as pileated woodpeckers and black bears,

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as logs will often host high densities of insects (Aney and McClelland 1985). Forest carnivores such as pine marten and Canada lynx rely on coarse woody debris to provide resting and denning habitat (Patton and Escano 1990, Squires et al. 2008). Loss or removal of coarse woody debris through logging and other forest management activities could reduce habitat quality and availability for species that rely on this important habitat attribute.

Amounts of snags and coarse woody debris vary considerably across the project area and few large old trees and snags greater than 20 inches dbh occur on the project area (<1 per acre). Those that exist are primarily Douglas-fir, and a few scattered spruce in cool, moist areas. Coarse woody debris in lodgepole pine stands and mixed lodgepole/Douglas-fir/spruce /subalpine fir stands is highly variable and ranges from about 5 to 40 tons per acre (visual estimation), and the material is primarily comprised of 3 to 12 inch diameter logs. Some localized sites have very heavy downed log concentrations with >50 tons per acre. In portions of some stands that have large quantities of beetle-infested lodgepole pine (8 to 12 inches dbh), snag amounts range from approximately 1 to 20 snags per acre.

Across the broader landscape, beetle activity and wildfires have contributed to the abundance of snags. Within the DNRC 37,310-acre cumulative effects analysis area, approximately 67 acres burned at high intensity at high elevations (approximately 8,000 to 9,000 feet). Outside of the identified cumulative effects analysis area, over 37,000 thousand acres have burned from 1990 to 2011, creating snags and downed woody material (FLI 2011).

-Environmental Consequences -- Snags and Coarse Woody Debris

--Direct and Indirect Effects of the No Action Alternative

Under this alternative, no logging or road construction would occur and no short-term changes would occur in the abundance or distribution of snags or coarse woody debris in the project area. Thus, no short-term effects would be anticipated. Over time, snags and downed logs would likely increase and be well distributed across the project area as a result of aging forest conditions and the natural attrition of live trees. Such expected increases would improve the availability of these habitat attributes over time for associated wildlife species that depend on them in the project area.

--Direct and Indirect Effects of the Action Alternative

Under the proposed action, snags and potential recruitment trees would be reduced from existing levels on the 789 acres proposed for harvest. These reductions would occur on approximately 44% of the existing 1,809 acres of conifer forest on the 4,755-acre project area due to timber felling operations and removal of dead and dying beetle-infested trees. Additional snags may also be lost in the short term following treatments due to wind throw. Illegal firewood cutting would not be expected to appreciably reduce snags further, because motorized public access would remain restricted on the project area. Across the project area, at least 1 large snag and 1 large recruitment trees per acre (both >21 inches dbh) would be retained. In cases where snags and recruitment trees meeting this minimum size are not present, the largest

available snags and trees would be retained. Given that most of the existing snags are lodgepole pine trees that have inherently high attrition rates, substitution of additional live trees could occur on some sites to ensure snag recruitment would be maintained over time in treated areas. Available snag habitat would be reduced on all treated acres in the project area, which could reduce habitat quality for wildlife species that require snags for meeting life requisites. However, some snags and future recruitment trees would be retained in a well distributed manner across the project area. Existing snag amounts would not be influenced on the approximately 766 acres of coniferous forest on the project area that would not receive harvest. Effects on the abundance and distribution of coarse woody debris would be variable. However, post-harvest monitoring on DNRC projects from 2001 to 2011 has indicated that ample amounts have been attained in most logging units on DNRC projects (DNRC 2005, DNRC 2011). Areas with currently high concentrations of coarse woody debris (i.e., approximately 50 tons per acre) would likely have amounts reduced due to operability needs and harvest operations. Whereas, the amounts of material in areas where down woody material is relatively sparse would likely increase by several tons following harvest (DNRC 2005, DNRC 2011). Post harvest coarse woody debris levels would range from 5 to 15 tons/acre and average approximately 7 tons/acre across harvest units. While some changes in the amount and distribution of woody material would occur across the project area, ample amounts would be expected to remain, which would provide for soil structure, habitat structure and feeding substrate for many species that utilize woody material to meet life requisites (Graham et al. 1994). Retained snags and recruitment trees would further ensure the presence of snags and downed woody material across the project area over time.

Thus, considering that: 1) snag densities would likely be decreased across 789 acres from existing levels (44% of existing conifer forest on the project area); 2) snags and recruitment trees (1 each per acre minimum) would be retained in all proposed harvest units; 3) coarse woody material would likely be retained in similar to greater amounts within proposed harvest units under both action alternatives; and 4) no new open roads would be constructed that could increase the potential for illegal firewood removal -- overall effects to wildlife species closely associated with snags and downed woody material would be moderate in the project area. Species most likely to be adversely affected would be those species that use, and sometimes prefer, smaller snags for feeding and nesting (eg. smaller primary and secondary cavity-nesting bird species), as greater amounts of smaller snags would likely be lost or removed across proposed harvest units.

--Cumulative Effects of the No Action Alternative

Under this alternative, no short-term changes would occur in the abundance or distribution of snags or coarse woody debris associated with forest management activities. Thus, no short-term effects would be anticipated. Over time, snags and downed logs would likely increase and be well distributed across the project area as a result of aging forest conditions and the natural attrition of live trees. Such expected increases would improve the availability of these habitat attributes over time for associated wildlife species that depend on them in the cumulative effects analysis area.

--Cumulative Effects of the Action Alternative

Under the proposed action, existing numbers of snags would be reduced from existing levels on the 789 acres (4%) proposed for treatment of approximately 18,032 total acres of coniferous forest within the 37,310-acre cumulative effects analysis area due to timber felling operations and removal of dead and dying beetle-infested trees. Additional recruitment trees and snags may also be lost in the short term following treatments due to wind throw. Illegal firewood cutting would not be expected to appreciably reduce snags further, because motorized public access would remain restricted on the project area. Additionally, across the project area, at least 1 large snag and 1 large recruitment tree per acre (both >21 inches dbh) would be retained on DNRC harvest units. If such large trees and snags are absent, the largest available snags and trees would be retained. Available snag habitat would be reduced on all treated acres in the project area, which would be expected to reduce habitat quality and the abundance of species that require snags as a life requisite. However, snags and future recruitment trees would be retained in a well distributed manner across much of the remainder of the cumulative effects analysis area, which would maintain habitat, albeit possibly for fewer individuals of species closely associated with snags. Over the next approximately 6 years, amounts of snags and coarse woody debris could also be influenced by the USFS GRLA Project, which could alter vegetation on approximately 2,176 acres (12%) of the approximately 18,032 total acres of coniferous forest within the 37,310-acre DNRC cumulative effects analysis area. Logging and other proposed vegetation treatments undertaken by both agencies would result in approximately 2,965 acres (16%) of total treatment area of the approximately 18,032 total acres of coniferous forest within the DNRC cumulative effects analysis area, where snags could be reduced and coarse woody debris amounts and distribution could be altered. Residual woody material on USFS lands proposed for vegetation management would likely be variable, depending upon individual treatment types, sites, fuel loads and burning conditions at the time of ignitions. Effects on the abundance and distribution of coarse woody debris would also be variable on DNRC lands, however, ample amounts have not been difficult to retain in most logging units during the last decade (DNRC 2005, DNRC 2011). Areas with currently high concentrations of coarse woody debris (i.e., approximately 50 tons per acre) would likely have amounts reduced due to operability needs and harvest operations. Whereas, the amounts of material in areas where down woody material is relatively sparse would likely increase following harvest. Post harvest coarse woody debris levels would range from 5 to 15 tons/acre and average approximately 7 tons/acre across DNRC harvest units. While some changes in the amount and distribution of woody material would occur across the DNRC project area, ample amounts would be expected to remain across the cumulative effects analysis area, which would provide for soil structure, habitat structure and feeding substrate for many species that utilize woody material to meet life requisites (Graham et al. 1994). Retained snags and recruitment trees would further ensure the presence of downed woody material across the project area and cumulative effects analysis area over time. Of the 2,965-acre total treatment area combined for both agencies, at least 1,269 acres (43%) would have many additional potential live replacement trees retained due to the proposed partial harvest treatment types, which would ensure the ample presence of snags, recruitment trees and coarse woody debris into the future. Given the access management restrictions that would be proposed for both projects, any changes in

potential for illegal firewood harvest that could affect the abundance of snags or coarse woody debris would be expected to be negligible.

Thus, considering that: 1) snag densities would likely be decreased on the 789 acres (4%) proposed for treatment of approximately 18,032 total acres of coniferous forest within the 37,310-acre cumulative effects analysis area due to timber felling operations and removal of dead and dying beetle-infested trees; 2) DNRC and USFS GRLA projects combined could affect approximately 2,965 acres (16%) of total treatment area of the approximately 18,032 total acres of coniferous forest within the DNRC cumulative effects analysis area, 3) snags and recruitment trees (1 each per acre minimum) would be retained in all proposed DNRC harvest units; 4) coarse woody material would likely be retained in similar to greater amounts within proposed harvest units under both action alternatives on DNRC lands; and 5) no new open roads would be constructed by either agency that could increase the potential for illegal firewood removal -- overall cumulative effects to wildlife species closely associated with snags and downed woody material would be minor in the cumulative effects analysis area. Species most likely to be adversely affected would be those species that use, and sometimes prefer, smaller snags for feeding and nesting (eg. smaller primary and secondary cavity-nesting bird species), as greater amounts of smaller snags would likely be lost or removed across proposed harvest units.

Fine Filter Analysis

In the fine-filter analysis, individual species of concern are evaluated. These species include wildlife species federally listed under the Endangered Species Act, species listed as sensitive by DNRC, species of concern identified through public scoping, and species managed as big game by DFWP. In western Montana, 2 terrestrial species that could be affected by forest management activities are federally classified as threatened; the Canada lynx and grizzly bear. On February 4, 2013 the wolverine was proposed for listing as a threatened species by the U.S. Fish and Wildlife Service, and a final determination and rule is anticipated one year from that date. Thus, they are considered below as a federally listed threatened species. Gray wolves were delisted on May 5, 2011 through a Congressional budget action (April 14, 2011).

Issue -- Fine Filter Terrestrial Wildlife Species

There is concern that activities proposed in this project may adversely affect federally listed threatened and endangered species, and/or sensitive species.

The potential for direct, indirect and cumulative effects was considered for the endangered, threatened and sensitive species included in the table below. For each of these species, the likelihood of adverse impacts was considered to be negligible or minor. The assessment rationale for each species is presented in each corresponding rationale cell in the table. For grizzly bears, Canada lynx, big game security, big game thermal cover, goshawks, and great gray owls, potential for adverse impacts was present, therefore, more detailed analyses for each of these species are included below.

Measurement Criteria
The management criteria used to evaluate impacts related to the following issues and species included: MNHP species occurrence record search 9/13/12 and 5/29/13, species-specific assessments of distribution and habitat suitability, field reviews, assessment of anecdotal information obtained from local biologists on species occurrence, assessment of risk factors for each species, timing of proposed activities, location of proposed activities, scale of activities, cover amounts, and road amounts as applicable.

Checklist for Endangered, Threatened and Sensitive Species-Central Land Office

Threatened and Endangered Species	**Potential for Impacts and Rationale** [Y/N] Potential Impacts and Mitigation Measures N = Not Present or No Impact is Likely to Occur Y = Impacts May Occur (Explain Below)
Canada Lynx (*Lynx canadensis*) -- ***Threatened Species*** Habitat: dense spruce/fir forest supporting snowshoe hares.	[Y] Detailed analysis provided below.
Grizzly Bear (*Ursus arctos*) ***Threatened Species*** Habitat: recovery areas, security from human activity	[Y] Detailed analysis provided below.
Wolverine (*Gulo gulo)* ***Proposed -- Threatened Species*** Habitat: large expanses with high elevation zones possessing deep persistent snow in spring, remote areas with ample prey and carion.	[N] At the landscape scale, the presence of abundant food supplies (i.e., ungulate carrion) and sparsely inhabited wilderness areas that contain persistent snow until late spring tend to define wolverine habitat (Kelsall 1981; Banci 1990; Aubry et al. 2007). The project area occurs at relatively low elevations in this geographic area and does not possess areas with high amounts of persistent snow in late spring that are suitable for denning female wolverines. Individual animals could occasionally use lands in the project area while foraging or dispersing, and they could be displaced by project-related disturbance if they are in the area. However, given their large home range sizes (~150 sq. mi. -- Hornocker and Hash 1981), and manner in which they use a broad range of forested and non-forested habitats, the proposed activities and alterations

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	of forest vegetation on the project area would have negligible influence on wolverines. Thus, minimal direct, indirect or cumulative effects to wolverines would be anticipated.

DNRC Sensitive Species	[Y/N] Potential Impacts and Mitigation Measures N = Not Present or No Impact is Likely to Occur Y = Impacts May Occur (Explain Below)
Gray Wolf (*Canis lupus*) Habitat: ample big game pops., security from human activity	[N] No known denning or rendezvous sites occur within 1 mile of the project area. However, wolves may occasionally use the project area and occasional sightings have been noted in the area (B. Pitman, USFS Biologist, pers. comm. 8/30/12). Minimal risk of direct, indirect or cumulative effects that would result in harm to wolves would be anticipated under either of the alternatives considered. If wolves or an active den site were detected in the immediate area, operations would cease, and a DNRC biologist would be consulted. Appropriate mitigations would be developed and applied prior to resuming activities.
Bald Eagle (*Haliaeetus leucocephalus*) Habitat: late-successional forest <1 mile from open water	[N] No bald eagle nests, feeding areas, roosting areas or suitable nesting habitat occur within 1 mile of the project area. Thus, no direct, indirect or cumulative effects to bald eagles would be anticipated under either of the alternatives considered.
Black-Backed Woodpecker (*Picoides arcticus*) Habitat: mature to old burned forest	[Y] No recent burns within the last 5 years occur on the project area or within 1 mile of the project area. However, pockets of beetle infested trees occur across the project area and cumulative effects analysis area. Removing beetle infested lodgepole pine trees could would potentially reduce potential feeding substrates across the 789 acres proposed for harvest. However, given the scale of removal and availability of infested trees within the 37,310 acre analysis area, minor direct, indirect or cumulative effects to black-backed woodpeckers would be anticipated.
	[N] Black-tailed prairie dogs have not been

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Black-tailed Prairie Dog (*Cynomys ludoviscianus*) Habitat: Prairie, shortgrass prairie, badlands	documented in the project area (MNHP Tracker 5/29/13) and grassland habitats in the project area would be minimally affected by the proposed action. The nearest known town occurrence is 11.6 miles distant from the project area. No direct, indirect or cumulative effects to prairie dogs would be anticipated under either of the alternatives considered.
White-tailed Prairie Dog *(Cynomys leucurus)* Habitat: mountain meadows, semi-desert grassland	[N] White-tailed prairie dogs inhabit dry sites in mixed-shrub/grass stands. Such sites in Montana are often comprised of Nuttall saltbrush, big sage brush, poverty sump weed and winter fat. White-tailed prairie dogs have been detected within the ¼/, ¼ latilong that encompasses the project area, however, the nearest documented colony lies >7.5 miles from the project area (DFWP 2013a). No colonies are known to occur on the project area, and none are known to occur within one mile of the project area. Thus, no direct, indirect or cumulative effects to white-tailed prairie dogs are anticipated as a result of either alternative considered.
Flammulated Owl (*Otus flammeolus*) Habitat: late-successional ponderosa pine and Doug.-fir forest	[N] The project area occurs outside of the distribution of flammulated owls in Montana, and warm forest types suitable for use by flammulated owls do not occur in or near the project area. Thus, no direct, indirect or cumulative effects to flammulated owls would be anticipated under either of the alternatives considered.
Greater Sage-grouse (*Centrocercus urophasianus*) Habitat: sagebrush semi-desert	**[** N **]** Greater sage grouse have not been observed in the project area, however, birds have been documented within 7.5 miles of the project area. Birds could potentially use non-forested areas in the project area, however, the nearest known lek is 11.2 miles distant (MNHP 5/29/13, DFWP 2013). Prefered sagebrush habitats and grassland habitats in the project area would be minimally affected by the proposed action. Thus, no direct, indirect or cumulative effects to greater sage grouse would be anticipated under either of the alternatives considered.

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Harlequin Duck (*Histrionicus histrionicus*) Habitat: white-water streams, boulder and cobble substrates	[N] Harlequin ducks have been observed in both West Fork Rock Creek and the Lake Fork Rock Creek in the Beartooth Mountain Range. These streams both occur greater than 3.5 miles from the project area, and no known streams supporting harlequin ducks occur within or near the project area (MNHP 2013). Thus, no direct, indirect or cumulative effects to harlequin ducks would be anticipated for either of the alternatives considered.
Mountain Plover (*Charadrius montanus*) Habitat: short-grass prairie, alkaline flats, prairie dog towns	[N] Mountain plovers have not been observed on the project area or within 1 mile of the project area (MNHP 5/29/13), and short-grass prairie habitat suitable for use by mountain plovers is not present in the project area. The nearest recorded observation of this species lies approximately 41 miles away. Thus, no direct, indirect or cumulative effects to mountain plovers would be anticipated under either of the alternatives considered.
Peregrine Falcon (*Falco peregrinus*) Habitat: cliff features near open foraging areas and/or wetlands	[N] No cliff features suitable as nesting areas occur within 1 mile of the project area, and the nearest known nest is approximately 8 miles distant. Thus, no direct, indirect or cumulative effects to peregrine falcons would be anticipated for either of the alternatives considered.
Pileated Woodpecker (*Dryocopus pileatus*) Habitat: late-successional ponderosa pine and larch-fir forest	[N] The project area occurs outside of the normal distribution of pileated woodpeckers in Montana. Thus, no direct, indirect or cumulative effects to pileated woodpeckers would be anticipated for either of the alternatives considered.
Spotted Bat *(Euderma maculatum)* Habitat: rock outcrops, cliffs, caves, old mines	[N] The project area lies within the potential distribution area of the spotted bat, however, the nearest documented record was over 45 mi. from the project area (MNHP 2013). These bats prefer open, arid habitats and they roost in cliffs and rocky outcrops near water (DFWP 2013a). Rock outcrops potentially suitable for roosting occur approximately ½ mile south of the project area on Burnt Mountain and in the limestone palisades running east to west along the southern border of the project area. Riparian areas associated with West Red Lodge Creek, Burnt Fork, Hogan Creek and Thiel Creek potentially provide seasonal feeding

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	areas. As potential roost sites are approximately ½ mile or greater from disturbance zones where activities would occur, and project activities would normally occur outside of typical evening feeding periods of bats, minimal risk of direct, indirect, or cumulative effects to spotted bats would be anticipated as a result of either alternative considered.
Townsend's Big-Eared Bat (*Plecotus townsendii*) Habitat: caves, caverns, old mines	[N] No caves, caverns, or old mines suitable for use by bats occur within 1 mile of the project area. Thus, no direct, indirect or cumulative effects to Townsend's big-eared bats would be anticipated for either of the alternatives considered.

Issue -- Canada Lynx

Canada Lynx

Timber harvesting and associated activities could remove canopy closure, alter stand conditions, and/or cause motorized disturbance, which could alter lynx habitat, rendering it unsuitable for supporting lynx.

Measurement Criteria

Assess suitable lynx habitat and potential reductions and effects related to the proposed action using DNRC SLI habitat data (2013) and model for direct and indirect effects at the project area scale (4,755 acres). Estimate potential lynx habitat at elevations >5,000 feet using USGS (2003) cover layer and FLI (2011) fire perimeter data to evaluate habitat reductions and effects from the proposed action to determine cumulative effects within the 37,310-acre cumulative effects analysis area.

Affected Environment

Canada lynx are currently federally listed as a threatened species in Montana. Canada lynx prey primarily on snowshoe hares (Squires and Ruggiero 2007) and live in subalpine fir/spruce forests, generally between 4,000 to 7,000 feet in elevation in western Montana (Ruediger et al. 2000). In western Montana, lynx prefer stands dominated by spruce and subalpine fir that possess high horizontal cover and provide habitat for snowshoe hares (Squires et al. 2010). Lynx home range sizes vary from approximately 16,000 to 25,000 acres (Ruediger et al. 2000). Dense, mature stands are preferred by lynx in winter, whereas younger dense, stands with high horizontal cover are preferred in summer (Squires et al. 2010). Mature subalpine fir stands containing abundant coarse woody debris are valuable for denning and provide cover for kittens, and they provide forested cover for travel and security (Squires et al. 2008). Historically, high intensity, stand-replacing fires of long fire intervals (150 to 300 years) occurred in continuous dense forests comprised of lodgepole pine, subalpine fir, and

Engelmann spruce. These fires created extensive even-aged patches of regenerating forest intermixed with old stands that maintained a mosaic of snowshoe hare and lynx habitat on the landscape.

The proposed project area ranges from approximately 5,500 to 6,500 feet in elevation. DNRC lands within the project area are dominated by mature stands containing predominantly lodgepole pine, and lesser amounts of Douglas-fir, spruce and subalpine fir. Relatively pure stands of both lodgepole pine and Douglas-fir are present, as well as mixed species stands of varying composition. Minor amounts of Engelmann spruce and subalpine fir are present on cool, moist sites, and trace amounts of limber pine and ponderosa pine are present on drier, exposed sites. Aspen stands of various ages also occur on the project area and likely provide habitat for snowshoe hares and secondary prey species. While many of the current coniferous forest cover types within the project area are considered suitable for use by lynx (Ruediger et al. 2000), most typically do not contain high horizontal cover comprised of subalpine and spruce bows described by Squires et al. (2010). Also, the project area is comprised of low-lying foothill areas along a grassland/forest ecotone, which are areas not normally considered as preferred habitat for lynx. Considering this and the presence of several habitat attributes within the project area that are known to be important for lynx and snowshoe hares (eg. dense overstory canopy, dense shrubs and downed logs), habitat in this area is likely best suited as travel habitat or matrix habitat (USFWS 2009) that would facilitate movement, linkage, and provide habitat for secondary prey species such as ruffed grouse, red squirrels, and other small mammals. For this analysis the three habitat classes that will be considered are: 1) non-habitat (i.e., rocks, ice, water and cover types that will never be habitat), 2) suitable habitat (i.e., habitat that provides structure and cover that facilitate occupancy and travel), and 3) temporary non-suitable habitat (i.e., habitat that temporarily does not have structural attributes necessary for suitable habitat, but will acquire them back over time as stands re-grow and age.). Currently in the 4,755-acre project area there are approximately 2,434 acres of suitable habitat (51%), 287 acres of temporarily non-suitable habitat (6%), and 2,034 acres of non-habitat (43%).

Under requirements of the federal listing of lynx as a threatened species, a draft recovery plan outline was written (USFWS 2005), and federally designated Critical Habitat has been described for in the Greater Yellowstone Area in Unit 5 (USFWS 2009). However, the project area occurs outside of the Critical Habitat boundary and no federal funding or permitting would be required for the proposed project. Thus, federal measures required under the Critical Habitat designation would not be applicable to this project.

-Environmental Consequences

--Direct and Indirect Effects of the No Action Alternative

Under this alternative none of the proposed forest management activities would occur and no alterations of forest vegetation or lynx habitat would occur. Thus no direct or indirect effects to lynx or lynx habitat would be anticipated.

--Direct and Indirect Effects of the Action Alternative

Currently on the 4,755-acre project area there are 2,434 acres of suitable lynx habitat (51%), 287 acres of temporary non-lynx habitat (6%), and 2,034 acres of non-habitat (43%) (Table W-3). Under the action alternative, approximately 700 acres (29%) of the 2,434 acres of existing suitable lynx habitat would be removed within the 4,755-acre project area and converted to temporary non-habitat. The 700 treated acres would be sparsely forested following harvest and would likely take 15 to 30 years to regenerate into a suitable habitat condition comprised of lodgepole pine, aspen, and Douglas-fir sapling stands. Given the amount of existing suitable lynx habitat that would be retained in the project area post-treatment [i.e., 1,734 acres retained (71%) of 2,434 existing acres of suitable habitat], proposed retention levels would exceed those required under ARM 36.11.435 (at least 408 acres suitable habitat required for denning and foraging). Should individual lynx be present in the project area at the time logging activities were initiated, there would be increased risk of their displacement due to the increased level of noise and disturbance for the duration of the project (potentially 2 to 4 years). Risk of any displacement attributable to motorized project activities beyond 3 years would not be expected. Given the size and location of the patches of lynx habitat affected and restriction of logging in riparian zones, habitat connectivity would not be appreciably altered for lynx. Similarly, linkage potential would be minimally influenced as 1,734 acres of suitable habitat (36% of project area) would remain after timber harvest, and no additional open roads or human developments would occur as a part of this proposal. In summary, given that: 1) 1,734 acres (36%) of the existing 2,434 would remain following logging; 2) that habitat effects would be temporary, but conifer stands may take 15 to 30 years to regenerate; 3) habitat found on the project area is generally marginal lynx habitat suitable for use for travel or matrix habitat; 4) risk of displacement due to motorized activities would be temporary and short-term at 2 to 4 years; and 5) habitat connectivity and linkage would not be appreciably altered by project activities, minor adverse direct and indirect effects to lynx would be expected.

Table W-3. Acreages (and percentage of project area) by alternative of lynx habitat on the DNRC Palisades Timber Sale Project Area (Data source DNRC SLI 2013).

Lynx Habitat Class	No Action Alternative Acres (%)	Action Alternative Acres Post Harvest (%)
Suitable Habitat	2,434 (51%)	1,734 (36%)
Temporary Non-suitable Habitat	287 (6%)	987 (21%)
Non-Habitat	2,034 (43%)	2,034 (43%)
Total	4,755	4,755

DRAFT

--Cumulative Effects of the No Action Alternative

Under this alternative none of the proposed forest management activities would occur and no alterations of the forest vegetation or lynx habitat would occur. Thus no cumulative effects to lynx or lynx habitat would be anticipated.

--Cumulative Effects of the Action Alternative

Due to data limitations, lynx habitat was modeled at the 37,310 cumulative effects analysis scale by considering stands most likely to be lynx habitat as those moderate to well-stocked stands with >40% coniferous canopy cover and aspen stands existing above 5,000 feet elevation. The 37,310-acre scale was used as an approximation for the home range size of a lynx in a landscape likely possessing relatively low densities of snowshoe hares. For this analysis, DNRC's current SLI data were used to identify lynx habitat and the applicable harvest units proposed on the project area. For the cumulative effects analysis area, DNRC SLI data, canopy cover data (USGS 2003), MSDI Land Cover Database (2010), and fire perimeter data (FLI 2011) were used to define the likely amounts of existing lynx habitat in that large geographic area. Also, due to data limitations, modeled habitat conditions could only be identified down to the level of "suitable" and "non-lynx habitat" types. Potential "temporary non-lynx habitat" could not be differentiated. The non-habitat component also includes acres at low elevations and elsewhere in non-lynx habitat types that would likely never be habitat. Currently on the 37,310-acre cumulative effects analysis area there are approximately 19,921 acres of suitable lynx habitat (53% of analysis area) and 17,389 acres of non-habitat (47% of analysis area) (Table W-4). Under the action alternative, approximately 700 acres (4%) of the 19,921 acres of existing suitable lynx habitat would be removed within the 37,310-acre cumulative effects analysis area and converted to temporary non-habitat. The 700 treated acres would be sparsely forested following harvest and would likely take 15 to 30 years to regenerate into a suitable habitat condition comprised of lodgepole pine, aspen, and Douglas-fir sapling stands. A relatively high percentage of existing suitable lynx habitat would be retained in the cumulative effects analysis area post-treatment (i.e., 19,222 acres (96%) retained of 19,921 existing acres). However, in addition to the DNRC project, the USFS GLRA Project could occur concurrently within the cumulative effects analysis area. Under the USFS proposal, approximately 2,176 could be affected in some way, of which approximately 996 of the acres could be converted temporarily to unsuitable habitat. Should both projects occur, up to 1,696 acres (9% of total suitable) could be temporarily converted from suitable habitat to temporary non-suitable habitat on both ownerships leaving approximately 18,226 acres of suitable habitat remaining (Table W-4). Should any individual lynx be present in the cumulative effects analysis area at the time logging activities are initiated by both agencies, there would be increased risk of their displacement due to the increased level of noise and disturbance for the duration of the project (periodically for up to 6 years). Should lynx be present in the vicinity, such disturbance could render some habitat temporarily unavailable for denning or foraging in the local areas where project activities would take place. Risk of any displacement attributable to motorized project activities beyond 6 years would not be expected. Disturbance associated with motorized and non-motorized human activities conducted in conjunction with both projects would be in addition to existing levels of human disturbance attributable to dispersed recreational activities during all seasons of the year. Given the

proposed treatment types and relatively small size and location of the patches of lynx habitat affected, habitat connectivity would not be appreciably altered by either project. Similarly, maintenance of linkage potential would be minimally influenced as considerable amounts of forest cover and lynx habitat would remain after timber harvest, and no additional open roads or human developments would occur as a part of either proposal. In summary, given that: 1) the 1,696 acres (~9%) (i.e., 700 acres on DNRC lands and approximately 996 acres on USFS lands) of habitat that would be affected is a relatively small amount in the context of an average lynx home range size; 2) that any associated habitat effects would be temporary, but conifer stands may take 15 to 30 years to regenerate; 3) habitat found on the project area is and portions of the cumulative effects analysis area are marginal lynx habitat suitable for use for travel or matrix habitat; 4) risk of displacement due to motorized activities would be temporary and short-term up to 6 years, 5) habitat connectivity and linkage would not be appreciably altered by project activities -- the DNRC Palisades and USFS GRLA Projects would result in a low level of adverse cumulative effects to lynx habitat and lynx.

Table W-4. Acreages by alternative of lynx habitat on the 37,310-acre DNRC Palisades Timber Sale Cumulative Effects Analysis Area (Data sources DNRC SLI 2013, USGS 2003, FLI 2011 and MSDI 2010). Suitable lynx habitat is defined as unburned areas >5,000 elevation possessing coniferous forest cover with >40% canopy cover, and aspen stands. Non-lynx habitat includes all forest with <40% canopy cover and non-forest classes.

Lynx Habitat Class	No Action Alternative Acres (%)	Action Alternative Acres Post Harvest DNRC Palisades Timber Sale Only (%)	Action Alternative Acres Post Harvest DNRC Palisades and USFS GRLA Projects (%)
Suitable Lynx Habitat (% of CE Analysis Area)	19,921 (53%)	19,222 (51%)	18,226 (49%)
Non-Lynx Habitat (% of CE Analysis Area)	17,389 (47%)	18,088 (49%)	19,084 (51%)
Total	37,310	37,310	37,310

Issue -- Grizzly Bear

Grizzly Bear

There is concern that timber harvesting activities could remove security cover, cause displacement of bears, increase roads, and increase presence of unnatural attractants and bear foods, which could adversely affect grizzly bears.

Measurement Criteria

Assessment of extent of cover removal [data sources DNRC SLI habitat data (2013), USGS 2003, and MSDI (2010)]; type, season and duration of proposed activities; and assessment of changes

in road types and amounts assessed within the 4,755-acre project area and 37,310-acre cumulative effects analysis area.

Affected Environment -- Grizzly Bear

In April 2007, the USFWS delisted grizzly bears in the Greater Yellowstone Ecosystem (GYE). In September 2009, the US District Court vacated the delisting rule, placing bears in that ecosystem back to listed status as a threatened species. The ruling is currently under appeal by the USFWS.

Forest-management activities may affect grizzly bears by altering cover and/or by increasing access to humans into otherwise secure areas by creating roads (Mace et al. 1996). Forest management operations can reduce the ability of vegetation and cover to conceal grizzly bears, which can lower effective bear use of habitat and render bears more vulnerable to human-caused mortality (Servheen et al. 1999). These actions could lead to the displacement of grizzly bears from preferred areas and/or result in an increased risk of human-caused mortality by bringing humans and bears closer together, which can increase their risk of being killed. Displacing bears from preferred areas may increase their energetic costs, particularly during the spring period, which may in turn lower their ability to survive and/or reproduce successfully. The greatest sources of grizzly bear mortality in both the GYE and Northern Continental Divide Ecosystem in Montana are attributable to human-related causes -- particularly associated with the acquisition of unnatural foods (Schwartz et al. 2006, Haroldson et al. 2006, Servheen 2009).

If people implementing forest management activities on the project area were to possess bear attractants that were stored in a non-secure manner, the risk of creating bear management situations could be elevated -- resulting in the prompt of future removal of a problem bear(s).

The project area lies approximately 21 miles due north of the GYE Grizzly Bear Recovery Zone, and occurs at the northerly edge of the occupied habitat boundary described by Wittinger (2002). There have been a number of confirmed grizzly bear sightings in the vicinity of the project area during the last several years and their numbers appear to be increasing (R. Mule', DFWP R-5, Biologist, pers. comm. 2/29/12). Given the frequency and types of observations, it is possible that a few grizzly bears may periodically use the general area as part of their home ranges during the non-denning seasons. Within the project area approximately 1,682 acres (35% of project area) of quality hiding cover with greater than 40% overstory canopy cover currently exists. An additional 1,233 acres (26% of project area) of aspen and deciduous stands occur in the project area. Within the 37,310-acre cumulative effects analysis area, 16,252 acres (44% of CE analysis area) of quality hiding cover with greater than 40% overstory canopy cover currently exists, and 3,699 additional acres (10% of CE analysis area) of aspen and deciduous stands are present. No open roads are present on the project area, but 18.1 miles of restricted roads are present at a density of 2.4 miles/sq. mi. Within the cumulative effects analysis area, approximately 50.8 miles of both restricted and open road classes combined are present. Recreational use and livestock grazing occurs within the project area and 37,310-acre cumulative effects analysis area, which may influence use of these lands by grizzly bears. Areas

suitable as denning habitat at high elevations on slopes >45% do not occur on the project area or within 1 mile of the project area.

-*Environmental Consequences*

--Direct and Indirect Effects of the No Action Alternative

Under this alternative none of the proposed forest management activities would occur, thus no direct or indirect effects to grizzly bears would be anticipated.

--Direct and Indirect Effects of the Action Alternative

Under the proposed action, cover and habitat connectivity associated with riparian areas would not be appreciable altered as no riparian timber harvesting would occur in the project. Across the project area, dense patches of mature forest cover would also remain and approximately 1,181 acres of aspen stands would remain. Retained stands of mature conifers and forested stringers would generally remain well connected and provide escape cover and visual screening, albeit at reduced levels from the existing condition. Of the 4,755-acre project area, 1,035 acres (22% of project area) would remain in coniferous mature forest cover with >40% overstory canopy closure and 1,181 acres of standing aspen would be retained (25% of project area). Following logging, forest patches on the project area would have variable tree density and would continue to provide a mosaic of habitat conditions. Overall, stand density would be reduced on 789 acres of mature forest. Tree density would be reduced most on 700 acres comprised mainly of lodgepole pine, so remaining cover would be sparse on these affected acres, causing bears that may wander into such areas to be more detectable by humans, which would result in minor added risk for bears, particularly in fall during the big game general hunting season. Intensively treated stands would likely take 15 to 30 years to regenerate into a suitable hiding cover comprised of lodgepole pine, aspen, and Douglas-fir sapling stands. Although there would be reductions in the acreage of cover following timber harvest, ample amounts of hiding cover and connected mature forest patches would remain in the project area, which would maintain suitable hiding and escape cover for grizzly bears, should they occasionally use the area.

Currently, there are 13 miles of restricted roads and approximately 5.1 miles of restricted motorized trails in the 4,755-acre project area, resulting in a motorized access route total of 18.1 miles and a density of 2.4 miles/sq. mile. To conduct the project, 5.2 miles of temporary road would be constructed and reclaimed after use. An additional 4.1 miles of road would be constructed and would remain permanent, but would remain restricted to motorized public use. In total, 17.3 miles of road would be operational and used in conjunction with logging activities for the duration of the project (2 to 4 years). Following completion of activities, 14.4 miles of restricted roads would remain as well as 6.1 miles of motorized trails, resulting in an increase of 2.4 miles of restricted motorized access routes, to be used primarily for future DNRC administrative purposes. Non-motorized public uses would continue to be allowed. The post project motorized access route total would be 20.5 miles and density would be 2.8 miles/sq. mi., which would be an increase of 0.4 miles/sq. mi. (17%) from the existing condition. Temporary

and existing restricted roads that would be reclaimed would be made impassible to off road vehicles and motorized passenger vehicles through various means including semi-permanent barrier types, slashing, debris scattering, road surface obliteration, and partial prism obliteration etc. During harvest operations disturbance from motorized equipment could disturb and displace bears and habitat in the project area, and habitats in the nearby vicinity may temporarily be unusable due to the level of noise and human activity. To minimize disturbance to grizzly bears during the spring period when they are nutritionally stressed, commercial activities (logging, hauling, road construction and re-construction) would be prohibited on the project area between April 1 to June 15. No public motorized access would be allowed in the project area while harvest activities are underway, thus no added risk due to this cause would be present. There would be short-term added risk of disturbance and displacement of grizzly bears that could result in minor adverse effects associated with logging operations, short term road construction, and road use. Minimal long-term measurable impacts to grizzly bears would be attributable to the overall increase in restricted road density of 0.4 miles/sq. mi. that would occur following project completion.

Under the action alternative DNRC field staff and contractors would be required to keep any unnatural bear foods or attractants (such as garbage) in a bear resistant manner. If contractors request to camp on or near the project area, they would be required by the operating contract to store any unnatural bear foods and attractants in a bear resistant manner. Compliance with contract terms would frequently be evaluated and would be enforced by a DNRC contract administrator. Any added risk to grizzly bears associated with unnatural bear foods or attractants would be minimal.

Given that: 1) 1,035 acres of conifer forest with >40% canopy cover would remain on the project area (comprising 22% of project area); 2) 1,181 acres of aspen stands of various ages would remain on the project area (comprising 25% of project area); 3) a mosaic of habitat conditions would remain following harvest and cover along riparian areas would be retained; 4) 700 acres of intensively treated stands would likely take 15 to 30 years to regenerate into a suitable hiding cover comprised of lodgepole pine, aspen, and Douglas-fir sapling stands; 5) linear road amounts would increase by 2.4 miles on the project area resulting in a density increase of 0.4 miles/sq. mi., but public motorized use would be restricted, which would limit long-term disturbance; 6) disturbance could occur on the project area for up to 4 years; 7) DNRC field staff and contractors would be required to keep any unnatural bear foods or attractants (such as garbage) in a bear resistant manner; and 8) commercial activities would be restricted during the spring period between April 1 and June 15; -- there would be a low level of adverse affects to grizzly bears associated with this project.

--Cumulative Effects of the No Action Alternative

Under this alternative none of the proposed logging activities or road construction and use would occur, thus no cumulative effects to grizzly bears would be anticipated.

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--Cumulative Effects of the Action Alternative

Under the proposed action, cover and habitat connectivity associated with riparian areas would not be altered as no riparian timber harvesting would occur in the Palisades project. Across the 37,310-acre DNRC cumulative effects analysis area following treatments on DNRC lands, large dense patches of mature forest cover and aspen groves and thickets would be present on 19,222 acres (52% of analysis area), which would provide a suitable network of cover capable of providing visual screening and facilitating movements of grizzly bears across the local landscape. Of the 37,310-acre cumulative effects analysis area, approximately 15,605 acres (42% of CE analysis area) would remain in mature forest cover with >40% overstory canopy closure. Following logging, forest patches on the project area would have variable tree density and would continue to provide a mosaic of habitat conditions. Overall, stand density would be reduced on 789 acres of mature forest. Tree density would be reduced most on 700 acres comprised mainly of lodgepole pine, so remaining cover would be sparse on these affected acres, causing bears that may wander into such areas to be more detectable by humans, which would result in minor added risk for bears, particularly in fall during the big game general hunting season. Intensively treated stands would likely take 15 to 30 years to regenerate into a suitable hiding cover comprised of lodgepole pine, aspen, and Douglas-fir sapling stands. If this DNRC project and the USFS GRLA project were occur simultaneously, the acreage of mature forest cover with >40% crown closure could be reduced to approximately 14,609 acres (39%) within the 37,310-acre cumulative effects analysis area. Openings reducing connectivity of mature forest would be created under the proposals of both agencies, which could reduce cover amount and quality for grizzly bears. However, habitat connectivity would not likely be substantially altered within the cumulative effects analysis area following treatments, because the majority of the remaining acreage of suitable cover would generally remain in large, well, connected patches across the area, particularly along the northerly-facing slopes of the Beartooth Face. Also, of the 2,965 acres of vegetation that both agencies have proposed for treatment, approximately 1,269 (43%) would continue to possess moderately to well stocked forest conditions post disturbance due to the partial harvest treatment prescriptions being proposed. Within treated stands on both the DNRC and USFS projects, individual trees and patchy tree retention would remain, which would continue to provide some lesser amounts of escape cover and visual screening within treatment areas. Although there would be some minor reductions in the acreage of cover following timber harvest, ample amounts of hiding cover and connected mature forest patches would remain in the cumulative effects analysis area, which would maintain suitable cover conditions for grizzly bears.

Within the cumulative effects analysis area there are currently approximately 50.8 miles of existing roads at an overall total road density of 0.9 miles/sq. mi. Following the DNRC project alone, road miles (and motorized trails) would increase by 2.4 miles for a total of 53.2 miles, which would result in a minimal change in density that would remain at 0.9 miles/sq. mi. Under the USFS GRLA proposal, 8.0 miles of temporary road could be constructed and decommissioned following use, and an additional 5.4 miles of existing road in the cumulative effects analysis area would be decommissioned as a part of project activities. Thus, should the USFS GRLA project occur as proposed, there would be a net reduction of 3.0 miles of roads in

the cumulative effects analysis area overall. Thus, following both projects total road miles would equal 47.8 and density would drop slightly to 0.8 miles/sq. mile in the cumulative effects analysis area. During road construction and the decommissioning of segments in both projects, the disturbance could directly displace grizzly bears for up to 6 years, and could influence their movement patterns while projects are active. Given that the relative amount of new roads and trails would decrease slightly overall, but public motorized access would remain restricted, minimal additional risk of long-term displacement and/or habitat avoidance by grizzly bears would be anticipated in association with the presence of motorized roads and trails compared to the existing condition. Following completion of USFS and DNRC project activities, continued use of habitats within the cumulative effects analysis area during the non-denning season would be expected.

Additional short-term disturbance associated with forest management activities proposed under both projects would be cumulative to existing high levels of motorized and non-motorized public recreational use, which occur within the cumulative effects analysis area. Such disturbance could increase the potential for temporary displacement of grizzly bears sensitive to the increased presence of humans and motorized activities. If present in the area, some bears could be displaced from normal home range areas into places with lower quality habitat, and/or be pressed into nearby areas possessing greater inherent risk of conflict with humans (eg. areas with high hunter density, subdivisions, home sites, and agricultural lands). Overall, forest management activities associated with the proposed DNRC action would have a minor adverse cumulative impact on forest conditions and well-connected mature forest cover, and minor, temporary impacts associated with logging disturbance and displacement of grizzly bears.

Under the action alternative DNRC field staff and contractors would be required to keep any unnatural bear foods or attractants (such as garbage) in a bear resistant manner. It is unlikely that contractors would request to camp on or near the project area, however, should they choose to do so, they would be required by a contract stipulation to store any unnatural bear foods and attractants in a bear resistant manner. Terms of the contract would frequently be evaluated and would be enforced by a DNRC contract administrator. Any added cumulative risk to grizzly bears associated with unnatural bear foods or attractants would be minimal. Overall, given that: 1) at least 14,609 acres of conifer forest with >40% canopy cover would remain in the cumulative effects analysis area (39% of analysis area); 2) also 3,617 acres of multi-aged aspen stands would continue to provide cover after treatments for a combined total cover area of 19,222 acres that would remain in the cumulative effects analysis area (comprising 52% of analysis area); 3) a mosaic of habitat conditions would remain following harvest and cover along riparian areas would be retained; 4) 1,696 acres of intensively treated stands across both projects would likely take 15 to 30 years to regenerate into a suitable hiding cover comprised of lodgepole pine, aspen, and Douglas-fir sapling stands; 5) linear road amounts would decrease by 3 miles across both projects in the cumulative effects analysis area resulting in a density decrease of 0.1 miles/sq. mi. and public motorized use would be restricted, which would limit long-term disturbance; 6) disturbance could occur on the cumulative effects analysis area for up

to 6 years; 7) DNRC field staff and contractors would be required to keep any unnatural bear foods or attractants (such as garbage) in a bear resistant manner; and 8) commercial activities would be restricted during the spring period between April 1 and June 15; -- there would be a low level of adverse cumulative affects to grizzly bears associated with this project.

Big Game

Issue--Big Game Security

There is concern that timber harvesting and road building will reduce security and seasonal cover for moose, elk, white-tailed deer, and mule deer, resulting in reduced numbers and/or their displacement from the area.

Measurement Criteria

The measurement criteria used to evaluate impacts related to big game species included: the timing of proposed activities, location of proposed activities, scale of activities, quantified cover amounts considering thresholds recommended by Hillis et al. (1991) and using the following data sources: [data sources DNRC SLI habitat data (2013), USGS (2003) and MSDI (2010)], elk herd unit boundaries (USFS 2012), fire polygon data (FLI 2011), road amounts DNRC SLI road data (2013), visual assessments of aerial photography and visual evaluation of cover and topography as related to linkage areas. Pre harvest canopy cover estimates for cumulative effects were obtained from the USGS (2003) cover layer and post harvest estimates were derived by subtracting acreages of harvest units that were deemed likely to possess <40% coniferous crown cover following treatments.

Affected Environment -- Big Game Security

Timber harvesting can increase vulnerability of big game animals by changing the size, structure, juxtaposition, and accessibility of areas that provide security during hunting season (Hillis et al. 1991). As visibility and accessibility increase within forested landscapes, moose, elk and deer have a greater probability of being observed and, subsequently, harvested by hunters, or they may become displaced or reduced in numbers due to lowered effective carrying capacity of the local habitat. Reduced cover attributable to logging and roads can also influence the effective use of habitat for big game species; particularly highly social species such as elk (Lyon et al. 1985). For the purpose of this analysis, cover was considered generically as "big game cover" for the four species of concern. Because elk are highly social wide-ranging species, providing for their cover needs helps ensure that habitat needs for other ungulates, such as deer and moose are met as well. Because of their smaller size and behavioral differences, mule deer and white-tailed deer are able to use smaller cover patches more effectively for escape and security. Moose are a solitary, wide-ranging species capable of effectively using relatively small cover patches, and the hunting season for moose is heavily regulated, greatly reducing risk of overharvest by humans. Therefore, for this analysis we assumed that if available security cover would provide for the needs of elk, it would also generally be adequate to meet the needs of moose, mule deer, and white-tailed deer.

Direct and indirect effects were considered at the scale of the project area. Cumulative effects were evaluated using a threshold value of 30% security cover within an analysis area the size of an elk herd home range (Hillis et al. 1991). Thus, the Butcher Creek Elk Herd Unit boundary was selected as the cumulative effects analysis area for this project. For this analysis the 30% threshold cover value was used as general indicator of pre and post harvest habitat suitability at the scale of the 124,029 acre Butcher Creek Elk Herd Unit (USFS 2012). To evaluate the potential for adverse impacts to big game security cover, only moderate to dense mature forest stands (with >40% over story canopy cover) of patch size generally >250 acres in relatively roadless areas were considered to contribute to security.

The project area is located just within the northerly boundary of DFWP Hunting District 520, and lands within the project area are part of the home range of a local elk herd that has consistently numbered approximately 100 animals since 2002 (S. Stewart, R-5, DFWP Biologist, pers. comm., 6/7/13). Moose, white-tailed deer and mule deer are also common in this herd unit, however, mule deer have appeared to decline in numbers recently along the Beartooth Face (R. Mule', DFWP R-5, Biologist, pers. comm. 2/29/12). Portions of the project area that receive the greatest use by elk and mule deer are generally sections 7 and 8 in the western portion of the area (S. Stewart, R-5, DFWP Biologist, pers. comm., 1/31/13).

The Butcher Creek Elk Herd Unit (124,029 acres) is an area delineated by wildlife managers to approximate the herd home range for elk in this area. Private agricultural lands to the north of the project area occur within both Hunting Districts 520 and 575 and make up the majority of the Butcher Creek Elk Herd Unit at 69% (Table W-5). Whereas, DNRC manages approximately 6% of the cumulative effects analysis area (Table W-5). Currently there are approximately 1,682 acres of coniferous cover with >40% canopy cover in the 4,755-acre project area (35% of project area), and 19,347 acres within the 124,029-acre cumulative effects analysis area (16% of cumulative effects analysis area). Existing low cover values in the cumulative effects analysis area are a result of the inclusion of the substantial acreage of private non-forested agricultural and pasture lands in this unit. Existing cover in this elk herd unit at 16% is well below the suggested threshold amount of 30% for the analysis unit (Hillis et al. 1991). Human uses such as farming, ranching and recreation are prevalent in this area. Also, within a broader geographic area around the Palisades Project Area, a number of large wildfires greater than 100 acres have burned since 1990. These have included the Sand Dunes Fire 1990 (900 ac.), the Robertson Draw Fire 1991 (3,341 ac), the Shepard Mountain Fire 1996 (14,890 ac), the Parkside Fire 1998 (148 ac), the Willie Fire 2000 (1,413 ac), the Cascade Fire 2008 (10,174 ac), and the Hole in the Wall Fire 2011 (6,203 ac). In total, these fires have burned approximately 37,070 acres of habitat and cover during the last two decades. Of these fires, two more directly affected vegetation within the Butcher Creek Elk Herd Unit. These include the Shepard Mountain Fire 1996 (14,890 ac) and the Cascade Fire 2008 (10,174) totaling 25,064 acres. Approximately 9,537 acres in these two fires occurred within the Butcher Creek Elk Herd Unit boundary. These fires have reduced available cover within the Butcher Creek Elk Herd Unit boundary and at the landscape scale for the big game species of concern in this analysis. Where cover data was limited and too old to capture effects of vegetation from more recent burns, fire perimeters were

overlaid to estimate areas of cover loss. For this analysis given data limitations, it was assumed that all cover within fire perimeters was removed, to provide a realistic, "worst case" baseline condition for analysis purposes.

Table W-5. Acreage by landowner in the Butcher Creek Elk Herd Unit cumulative effects analysis area for the DNRC Palisades Timber Sale.

Landowner	Butcher Creek Elk Herd Unit Acres (% of Herd Unit)
Private	85,112 (69%)
USFS	30,620 (25%)
DNRC	8,169 (6%)
BLM	128 (0.1%)
Total	124,029

-Environmental Consequences

--Direct and Indirect Effects of the No Action Alternative

Under this alternative none of the proposed forest management activities would occur, thus no direct or indirect effects to security habitat for moose, elk, mule deer and white-tailed deer would be anticipated.

--Direct and Indirect Effects of the Action Alternative

Under the action alternative, tree density within harvested stands would be reduced on 789 acres of mature forest. Of the existing 1,682 acres of security habitat patches on the project area with >40% mature conifer canopy cover, 647 acres would be removed leaving 1,035 acres (62%) after logging. Thus, 22% of the 4,577-acre project area would remain in mature forest conifer cover. Across the project area other dense patches of mature forest cover would be present and remain well connected, particularly with very large blocks of unfragmented, continuous mature forest to the south on USFS lands (see cumulative effects subsection below for more details). Following logging, forest patches on the project area would have variable tree density (albeit, much lower in intensively logged stands), and would continue to provide a mosaic of habitat conditions. Within harvested stands, individual trees and retention along riparian areas would remain, which would continue to provide some amount of escape cover and visual screening for big game animals. Although there would be 647 less acres of cover capable of providing security following timber harvesting, hiding cover and connected mature forest patches would remain in the project area, which would maintain suitable cover conditions for moose, elk, mule deer, and white-tailed deer, which would be expected to continue to use the project area. Given the expected reductions in mature forest cover, individuals of the four big game species of concern could be displaced immediately following project activities for up to several decades.

Following logging associated with this project, harvested stands could require up to 30 years before security cover would re-establish. Reduced numbers of big game animals in the area would not be anticipated as considerable mature forest cover would remain in large blocks south of the project area (see cumulative effects discussion below for more details).

Currently, there are 13 miles of restricted roads and approximately 5.1 miles of restricted motorized trails in the 4,755-acre project area, resulting in a motorized access route total of 18.1 miles and a density of 2.4 miles/sq. mile. To conduct the project, 5.2 miles of temporary road would be constructed and reclaimed after use. An additional 4.1 miles of road would be constructed and would remain permanent, but would remain restricted to motorized public use. In total, 17.3 miles of road would be operational and used in conjunction with logging activities for the duration of the project (2 to 4 years). Following completion of activities, 14.4 miles of restricted roads would remain as well as 6.1 miles of motorized trails, resulting in an increase of 2.4 miles of restricted motorized access routes, to be used primarily for future DNRC administrative purposes. Non-motorized public uses would continue to be allowed. The post project motorized access route total would be 20.5 miles and density would be 2.8 miles/sq. mi., which would be an increase of 0.4 miles/sq. mi. (17%) from the existing condition. Temporary and existing restricted roads that would be reclaimed would be made impassible to off road vehicles and motorized passenger vehicles through various means including semi-permanent barrier types, slashing, debris scattering, road surface obliteration, and partial prism obliteration etc. During harvest operations disturbance from motorized equipment could disturb and displace big game animals in the area, and habitats in the nearby vicinity may temporarily be unusable due to the level of noise and human activity. No public motorized access would be allowed in the project area while harvest activities are underway, thus no added risk due to this cause would be present. There would be short-term added risk of disturbance and displacement of big game animals that could result in minor adverse effects associated with logging operations, short term road construction, and road use. Minimal long-term measurable impacts to moose, elk, mule deer or white-tailed deer would be attributable to the overall increase in restricted road density of 0.4 miles/sq. mi., that would occur following project completion.

Given that: 1) 1,035 acres of conifer forest with >40% canopy cover would remain on the project area (comprising 22% of project area); 2) a mosaic of habitat conditions would remain following harvest and cover along riparian areas would be retained; 3) 700 acres of intensively treated stands would likely take 15 to 30 years to regenerate into a suitable hiding cover comprised of lodgepole pine, aspen, and Douglas-fir sapling stands; 4) linear road amounts would increase by 2.4 miles on the project area resulting in a density increase of 0.4 miles/sq. mi., but public motorized use would be restricted, which would limit long-term disturbance; 5) disturbance could occur on the project area for up to 4 years -- there would be a moderate level of adverse direct and indirect affects to moose, elk, mule deer and white-tailed deer associated with this project.

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--Cumulative Effects of the No Action Alternative

Under this alternative none of the proposed forest management activities would occur, thus no cumulative effects related to security and cover for moose, elk, mule deer and white-tailed deer would be anticipated.

--Cumulative Effects of the Action Alternative

Under the proposed action, cover and habitat connectivity associated with riparian areas would not be altered as no riparian timber harvesting would occur in the Palisades project. Across the 124,029-acre DNRC cumulative effects analysis area (i.e., Butcher Creek Elk Herd Unit Boundary) following treatments on DNRC lands, large dense patches of mature forest conifer cover and aspen groves and thickets would be present on 24,590 acres (20% of analysis area), which would provide a network of cover capable of providing visual screening and facilitating movements of moose, elk and deer across the local landscape. The greatest amounts of the highest quality security cover are found in the southerly 1/3 of the herd unit where large connected patches of mature forest stands occur on USFS ownership. Of the 124,029-acre cumulative effects analysis area, approximately 18,700 acres (15% of CE analysis area) would remain in mature forest cover with >40% overstory canopy closure. This percentage is well below recommended threshold values for an elk herd analysis unit (Hillis et al. 1991), however, given the high percentage of private pasture and agricultural land in this herd unit, it is unlikely that the 30% security cover value will ever be attainable.

Following logging, forest patches on the project area would have variable tree density and would continue to provide a mosaic of habitat conditions. Overall, stand density would be reduced on 789 acres of mature forest. Tree density would be reduced most on 700 acres comprised mainly of lodgepole pine, so remaining cover would be sparse on these affected acres, causing big game animals that may wander into such areas to be more detectable by humans, which would result in minor added risk of mortality, particularly in fall during the big game general hunting season. Intensively treated stands would likely take 15 to 30 years to regenerate into a suitable hiding cover comprised of lodgepole pine, aspen and Douglas-fir sapling stands.

If this DNRC project and the USFS GRLA project were occur simultaneously, the acreage of mature forest cover with >40% conifer crown closure could be reduced to approximately 17,704 acres (14%) within the 124,029-acre cumulative effects analysis area. Also multi-aged aspen stands on approximately 4,867 acres would continue to provide cover after both the DNRC and USFS treatments for a combined total remaining cover area of approximately 22,571 acres (18% of analysis area in conifer and aspen stands. Openings reducing connectivity of mature forest would be created under the proposals of both agencies, which could reduce cover amount and quality for big game animals. However, habitat connectivity would not likely be substantially altered within the cumulative effects analysis area following treatments, because the majority of the remaining acreage of suitable cover would generally remain in large, well, connected patches across the area, particularly along the northerly-facing slopes of the Beartooth Face in

the southern portion of the cumulative effects analysis area. Also, of the 2,965 acres of vegetation that both agencies have proposed for treatment, approximately 1,269 (43%) would continue to possess moderately to well stocked forest conditions post disturbance due to the partial harvest treatment prescriptions being proposed. Within treated stands on both the DNRC and USFS projects, individual trees and patchy tree retention would remain, which would continue to provide some lesser amounts of escape cover and visual screening within treatment areas. Although there would be some minor reductions in the acreage of cover following timber harvest, ample amounts of hiding cover and connected mature forest patches would remain in the cumulative effects analysis area, which would maintain suitable cover conditions for moose, elk and deer.

Within the cumulative effects analysis area there are currently approximately 235 miles of existing roads at an overall total road density of 1.2 miles/sq. mi. Following the DNRC project alone, road miles (and motorized trails) would increase by 2.4 miles for a total of 237.4 miles, which would result in a minimal change in density that would remain at 1.2 miles/sq. mi.

Under the USFS GRLA proposal, 8.0 miles of temporary road could be constructed and decommissioned following use, and an additional 5.4 miles of existing road in the cumulative effects analysis area would be decommissioned as a part of project activities. Thus, should the USFS GRLA project occur as proposed, there would be a net reduction of 3.0 miles of roads in the cumulative effects analysis area overall. Thus, following both projects total road miles would equal 232 and density would drop slightly, but would remain at 1.2 miles/sq. mile in the cumulative effects analysis area. The amount and density of open roads would not change from the baseline condition. During road construction and the decommissioning of segments in both projects, the disturbance could directly displace big game animals for up to 6 years, and could influence their movement patterns while projects are active. Given that the relative amount of new roads and trails would decrease slightly overall, but public motorized access would remain restricted, minimal additional risk of long-term displacement and/or habitat avoidance by moose, elk and deer would be anticipated in association with the presence of motorized roads and trails compared to the existing condition. Following completion of USFS and DNRC project activities, continued use of habitats within the cumulative effects analysis area during the non-denning season would be expected, and measureable reductions in numbers for any of the four species considered would not be expected at the herd unit or hunting district scale.

Additional short-term disturbance associated with forest management activities proposed under both projects would be cumulative to existing high levels of motorized and non-motorized public recreational use, which occur within the cumulative effects analysis area. Such disturbance could increase the potential for temporary displacement of big game animals sensitive to the increased presence of humans and motorized activities. If present in the area, some individuals could be displaced from normal home range areas into places with lower quality habitat, and/or be pressed into nearby areas possessing greater inherent risk of human or predator-caused mortality. Overall, forest management activities associated with the proposed DNRC action would have a minor adverse cumulative impact on forest conditions

and well-connected mature forest cover, and minor, temporary impacts associated with logging disturbance and displacement of moose, elk and deer.

Overall, given that: 1) at least 18,700 acres of conifer forest with >40% canopy cover would remain in the cumulative effects analysis area (15% of analysis area); 2) also multi-aged aspen stands on approximately 4,867 acres would continue to provide cover after both the DNRC and USFS treatments for a combined total remaining cover area of 22,571 acres (18% of analysis area in conifer and aspen stands); 3) a mosaic of habitat conditions would remain following harvest and cover along riparian areas would be retained; 4) 1,696 acres of intensively treated stands across both projects would likely take 15 to 30 years to regenerate into a suitable hiding cover comprised of lodgepole pine and Douglas-fir sapling stands; 5) linear road amounts would decrease by 3.0 miles across both projects in the cumulative effects analysis area resulting in a density decrease of 0.1 miles/sq. mi. and public motorized use would be restricted, which would limit long-term disturbance; 6) disturbance could occur on the cumulative effects analysis area for up to 6 years; and 7) the cumulative effects analysis area has inherently low cover values due to the abundance of private land within the boundary; -- thus, there would be a low level of adverse cumulative affects to moose, elk, mule deer, and white-tailed deer associated with this project.

Issue -- Big Game Thermal Cover

There is concern that timber harvesting will reduce winter thermal cover for moose, elk, white-tailed deer, and mule deer, resulting in reduced numbers and/or their displacement from the area.

Measurement Criteria

Same as above for Big Game Security analysis.

Affected Environment -- Big Game Thermal Cover

Relatively disturbance-free areas with low snow accumulation and ample cover and forage are important in winter for moose, elk and deer herds in western Montana. Areas where these species winter are typically found at low to mid elevations (~3,000 to 6,500 ft.) and possess moderate to steep slopes – particularly associated with southerly or westerly exposures. Densely stocked thickets of conifer regeneration and densely forested mature stands provide thermal protection and hiding cover, which can reduce energy expenditures and stress associated with cold temperatures, wind, and human-caused disturbance. Areas with mature forest cover are also important for snow interception, which makes travel and foraging less stressful for elk and deer during periods when snow is deep. Because of their larger size, moose are better adapted to withstand deeper snow conditions and cold temperatures (Jenkins and Wright 1988). Dense stands that are well connected provide for animal movements across wintering areas during periods with deep snow, which improves their ability to find forage and shelter under varied environmental conditions. Thus, removing cover that is important for wintering moose, elk, and deer through forest management activities can increase their energy expenditures and stress in winter. Reductions in cover could ultimately result in a reduction in winter range carrying capacity and subsequent increases in winter mortality within local herds.

For this analysis DFWP winter habitat GIS data layers were obtained for moose, elk, mule deer, and white-tailed deer (DFWP 2008). Winter cover was preliminarily evaluated for pre harvest and post harvest conditions using USGS (2003) cover data, 2011 NAIP photography and FLI (2011) fire perimeter data for both the 4,755-acre project area and 124,029-acre Butcher Creek Elk Herd Boundary. Elk and white-tailed deer spend sizable portions of most winters north of project area lands on neighboring private agricultural lands where there is little thermal cover provided by conifers. While some portions of mapped winter range for white-tailed deer, mule deer, elk and moose occurred in the Butcher Creek Elk Herd Unit, it was deemed more appropriate to analyze changes to cover at the 37,310-acre cumulative effects analysis scale for this project. The 37,310-acre analysis unit is the scale where most activities would be concentrated by both DNRC and the USFS, and is the general location where the majority of dense conifer cover persists in the local geographic area. Within the cumulative effects analysis area selected, one recent fire affected cover during the last two decades -- the Cascade Fire. The cumulative effects analysis area overlaps approximately 67 acres of the area that burned in this fire. However, these acres occurred along the ridge top east of Bare Mountain at approximately 9,000 ft. in elevation. Thus, these areas would not be expected to receive use in winter by any of the big game species of concern due to deep snow and harsh winter conditions in this zone.

Based on coarse scale winter range maps developed by DFWP (2008), no white-tailed deer winter range occurs within the project area or 37,310-acre cumulative effects analysis area, thus, they will not be considered further in this analysis (Table W-6). Mapped winter range for mule deer, elk and moose in the project area ranges from 3,141 acres to 4,755 acres within the project area, and from 9,540 to 21,039 acres in the cumulative effects analysis area (Table W-6). These values represent the general area where winter range occurs for these species, but all acres do not provide suitable cover attributes. There are currently 1,682 acres of thermal cover in the project area (35% of project area), and 16,252 acres of thermal cover in the cumulative effects analysis area (44% of cumulative effects analysis area). There are also 18.1 miles of restricted roads and restricted motorized trails in the project area and 50.8 miles of roads (both restricted and open classes combined) in the cumulative effects analysis area.

Table W-6. Acreages of mapped big game winter range by species on the DNRC Palisades Timber Sale Project Area and cumulative effects analysis area. Data sources DNRC SLI (2013), and DFWP (2008).

Species	Acreage of Mapped Winter Range on the 4,755-acre Project Area (% of Area)	Acreage of Mapped Winter Range on the 37,310-acre Cumulative Effects Analysis Area (% of Area)
White-tailed Deer	0 (0%)	0 (0%)
Mule Deer	3,142 (66%)	9,540 (26%)
Elk	4,755	19,831

	(100%)	(53%)
Moose	4,755 (100%)	21,039 (56%)

-Environmental Consequences -- Big Game Thermal Cover

--Direct and Indirect Effects of the No Action Alternative

Under this alternative none of the proposed forest management activities would occur that could disturb wintering moose, elk, mule deer, or white-tailed deer, and no forested cover would be altered. Thus, no direct or indirect effects to wintering animals or big game winter range would be anticipated.

--Direct and Indirect Effects of the Action Alternative

Under the action alternative, stand density and winter cover with >40% overstory canopy cover would be reduced on 789 acres of mature forest in the project area. Of the 4,755-acre project area, 1,035 acres (22% of project area) would remain in mature forest cover with >40% overstory canopy closure following logging. All of these acres with residual cover would persist below 6,500 feet elevation and would be potentially usable for big game animals in winter, particularly moose and mule deer. Following logging, forest patches on the project area would continue to have variable tree density and would continue to provide a mosaic of habitat conditions, albeit of reduced quality for use in winter. Mature forest stands in the project area would generally remain well connected and provide a suitable network of cover capable of facilitating movements of wintering animals across the local landscape. Within harvested stands, individual trees and patchy tree retention would remain, which would continue to provide limited escape cover and visual screening.

Of the wintering areas identified using DFWP habitat layers (DFWP 2008), no cover on white-tailed deer winter range would be affected, however, cover would be affected for the other three species. Cover on approximately 497 acres of mule deer winter range would be affected, and 647 acres of cover on elk and moose winter ranges would be affected (Table W-7). Harvested stands where cover would be removed could require 30 to 50 years to regenerate and attain a size capable of providing thermal cover.

Table W-7. Acreage of thermal cover areas with >40% overstory canopy cover on big game winter range by species and alternative on the DNRC Palisades Timber Sale Project Area. Data sources DNRC SLI (2013), DFWP (2008), USGS (2003) and FLI (2011).

Species	No Action Alternative Winter Cover Acres (% of Project Area)	Action Alternative Winter Cover Acres (% of Project Area)	Difference in Acres (% Change)
White-tailed Deer	0 (0%)	0 (0%)	0 (0%)
Mule Deer	1,158 (24%)	661 (14%)	497 (10%)

Elk	1,682 (35%)	1,035 (22%)	647 (13%)
Moose	1,682 (35%)	1,035 (22%)	647 (13%)

Under the action alternative, approximately 17.3 miles of existing and new roads would be used to conduct harvest activities. Some logging activities could occur in the winter, and disturbance created by mechanized logging equipment and trucks would likely temporarily displace big game animals during periods of operation for 2 to 4 years. Following harvest activities, the remaining total road density consisting entirely of restricted roads (allowable uses -- foot and non-motorized travel, and DNRC administrative use only) would be 2.8 miles/square mile and disturbance levels would revert back to pre-project conditions with minimal disturbance to wintering big game animals. No public motorized access would be allowed in the project area while harvest activities are underway, thus no added risk of displacement due to this cause would be present. There would be short-term added risk of disturbance and displacement of wintering animals that could result in moderate adverse effects associated with logging operations, short term road construction and road use in the project area. However, no long-term appreciable impact to winter range carrying capacity or factors that would create long-term displacement or reduced numbers of big game detectable at the scale of an elk herd unit would be anticipated.

Overall, given that: 1) approximately 1,035 acres of thermal cover would remain on the project area following logging; 2) that mature forest stands in the project area would generally remain well connected and provide a suitable network of cover capable of facilitating movements of wintering animals across the local landscape; 3) patchy tree retention would remain, which would continue to provide limited escape cover and visual screening; 4) harvested stands where cover would be removed could require 30 to 50 years to regenerate and attain a size capable of providing thermal cover; 5) disturbance during some portions of each winter could occur in harvest units and on 17.3 miles of roads in the project area, which could temporarily disturb and displace wintering big game animals for 2 to 4 years; and 6) all used roads would remain restricted following their use and no long-term appreciable impacts to winter range carrying capacity or displacement would be anticipated -- Thus, moderate adverse effects to moose, elk, and mule deer would be expected.

--Cumulative effects of the No Action Alternative

Under this alternative none of the proposed forest management activities would occur that could disturb wintering moose, elk, mule deer, or white-tailed deer, and no forested cover would be altered. Thus, no direct or indirect effects to wintering animals or big game winter range would be anticipated.

--Cumulative Effects of the Action Alternative

Under the action alternative, stand density and winter cover with >40% overstory canopy cover would be reduced on 789 acres of mature forest in the 37,310-acre cumulative effects analysis area. Of the 37,310-acre analysis area under DNRC's project alone, approximately 15,605 acres

(42% of the CE analysis area) would remain in mature forest cover with >40% overstory canopy closure following logging. Approximately 1/3 of these acres with residual cover would persist below 6,500 feet elevation (5,150 acres) and would be potentially usable for big game animals in winter; particularly moose, and mule deer. Following logging, forest patches in the cumulative effects analysis area would continue to have variable tree density and would continue to provide a mosaic of habitat conditions, albeit of reduced quality for use in winter. Mature forest stands in the project area would generally remain well connected and provide a suitable network of cover capable of facilitating movements of wintering animals across the local landscape. Within harvested stands, individual trees and patchy tree retention would remain, which would continue to provide limited escape cover and visual screening.

Of the wintering areas identified using DFWP habitat layers (DFWP 2008), no cover on white-tailed deer winter range would be affected and they will not be discussed in further detail in this analysis. However, cover would be affected for the other three species. As for the project area, cover on approximately 497 acres of mule deer winter range would be affected, and 647 acres of cover on elk and moose winter ranges would be affected (Table W-8). Harvested stands where cover would be removed could require 30 to 50 years to regenerate and attain a size capable of providing thermal cover. If this DNRC project and the USFS GRLA project were occur simultaneously, the acreage of mature forest cover with >40% crown closure could be reduced to approximately 14,609 acres (39%) within the 37,310-acre cumulative effects analysis area. Openings reducing connectivity of mature forest would be created under the proposals of both agencies, which could reduce cover amount and quality for wintering big game animals. However, habitat connectivity would not likely be substantially altered within the cumulative effects analysis area following treatments, because the majority of the remaining acreage of suitable cover would generally remain in large, well, connected patches across the area, particularly along the northerly-facing slopes of the Beartooth Face. However, only about 1/3 of the remaining 14,609 acres (approximately 4,865) of thermal cover would exist below 6,500 feet in elevation and would be usable by moose, elk and mule deer. Of the 2,965 acres of vegetation that both agencies have proposed for treatment, approximately 1,269 (43%) would continue to possess moderately to well stocked forest conditions post disturbance due to the partial harvest treatment prescriptions being proposed. Within treated stands on both the DNRC and USFS projects, individual trees and patchy tree retention would remain, which would continue to provide some lesser amounts of escape cover and visual screening within treatment areas.

Table W-8. Acreage of thermal cover areas with >40% overstory canopy cover on big game winter range by species and alternative on the DNRC Palisades Timber Sale 37,310-acre Cumulative Effects Analysis Area. Data sources DNRC SLI (2013), DFWP (2008), USGS (2003) and FLI (2011).

Species	No Action Alternative Winter Cover Acres (% of CE Analysis Area)	Action Alternative Winter Cover Acres (% of CE Analysis Area)	Difference in Acres (% Change)
White-tailed	0	0	0

Deer	(0%)	(0%)	(0%)
Mule Deer	1,869 (5%)	1,372 (4%)	497 (1%)
Elk	4,849 (13%)	4,202 (11%)	647 (2%)
Moose	5,871 (14%)	5,224 (14%)	647 (0%)

Under the action alternative, approximately 17.3 miles of existing and new roads would be used to conduct harvest activities. Some logging activities could occur in the winter, and disturbance created by mechanized logging equipment and trucks would likely temporarily displace big game animals during periods of operation for 2 to 4 years. Within the cumulative effects analysis area there are currently approximately 50.8 miles of existing roads at an overall total road density of 0.9 miles/sq. mi. Following the DNRC project alone, road miles (and motorized trails) would increase by 2.4 miles for a total of 53.2 miles, which would result in a minimal change in density that would remain at 0.9 miles/sq. mi. Under the USFS GRLA proposal, 8.0 miles of temporary road could be constructed and decommissioned following use, and an additional 5.4 miles of existing road in the cumulative effects analysis area would be decommissioned as a part of project activities. Thus, should the USFS GRLA project occur as proposed, there would be a net reduction of 3.0 miles of roads in the cumulative effects analysis area overall. Thus, following both projects total road miles would equal 47.8 and density would drop slightly to 0.8 miles/sq. mile in the cumulative effects analysis area. During project activities proposed by both agencies, the disturbance could directly displace wintering big game animals for up to 6 years, and could influence their movement patterns and habitat use while projects are active. Should winter logging not occur on USFS lands, this disturbance would be considerably less and about ½ the duration. Given that the relative amount of new roads and trails would decrease slightly overall, but public motorized access would remain restricted, and winter activities would be short term, minimal additional risk of long-term displacement and/or habitat avoidance by moose, elk, or mule deer would be anticipated in association with the presence and winter use of motorized roads and trails compared to the existing condition. Following completion of USFS and DNRC project activities, continued use of remaining densely forested habitats within the cumulative effects analysis area in winter would be expected.

No public motorized access would be allowed on DNRC project area lands while harvest activities are underway, thus no added risk of displacement due to this cause would be present. There would be short-term added risk of disturbance and displacement of wintering animals that could result in moderate adverse effects associated with logging operations, short term road construction and road use in the project area. However, no long-term appreciable cumulative impacts to winter range carrying capacity or factors that would create long-term displacement or reduced numbers of big game detectable at the scale of an elk herd unit would be anticipated.

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Overall, given that: 1) at least 14,609 acres of thermal cover would remain in the cumulative effects analysis area following logging; 2) that mature forest stands in the project area would generally remain well connected and provide a suitable network of cover capable of facilitating movements of wintering animals across the local landscape; 3) patchy tree retention would remain, which would continue to provide limited escape cover and visual screening; 4) that only about 1/3 of the remaining thermal cover would persist below 6,500 feet elevation; 5) harvested stands where cover would be removed could require 30 to 50 years to regenerate and attain a size capable of providing thermal cover; 6) disturbance during some portions of each winter could occur in harvest units and on 17.3 miles of roads in the project area and on USFS lands, which could temporarily disturb and displace wintering big game animals in the cumulative effects analysis area for up to 6 years; 7) total road density would essentially remain unchanged following both projects; and 8) all roads; that would be used would remain restricted following their use and no long-term appreciable impacts to winter range carrying capacity or displacement would be anticipated -- thus, a low level of adverse effects to moose, elk, and mule deer would be expected. No long-term appreciable cumulative impacts to winter range carrying capacity or factors that would create long-term displacement or reduced numbers of big game detectable at the scale of an elk herd unit would be anticipated.

Issue -- Goshawk

There is concern that timber harvesting and log hauling could adversely affect habitat for goshawks, resulting in their displacement, both short and long term. Also, nesting pairs could be disturbed, resulting in nest abandonment and subsequent loss of chicks.

Measurement Criteria

Assess change in acreage of mature forest habitat acreage on DNRC lands in the project area possessing >40% overstory canopy cover (DNRC SLI Data 2013 and LFI 2011 fire data) and estimate potential changes in habitat within two nest stands on neighboring USFS lands and their associated Potential Foraging Habitat areas using a USFS habitat map for the identified Red Lodge Creek East and Red Lodge Creek West potential foraging areas -- dated 12/20/2012. Evaluate timing and duration of activities.

Affected Environment -- Goshawk

Northern goshawks are forest generalists with specific nesting habitat requirements (Squires and Reynolds 1997, Reynolds et al. 1992, McGrath et al. 2003, Squires and Kennedy 2006). The goshawk forages on various species, with principal prey being snowshoe hares, Columbian ground squirrels, red squirrels, blue grouse, ruffed grouse, northern flickers, American robins, gray jays, and Clark's nutcrackers (Reynolds et al. 1992, Squires 2000, Clough 2000, Watson et al. 1998, Cutler et al. 1996, Boal and Mannan 1996). While acquiring this wide range of prey species, goshawks forage in a diversity of habitats. Beier and Drennan (1997), however, observed that goshawks tend to forage in areas based more on habitat attributes rather than prey abundance. Beier and Drennan (1997) also found that goshawks tend to forage relatively selectively in forests with greater abundance of large trees, canopy cover, and basal area, but had relatively open understories. Goshawks will nest in a range of forest cover types, including pine, fir, and aspen stands on northerly slopes. Such stands tend to be in the latter stages of

successional development, and they tend to have greater canopy cover and basal area than on surrounding lands (Reynolds et al. 1992, Squires and Reynolds 1997, Finn et al. 2002, Clough 2000, McGrath et al. 2003). McGrath et al. (2003) found that nests are typically surrounded by stands in the stem exclusion and understory reinitiation stages of successional development (Oliver and Larson 1996), which possess canopy closure ≥ 50% in an area of about 74-acres. Prey availability, intraspecific competition (competition with other goshawks) and forest type can influence home range size of goshawks, which vary from about 1,200 to 12,000 acres (Squires and Reynolds 1997). Reich et al. (2004) observed that in some locations, the availability of locations with high potential for nests may not limit local population density as much as territorial competition between nesting pairs. They also noted that the number of activities may have more to do with the size of the nesting population than the availability of suitable nesting habitat.

Human activities, such as those associated with logging may have adverse effects on goshawks (Reynolds et al. 1992). If such disturbances occur near active nests, nest failure and/or abandonment may occur. Removal of mature trees, particularly in or near, nest stands can reduce habitat quality and cause goshawks to abandon stands for future nesting. When this occurs, goshawks may be displaced to other less suitable habitat.

The USFS considers goshawks as a sensitive species, and goshawks were observed by DNRC staff in the 4,755-acre project area in summer 2012 and spring 2013. When observed, the individuals were exhibiting defensive nest-protecting behavior, suggesting an active nest was nearby or fledged young were present. Nests could not be located in the immediate vicinity of the observations. Also, two known nests and their associated potential foraging areas occur on adjacent USFS lands.

Approximately 1,682 acres of mature conifer forest with >40% canopy cover comprised primarily of lodgepole pine and secondarily Douglas-fir and mixed conifer types are present on the project area. These stands are potentially usable by goshawks for either foraging or nesting. An additional 1,233 acres of aspen stands occur in the project area, which may also be usable by goshawks for either foraging or nesting. In total these types comprise 2,915 acres at about 61% of the project area. Of the USFS identified goshawk habitat on or near DNRC lands associated with two active nests, the Red Lodge Creek West potential foraging area comprises 830 acres of which the nest stand within the core totals approximately 61 acres. The identified Red Lodge Creek East potential foraging area comprises 753 acres and the nest stand within the core is approximately 47 acres. Within the 37,310-acre cumulative effects analysis area, approximately 16,252 acres of mature conifer forest (44% of the cumulative effects analysis area), and 3,699 acres of aspen stands exist (10% of the cumulative effects analysis area). Combined, these types total 19,921 acres of potentially usable habitat for foraging and nesting.

-Environmental Consequences – Goshawk

--Direct and Indirect Effects of the No Action Alternative

Under this alternative none of the proposed forest management activities would occur that could disturb goshawks or their habitat and no forest cover would be altered. Thus, no direct or indirect effects to goshawks would be anticipated.

--Direct and Indirect Effects of the Action Alternative

Of the 4,755-acre project area, 1,035 acres (22% of project area) would remain in coniferous mature forest cover with >40% overstory canopy closure and 1,181 acres of standing aspen would be retained (25% of project area). Following logging, forest patches on the project area would have variable tree density and would continue to provide a mosaic of habitat conditions. Overall, stand density would be reduced on 789 acres of mature forest. Tree density would be reduced most on 700 acres comprised mainly of lodgepole pine, so remaining cover would be sparse on these affected acres, removing potential nesting habitat and/or foraging stands for goshawks. Intensively treated stands would likely take 30 to 50 years to regenerate and grow into suitable habitat comprised of lodgepole pine, aspen, and Douglas-fir sapling stands. Although there would be reductions in the acreage of cover following timber harvest, some mature forest patches would remain in the project area, which would provide foraging habitat. Disturbance associated with this alternative could continue for up to 4 years.

On DNRC lands within the Red Lodge West potential foraging area, approximately 20 acres (33%) of the identified 61 acre nest stand would be treated, which could reduce habitat quality in that stand that could potentially displace future nesting by that pair. Within this potential foraging area, approximately 148 acres (18%) of the total 830-acre area would be treated, which could reduce habitat quality for foraging on those acres.

On DNRC lands within the Red Lodge East potential foraging area, approximately no portion (0%) of the identified 47-acre nest stand would be treated. Within this potential foraging area, approximately 65 acres (18%) of the total 753-acre area would be treated, which could reduce habitat quality for foraging on those acres.

It can be very difficult to know from year to year where active nests will occur as goshawks have alternate nests, but may same use the same nest in subsequent years. Thus, should an active nest be found in any portion of the project area or on adjacent lands within ¼ mile of the project area, site specific mitigation measures would be developed by a DNRC wildlife biologist before project activities at the affected site could resume. Mitigation measures would include restriction of all motorized activities within ¼ mile of the nest from April 1 through August 15 and additional tree retention requirements within a 20-acre area surrounding the nest (see mitigation section below for further details). The Intent of the mitigation measures would be to retain nesting habitat quality to the extent possible within the active nesting stand and minimize risk of nest failure or loss of fledglings during the season the nesting birds are detected.

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Overall, given that: 1) 1,035 acres of conifer forest with >40% canopy cover would remain on the project area following logging (comprising 22% of project area); 2) 1,181 acres of aspen stands of various ages would remain on the project area following logging (comprising 25% of project area); 3) a mosaic of habitat conditions would remain following harvest; 4) 700 acres of intensively treated stands would likely take 30 to 50 years to regenerate into suitable habitat comprised of lodgepole pine, aspen, and Douglas-fir stands; 5) disturbance could occur on the project area for up to 4 years, but would be temporary; 6) one USFS identified nest stand and 2 potential foraging areas could be affected; and 7) mitigations would be in place that would restrict activities within ¼ mile of an active nest if found from April 1 to August 15, and additional tree retention within a 20-acre area around the nest would be required -- there would be a moderate level of adverse effects to goshawks associated with the proposed activities.

--Cumulative Effects of the No Action Alternative

Under this alternative none of the proposed forest management activities would occur that could disturb goshawks or their habitat and no forest cover would be altered. Thus, no cumulative effects to goshawks would be anticipated.

--Cumulative Effects of the Action Alternative

Across the 37,310-acre DNRC cumulative effects analysis area following treatments on DNRC lands, large dense patches of mature forest cover and aspen groves and thickets would be present on 19,222 acres (52% of analysis area), which would provide a suitable network of habitat across the local landscape. Of the 37,310-acre cumulative effects analysis area, approximately 15,605 acres (42% of CE analysis area) would remain in mature forest cover with >40% overstory canopy closure. Following logging, forest patches on the project area would have variable tree density and would continue to provide a mosaic of habitat conditions. Overall, stand density would be reduced on 789 acres of mature forest. Tree density would be reduced most on 700 acres comprised mainly of lodgepole pine, so remaining cover would be sparse on these affected acres, reducing habitat quality for goshawks. Intensively treated stands would likely take 30 to 50 years to regenerate into a suitable habitat comprised of lodgepole pine, aspen, and Douglas-fir stands. If this DNRC project and the USFS GRLA project were occur simultaneously, the acreage of mature forest cover with >40% crown closure could be reduced to approximately 14,609 acres (39%) within the 37,310-acre cumulative effects analysis area. Openings reducing connectivity of mature forest would be created under the proposals of both agencies, which could reduce cover amount and quality for goshawks. However, habitat connectivity would not likely be substantially altered within the cumulative effects analysis area following treatments, because the majority of the remaining acreage of suitable cover would generally remain in large, well, connected patches across the area, particularly along the northerly-facing slopes of the Beartooth Face. Also, of the 2,965 acres of vegetation that both agencies have proposed for treatment, approximately 1,269 (43%) would continue to possess moderately to well stocked forest conditions post disturbance due to the partial harvest treatment prescriptions being proposed. Although there would be some minor reductions in the acreage of suitable foraging and nesting habitat following timber harvest, ample amounts would remain in the cumulative effects analysis area, which would maintain suitable habitat

conditions for goshawks, albeit at slightly reduced quality at the scale of the 37,310-acre cumulative effects analysis area.

Should both the DNRC and USFS project occur, disturbance in the affected area could be ongoing for up to 6 years. Additional short-term disturbance associated with forest management activities proposed under both projects would be cumulative to existing levels of motorized and non-motorized public recreational use, which occur within the cumulative effects analysis area. Such disturbance could increase the potential for displacement of goshawks. It can be very difficult to know from year to year where active nests will occur as goshawks have alternate nests, but may same use the same nest in subsequent years. Thus, should an active nest be found in any portion of the project area or on adjacent lands within ¼ mile of the project area, site specific mitigation measures would be developed by a DNRC wildlife biologist before project activities at the affected site could resume. Mitigation measures would include restriction of all motorized activities within ¼ mile of the nest from April 1 through August 15 and additional tree retention requirements within a 20-acre area surrounding the nest. The Intent of the mitigation measures would be to retain nesting habitat quality to the extent possible within the active nesting stand and minimize risk of nest failure or loss of fledglings during the season the nesting birds are detected.

Overall, given that: 1) at least 14,609 acres of conifer forest with >40% canopy cover would remain in the cumulative effects analysis area (39% of analysis area); 2) also 3,617 acres of multi-aged aspen stands would continue to provide cover after treatments for a combined total cover area of 19,222 acres that would remain in the cumulative effects analysis area (comprising 52% of analysis area); 3) a mosaic of habitat conditions would remain following harvest; 4) 1,696 acres of intensively treated stands across both projects would likely take 30 to 50 years to regenerate into a suitable habitat comprised of lodgepole pine, aspen, and Douglas-fir stands; 5) disturbance could occur on the cumulative effects analysis area for up to 6 years, but would be temporary; 6) one known USFS identified nest stand and 2 potential foraging areas could be affected by project activities; and 7) mitigations would be in place that would restrict activities within ¼ mile of an active nest if found from April 1 to August 15, and additional tree retention within a 20-acre area around the nest would be required, should a nest be found -- forest management activities associated with the proposed DNRC action would have a minor adverse cumulative impact on forest conditions and well-connected mature forest cover, and minor, temporary impacts associated with logging disturbance and displacement of goshawks.

Issue -- Great Gray Owls

There is concern that timber harvesting and log hauling could adversely affect habitat for great gray owls, resulting in their displacement, both short and long term. Also, nesting pairs could be disturbed, resulting in nest abandonment and subsequent loss of chicks.

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Measurement Criteria
Assess change in acreage of mature forest habitat acreage on DNRC lands in the project area possessing >40% overstory canopy cover (DNRC SLI Data 2013 and LFI 2011 fire data). Evaluate timing and duration of activities.

Affected Environment -- Great Gray Owls

Great gray owls are the largest owl species in North America and little is known about their ecology in Montana (DFWP 2013a). Great gray owls are currently listed as a state species of concern with an S3 classification, indicating that they are potentially at risk because of limited and/or declining numbers (MNHP 2013). They are broadly distributed across Canada and Alaska, and they are commonly associated with boreal forests (Terres 1980, Duncan and Hayward 1994). They are forage primarily on small mammals and occasionally small birds, and they use a variety of habitats including; dense conifer forest, hardwood forest, riparian areas, spruce forests, bogs, and meadows (DFWP 2013a, Terres 1980, Duncan and Hayward 1994). They frequently depend upon other raptors or ravens for vacant nests, but occasionally will nest in the tops of large, broken-topped snags. In the northerly portion of their distribution they tend to nest near bogs or clearings (DFWP 2013a., Terres 1980, Duncan and Hayward 1994). Nests are frequently re-used. Nesting typically begins in April and extends to early June (DFWP 2013a.). Young leave the nest at 3 to 4 week of age and are fully independent at 4 to 5 months (DFWP 2013a.).

Great gray owls have been observed in the DNRC Palisades Timber Sale project area and desirable habitat characteristics such as, mature conifer and hardwood forest types intermixed with upland meadows and wet areas. Potential nesting habitat is present in the project area and the owls may nest in the project area (S. Stewart, DFWP R-5 Biologist, pers. comm. June 2, 2011).

-Environmental Consequences -- Great Gray Owls

--Direct and Indirect Effects of the No Action Alternative

Under this alternative none of the proposed forest management activities would occur that could disturb great gray owls or their habitat, and no forest cover would be altered. Thus, no direct or indirect effects to great gray owls would be anticipated.

--Direct and Indirect Effects of the Action Alternative

Of the 4,755-acre project area, 1,035 acres (22% of project area) would remain in coniferous mature forest cover with >40% overstory canopy closure and 1,181 acres of standing aspen would be retained (25% of project area). Following logging, forest patches on the project area would have variable tree density and would continue to provide a mosaic of habitat conditions. Overall, stand density would be reduced on 789 acres of mature forest. Tree density would be reduced most on 700 acres comprised mainly of lodgepole pine, so remaining cover would be sparse on these affected acres, removing potential nesting habitat and/or foraging stands for great gray owls. Intensively treated stands would likely take 30 to 50 years to regenerate and grow into suitable nesting habitat comprised of lodgepole pine, aspen, and Douglas-fir sapling stands. Although there would be reductions in the acreage of cover following timber harvest,

some mature forest patches would remain in the project area, which would provide forested foraging habitat. Meadows, wetlands and riparian areas would be minimally influenced by the proposed activities and new openings created by logging units would provide open foraging areas for great gray owls. The 89 acres treated using variable treatment where harvest of Douglas-fir, spruce and subalpine fir would be restricted, would continue to provide large, potential nesting trees and larger snags, which would maintain important nesting habitat and structural features in these areas for great gray owls. Ample mature forest habitat would remain following logging activities that would maintain nesting habitat suitability in the most desirable locations near wet areas and meadows. Disturbance associated with this alternative could continue for up to 4 years, which could influence daily activities of great gray owls, should they be present on the project area.

It can be very difficult to know from year to year where active nests will occur, however, great gray owls can use the same nest repeatedly (DFWP 2013a). Thus, should an active nest be found in any portion of the project area or on adjacent lands within ¼ mile of the project area, site specific mitigation measures would be developed by a DNRC wildlife biologist before project activities at the affected site could resume. Mitigation measures would include restriction of all motorized activities within ¼ mile of the nest from April 1 through August 15 and additional tree retention requirements within a 20-acre area surrounding the nest (see mitigation section below for further details). The Intent of the mitigation measures would be to retain nesting habitat quality to the extent possible within the active nesting stand and minimize risk of nest failure or loss of fledglings during the season the nesting birds are detected.

Overall, given that: 1) 1,035 acres of conifer forest with >40% canopy cover would remain on the project area following logging (comprising 22% of project area); 2) 1,181 acres of aspen stands of various ages would remain on the project area following logging (comprising 25% of project area); 3) a mosaic of habitat conditions would remain following harvest; 4) 700 acres of intensively treated stands would likely take 30 to 50 years to regenerate into suitable habitat comprised of lodgepole pine, aspen, and Douglas-fir stands; 5) Meadows, wetlands and riparian areas would be minimally influenced by the proposed activities and 89 acres treated using variable retention treatment would continue to provide large, potential nesting trees and larger snags; 6) disturbance could occur on the project area for up to 4 years, but would be temporary; and 7) mitigations would be in place that would restrict activities within ¼ mile of an active nest if found from April 1 to August 15, and additional tree retention within a 20-acre area around the nest would be required -- there would be a minor level of adverse effects to great gray owls associated with the proposed activities.

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--Cumulative Effects of the Action Alternative

Across the 37,310-acre DNRC cumulative effects analysis area following treatments on DNRC lands, large dense patches of mature forest cover and aspen groves and thickets would be present on 19,222 acres (52% of analysis area), which would provide a suitable network of habitat across the local landscape. Of the 37,310-acre cumulative effects analysis area, approximately 15,605 acres (42% of CE analysis area) would remain in mature forest cover with >40% overstory canopy closure. Following logging, forest patches on the project area would have variable tree density and would continue to provide a mosaic of habitat conditions. Overall, stand density would be reduced on 789 acres of mature forest. Tree density would be reduced most on 700 acres comprised mainly of lodgepole pine, so remaining cover would be sparse on these affected acres, reducing habitat quality for great gray owls. Intensively treated stands would likely take 30 to 50 years to regenerate into a suitable habitat comprised of lodgepole pine, aspen, and Douglas-fir stands. If this DNRC project and the USFS GRLA project were occur simultaneously, the acreage of mature forest cover with >40% crown closure could be reduced to approximately 14,609 acres (39%) within the 37,310-acre cumulative effects analysis area. Openings reducing connectivity of mature forest would be created under the proposals of both agencies, which could reduce cover amount and nesting habitat quality for great gray owls, but could improve foraging habitat and prey abundance. Any changes in connectivity of mature forest habitat would likely be of little concern for great gray owls, as they are adapted to use a broad range of forested and non-forested conditions. Of the 2,965 acres of vegetation that both agencies have proposed for treatment, approximately 1,269 (43%) would continue to possess moderately to well stocked forest conditions post disturbance due to the partial harvest treatment prescriptions being proposed. Although there would be some minor reductions in the acreage of suitable foraging and nesting habitat following timber harvest, ample amounts would remain in the cumulative effects analysis area, which would maintain suitable habitat conditions for great gray owls.

Should both the DNRC and USFS project occur, disturbance in the affected area could be ongoing for up to 6 years. Additional short-term disturbance associated with forest management activities proposed under both projects would be cumulative to existing levels of motorized and non-motorized public recreational use, which occur within the cumulative effects analysis area. Such disturbance could increase the potential for displacement of great gray owls. It can be very difficult to know from year to year where active great gray owl nests will occur, however, they frequently use the same nest in subsequent years (DFWP 2013a). Thus, should an active nest be found in any portion of the project area or on adjacent lands within ¼ mile of the project area, site specific mitigation measures would be developed by a DNRC wildlife biologist before project activities at the affected site could resume. Mitigation measures would include restriction of all motorized activities within ¼ mile of the nest from April 1 through August 15 and additional tree retention requirements within a 20-acre area surrounding the nest. The Intent of the mitigation measures would be to retain nesting habitat quality to the extent possible within the active nesting stand and minimize risk of nest failure or loss of fledglings during the season the nesting birds are detected.

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Overall, given that: 1) at least 14,609 acres of conifer forest with >40% canopy cover would remain in the cumulative effects analysis area (39% of analysis area); 2) also 3,617 acres of multi-aged aspen stands would continue to provide cover after treatments for a combined total cover area of 19,222 acres that would remain in the cumulative effects analysis area (comprising 52% of analysis area); 3) a mosaic of habitat conditions would remain following harvest; 4) 1,696 acres of intensively treated stands across both projects would likely take 30 to 50 years to regenerate into a suitable habitat comprised of lodgepole pine, aspen, and Douglas-fir stands; 5) Meadows, wetlands and riparian areas would be minimally influenced by the proposed activities and 89 acres treated on DNRC lands using variable retention treatment would continue to provide large, potential nesting trees and larger snags; 6) disturbance could occur on the cumulative effects analysis area for up to 6 years, but would be temporary; and 7) mitigations would be in place that would restrict activities within ¼ mile of an active nest if found from April 1 to August 15, and additional tree retention within a 20-acre area around the nest would be required, should a nest be found -- forest management activities associated with the proposed DNRC action would have a minor adverse cumulative impact on forest conditions and habitat, and minor adverse temporary impacts associated with logging disturbance and displacement of great gray owls.

List of Mitigations

-Active Nest Disturbance Mitigation for Goshawks and Great Gray Owls -- restrict all harvest activities within ¼ mile of the active nest from April 1 through August 15, and retain additional trees within a 20-acre area surrounding the nest. Basal area would not be reduced below 90 square feet per acre near the nest. Deviations from the ¼ mile restriction may occur if a DNRC wildlife biologist deems that sufficient cover and/or topography are present in amounts sufficient to provide ample screening of the nest. Harvest activities include: chainsaw operation and timber felling, skidding and ground-based yarding, road construction and maintenance, log loading, log processing, and log hauling. *Because one primary haul route accesses most of the project area, development of site-specific measures may be necessary if a nest is located <1/4 mile from this route, to minimize adverse effects to nesting birds, while allowing a reasonable level of operation to continue.* Should such a situation arise, a DNRC wildlife biologist would develop a site specific plan to minimize the exposure, frequency, and duration to disturbance associated with hauling, while considering site-specific cover conditions, terrain, the sensitivity phase of the nesting season, and stage of fledgling development.

- Given operability and human safety constraints, retain all existing non-merchantable snags where possible.
- Across all harvest units, retain at least 1 large snag and 1 large recruitment trees per acre (both >21 inches dbh, or largest available). Distribution may be variable.
- In all harvest units retain large woody debris within ranges recommended by Graham et al. (1994). For this project the appropriate range is approximately 5 to 15 tons/acre.
- If a wolf den is found within 1 mile of active harvest units or within 0.5 miles of a rendezvous site, cease operations and consult a DNRC wildlife biologist for appropriate site specific mitigations before resuming activities.

- Require DNRC employees and contractors to store any unnatural bear foods or attractants in a bear-resistant manner (contract clause requirement).
- Where opportunities exist, retain leave trees and retention areas in a clumped fashion to emulate natural disturbance patterns and reduce sight distances for wildlife.
- Restrict mechanized operations from April 1 to June 15 to minimize risk of disturbing grizzly bears.
- Reclaim 7.2 miles of temporary and existing unneeded roads effectively to prevent all forms of motorized access upon project completion.
- Ensure gates or other closure devices are functional and effective on restricted road segments.

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Recreation

The 4,755 acres of blocked state trust land in the Palisades area provides the public with recreational opportunities. This analysis describes the existing environment of recreational uses and discloses the potential environmental effects the proposed action.

Analysis Areas

The analysis area used to determine direct and indirect environmental effects of the proposed action on the recreation resource will be the 4,755 acre project area.

The analysis area used to determine cumulative environmental effects of the proposed action will include all state trust lands in the Palisades project area and surrounding public lands including USFS property. This analysis area will herein be referred to as the cumulative effects analysis area.

Analysis Methods

The methodologies used to portray the existing environment and determine the environmental effects of the proposed action on recreational uses within the project and cumulative effects analysis areas include: determining types of existing recreational uses, and estimating any changes that may result under each alternative. Cumulative effects include consideration of other actions indicated in *Chapter 2 – Relevant Past, Present, and Related Future Actions*.

Issues

A number of concerns were raised during the scoping period regarding potential impacts of the proposed action on recreation throughout the project area and cumulative effects analysis area. The following issue statements were brought forth to account for those concerns and to ultimately guide the analysis of this section.

- Harvest activities may adversely affect recreational experiences within the project area.
- Increase in road densities may result in ATV and other motorized use of the area which may adversely affect current recreational users within the project area.

Measurement Criteria

Quantitative and qualitative changes to the following measurement criteria are intended to 'measure' the extent of the potential direct, indirect, and cumulative environmental effects the proposed action may have on existing recreational uses in the area:

- general recreational use of the area
- amount, duration, time of year and location of forest-management activities in the area

Relevant Agreements, Laws, Plans, Permits, Licenses, and Other Authorizations

DNRC Recreational Use Rules

DNRC Recreational Use Rules (*ARM 36.25.146 through 162*) regulate and provide for the reasonable recreational use of legally accessible school trust lands. Recreational use is divided into the following two categories and, subsequently, requires two different types of recreational licenses for those wishing to engage in recreational activities on school trust lands:

- General recreational use refers to recreational activities that are non-concentrated and noncommercial. Examples of these activities include snowmobiling, hiking, bicycling, hunting, motorized use, horseback riding, and berry picking**.** Any person over the age of 12 who wishes to engage in activities that pertain to general recreational uses is required to obtain a 12-month General Recreational Use License from state license providers (i.e. FWP). For recreationists younger than 17 or older than 60, the license is $5. For recreationists between the ages of 17 and 60, the license is $10. All license holders are required to abide by current restrictions, closures, and regulations.

- Special recreational use refers to recreational commercial activities in which an entity charges a participant a fee, specific non-commercial organized group activities, and overnight activities using non-designated campground areas. Specific examples of such activities include outfitting, non-commercial recreational lodges or retreats, and overnight horse camping. Any person who wishes to engage in activities that pertain to special recreational uses is required to obtain a Special Recreational Use License from DNRC. The cost of the license is determined by DNRC and assessed at what DNRC considers to be the full market value of that use.

Affected Environment

The state trust lands in the Palisades area are located about 6 miles southwest of Red Lodge. Due to their size and location as well as being adjacent to United Sates Forest Service (USFS) lands, these lands provide access to outdoor recreational opportunities within a few miles of Red Lodge. Public access to these lands can be gained from surrounding USFS property.

Recreational use is facilitated by the use of trails, and roads developed by prior users for land, lease and water rights management. The recreational activities generally associated with these lands include hiking, horseback riding, and hunting.

General Recreational Use

Currently there are approximately 13.0 miles of road within the project area designated as "Motorized Use Restricted Year-Round".

Recreational use of the road system is present throughout the year, but the types of use change seasonally. During winter and early spring the road system provides a starting point for cross-country skiers. During late spring and summer the area sees the heaviest recreational use which includes hiking, and horseback riding.

In the fall the primary use transitions to hunting activities. Big game hunting focuses on bear in the spring and deer, moose and elk in the fall. Hunting in the area is by both archery and firearm, there are no restrictions with the exception that firearms cannot be discharged within ¼ mile of occupied structures without permission of the occupant (*ARM 36.25.149c*). Specifics on the existing condition of big game populations and other wildlife are detailed in *Chapter 3 — Wildlife*. Palisades has minor trespassing issues, mostly during hunting season associated with ATV and occasionally motorized traffic use. Since there is no public road access most of the trespass issues come from adjoining landowners and individuals they allow to access state property through private roads.

Forest Management Activities

Forest management activities have been part of the management of the state trust lands in the Palisades area since the 1960's. These activities have included; timber harvest, road building, and firewood permits. The last major forest management activities that would have been noticeable by recreationists took place in 1986, 1987, and the last in 1993. In the last 20 years recreationists would have encountered no major sale activity.

These sections are not open to firewood permits currently as there is no motorized public road access.

Environmental Consequences

--Direct and Indirect Effects of the No-Action Alternative

No appreciable changes to access or existing infrastructure would occur.

--Direct and Indirect Effects of the Action Alternative

The Action Alternative would result in a temporary displacement of recreationists and a reduced quality of recreational experience within the project area during harvest activities.

General Recreational Use and Forest Management Activities

Recreationist could expect temporary industrial activity (road construction and timber harvest activities timber hauling, sale administration and harvest crews), a change in the character of the ground within the harvest units (*see Chapter 3 – Vegetation*) and alterations in animal movements and use (*see Chapter 3- Wildlife*). These disturbances could be expected intermittently over a 2 to 3 year period from the start of the sale.

Approximately 9.3 miles of new road would be constructed. During the 2 to 3 year operating period, these roads would be closed to public motorized access, yet open for non-motorized recreational purposes.

Following the completion of the project, approximately 7.2 miles of road within the project area would be reclaimed. Those who choose to recreate along the reclaimed road system may find it difficult to travel. However, a net gain of 1.4 miles (total 14.4 miles) will be available to non-motorized recreation. Similar to existing conditions, all roads would be managed as Motorized Use Restricted—Year Round.

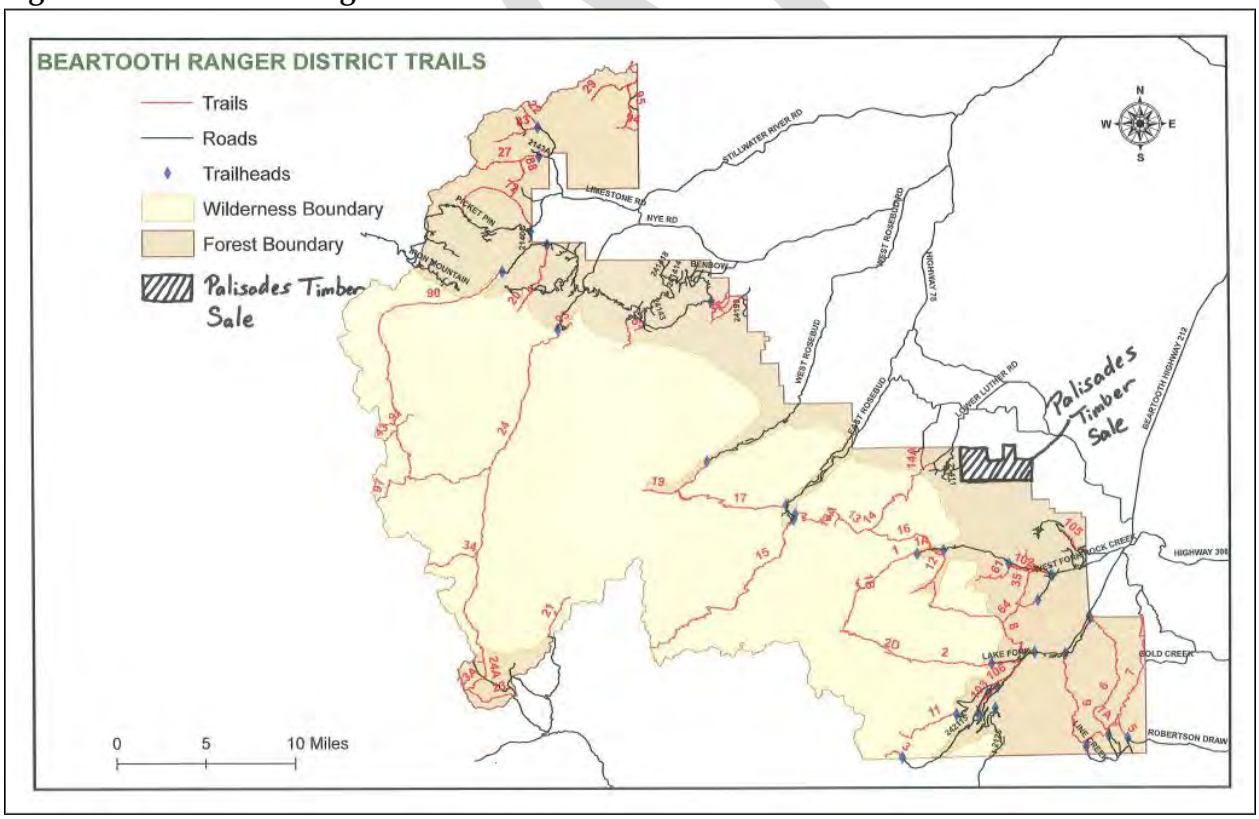
Within the project area the general recreational use would likely be temporarily displaced in active harvest units. However, the Palisades project area is bordered to its south and west by Custer National Forest. Custer NF also provides hunting, fishing, hiking and outdoor recreational opportunities. Recreationists displaced from Palisades have ample opportunity to recreate on these lands in the Beartooth Ranger District which includes 587,000 acres of land, 345,000 acres of which are federally designated wilderness as well as 20 established campgrounds, and 443.2 miles of recreation trails with various designations as described in the table R-1 and illustrated in Figure R-1.

Table R-1 Custer National Forest-Beartooth Ranger District Trail Summary

Trail Designation	Miles of Trail
Wilderness Trails (Non-Motorized)	185
Non-Motorized, non-wilderness trails	141
Dual Designated Trails	52
Motorized Trails	57
Motorized 50" or less Trails	8.2
Total Miles of Trail	443.2

Source: USFS Beartooth RD

Figure R-1 Beartooth Ranger District Trails



Harvest activities that would affect recreation uses during the summer, fall and winter would include; road construction, timber harvest, traffic and vegetative change within designated harvest units.
Slash pile burning would likely take place during appropriate conditions in the fall/winter following harvest. Slash pile burning may be carried out in multiple stages.
Hunting, a primary fall activity, would see the most conflict along the travel route and in the area of the harvest units. Human activity in and around the active harvest units would likely lead to temporary displacement of game during the activity. The removal of vegetative cover would potentially affect the way hunters ultimately use the area in the future (*see Chapter 3 — Wildlife for details*).

--Cumulative Effects of the No-Action Alternative

No appreciable changes to access would occur. Backcountry, user pioneered trail and game trail access would become more difficult in the stands that are primarily lodge pole pine due to possible beetle mortality, hunting patterns may also be affected by these changes.

--Cumulative Effects of the Action Alternative

Although recreationists may experience temporary displacement and / or increased noise and activity within the project area during harvest operations, areas outside of the project area would continue to offer recreational opportunities to those who may wish to experience more solitude.

With these surrounding public lands no recreationalist will have their ability to recreate eliminated due to a temporary displacement from the Palisades project area.

Once harvest operations have completed administrative use of the road system and activities within the harvest units would be reduced to near pre-sale levels. Continuing invasive plant monitoring and management would be necessary mostly along the road system. Where accessible and where the forest would benefit from it, the improved access may allow for small timber sale permits to take place allowing for continuous forest management in the future.
Compared to existing conditions, the amount of road managed as Motorized Use Restricted Year-Round would increase by 1.6 miles. Similar to existing conditions, no roads would be managed for motorized public use.

The existing infrastructure would continue to be available to support the recreational uses of hiking, horseback riding, skiing and access to the backcountry. Hunting patterns would be expected to change over time, but not be eliminated.

Cultural Resources

Scoping notices were sent to Montana Tribal representatives with the intent of requesting input on tribal cultural resources pertaining to the project area. The Fort Peck Tribal Historic Preservation Officer, Curly Youpee, commented that the general Red Lodge area is a place of importance to the Sioux people, but nothing more specific was provided. During subsequent telephone conversations, Mr. Youpee requested a copy of the cultural resources inventory report that DNRC would prepare. This document was provided to him, but no additional comments have been submitted by Mr. Youpee.

A Class III inventory of cultural and paleontologic resources of the area of potential effect (APE) was conducted by DNRC staff. No paleontologic resources were identified, but 10 cultural resources were found to be within the project APE. Six cultural properties (24CB2321, 24CB2325, 24CB2326, 24CB2327, 24CB2328, and 24CB2329) are historic irrigation ditches, one is possible homestead (24CB2322), one is a possible homestead/sheep handling facility (24CB2323), and one (24CB2324) is a possible seasonal hunting camp (ca. 1950's - 1970's). Project related disturbances will not physically disturb the irrigation ditches or the two possible homesteads. In contrast, site 24CB2324 could be disturbed with timber harvest work, but because the site is considered here to be ineligible for National Register listing, there will be no effect to Heritage Properties.

Presently, site 24CB2138 , a former Forest Service administrative trail abandoned several decades ago has been left unevaluated for National Register listing eligibility. It is recommended here that efforts should be made to protect some of the known trail route in the APE. These visible segments should be flagged and avoided with timber harvest related ground disturbing activities if possible.

A cultural and paleontologic resources inventory report has been prepared and is on file with the DNRC, (Helena) and the Montana State Historic Preservation Office (Helena):

Rennie, Patrick J.
2013 A Cultural and Paleontologic Resources Inventory of the Palisades Timber Sale: Carbon County, Montana. Report prepared for the DNRC (Helena, MT). Report dated May, 2013.

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Aesthetics

Introduction

This analysis describes the existing visual quality and noise levels throughout the area and discloses the potential environmental effects the proposed action may have on those attributes.

Analysis Area

The analysis area used to determine the direct and indirect effects of the proposed action on the visual quality and noise levels will be the project area.

The analysis area used to determine cumulative environmental effects of the proposed action on the visual quality and noise levels will include state, private, and federal lands within the 51,770 acre Upper Red Lodge creek watershed which surrounds the project area. The cumulative effects analysis area is largely privately owned comprising nearly 54 percent of the land, while 34 percent is in federal ownership managed by the Custer National Forest. The State of Montana owns approximately 12 percent and is managed by the Trust Lands Management Division of DNRC. This analysis area will herein be referred to as the cumulative effects analysis area. Both analysis areas and observer points are displayed in *APPENDIX A1 – AESTHETICS ANALYSIS AREAS AND OBSERVER POINTS* at the end of this document.

Analysis Methods

The methodologies used to portray the existing environment and determine the environmental effects of the proposed action on the visual quality in the project area and cumulative effects analysis area include using a geographic information system (GIS), aerial photo interpretation, and photo points within the analysis area.

By conducting a viewshed analysis in GIS, past, proposed, and potential future visible and non-visible harvest acres that affect the aesthetics of the area from different observer points can be summarized. Observer points and road segments that are highly trafficked and/or regularly visited locations by the public were identified as important viewsheds through the public scoping process. These observer points are described below in *TABLE AS1 – VIEWSHED LOCATIONS AND DESCRIPTIONS.*

An observer point analyzes a viewshed from a static point on the landscape given the elevation relative to surrounding features. An observer line, such as a road segment, is a linear feature that summarizes the total visible acres at each point along the road and is a cumulative measure. This is an important consideration when evaluating the summarized visible acres data from these linear features as not all of the acres are typically visible from one location on the road but rather small portions are visible from a couple specific spots. Another equally important consideration used in these viewshed analyses is that no surface vegetation was incorporated into the modeled surface. Visual obstructions in the foreground line of sight from trees and shrubs are not accounted. This assumption largely overestimates the visible acres from a particular location and can be assumed a worst case scenario.

TABLE AS1 – VIEWSHED LOCATION AND DESCRIPTIONS

Viewshed Location	Feature	Distance (mi)	Description
Luther	Point	Static	At the junction of Lower and Upper Luther roads in the townsite of Luther
Upper Luther Rd at HWY 78	Point	Static	Junction of the Upper Luther road and State highway 78
Grizzly Peak	Point	Static	The top of Red Lodge Mountain Resort at Grizzly Peak
Sheep Mountain	Point	Static	At the top of Sheep Mountain located on State Trustlands
Luther-Roscoe Rd	Linear	1.0	The portion of the Luther-Roscoe road within the cumulative effects analysis area
Upper Red Lodge Creek Rd	Linear	2.6	The county owned portion of the Upper Red Lodge Creek road
Lower Luther Rd	Linear	2.4	Lower Luther county road from the town of Luther to the junction with State highway 78
Hwy 78	Linear	8.4	That portion of State highway 78 within the cumulative effects analysis area
Upper Luther Rd	Linear	6.1	Upper Luther county road from the junction of State highway 78 to the townsite of Luther
Barlow Creek Rd	Linear	1.8	The county owned portion of the Barlow Creek road beginning at the junction of Upper Luther road

These observer points and road segments were used to convey the affects for both the existing environment and the environmental effects of implementing the proposed action described in *CHAPTER 2 – ALTERNATIVES*.

Issues and Measurement Criteria

The following issues concerning visual quality and noise levels were raised during internal and external scoping and will be analyzed in further detail:

- Harvest activities may adversely affect the visual quality of the landscape.
- Activities associated with this project may increase local noise levels.

Quantitative and qualitative changes to the following measurement criteria are intended to "measure" the extent of the potential direct, indirect and cumulative environmental effects the proposed action may have on the existing visual amount and quality and noise levels in the area. The measurement criteria used to describe the anticipated effects from the proposed actions related to these issues are described below in *TABLE AS2 – MEASUREMENT CRITERIA*.

TABLE AS2 – MEASUREMENT CRITERIA

Generalized Issue	Measurement Criteria	Units
Harvest Unit Visibility	Amount of visible forest management activites	Acres
Noise from Forest Management Activites	Magnitude, Timing, duration and type of noise	Qualitative

Affected Environment

Overview

The area in question involves the landscape to the south of Luther, Montana, commonly referred to as the Beartooth Front. The viewshed of this area consists of numerous rolling rangeland foothills of moderate relief grading to more planer, timbered hillslopes as elevation increasing and proximity to the Beartooth front decreases. These foothills are moderately dissected by numerous south to north orientated drainages which results in a landscape that is relatively complex with multiple aspects and varied slopes. Because of this complexity, a continuous line of sight to the project area is only found at elevated positions. Cumulatively, the project area is most visible along State highway 78 and the Upper Luther road though even along these roads less than half the project area is visible. Subalpine and alpine environments

are encountered at the highest elevations with numerous avalanche paths accounting for the majority of the vegetative pattern is this area. The current viewshed of the landscape has been influenced by timber harvest, agricultural activities, residential, industrial (power-line infrastructure) and ski area development as well as wildland fire.

Visual Quality

Harvest Units

Forest management activities on the state trust lands in the Palisades Project area began in the early 1980's and described in *CHAPTER 1 – RELEVANT PAST, PRESENT, AND RELATED FUTURE ACTIONS*. These acres of harvest resulted in a visible change in the viewshed by altering continuous forest canopy cover. Very little of these past management actions are visible today from the defined observer points and ranges from not visible to upwards of approximately 60 acres dependant on position. Of the visible areas of the project area, previous management activities can only be obverted on approximately 6 percent of the acreage. The amount of the project area and past harvest visible from the various observer points is presented below in *TABLE AS3 – EXISTING VISIBILITY*.

TABLE AS3 – EXISTING VISIBILITY

Viewshed	Feature	Project Area Visibility (acres)	% Project Area	Existing Harvest Visibility (acres)	% of Visible Project Area
Luther	Point	18	<1%	0	0%
Upper Luther Rd at HWY 78	Point	610	13%	34	6%
Grizzly Peak	Point	2,032	43%	52	3%
Sheep Mountain	Point	1,195	25%	0	0%
Hwy 78	Linear (8.4)	2,093	44%	62	3%
Upper Luther Rd	Linear (6.1 mi)	2,240	47%	41	2%
Upper Red Lodge Creek Rd	Linear (2.6 mi)	270	6%	0	0%
Lower Luther Rd	Linear (2.4)	511	11%	6	1%
Barlow Creek Rd	Linear (1.8 mi)	304	6%	0	0%
Luther-Roscoe Rd	Linear (1.0 mi)	85	2%	0	0%

Existing harvest within the cumulative effects analysis area is largely limited to US Forest Service lands within the West Red Lodge Creek and the East fork West Red Lodge Creek. These historic harvests have largely regenerated and are similar in appearance to the historic harvest within the project area described above. In general, historic harvest comprises a very small portion (<1%) of the total cumulative effects analysis area.

The visual effects of these historic harvests, both in the project and cumulative effects analysis areas are the most noticeable during and just after the harvest, when the disturbance is at greatest contrast with the surrounding environment. As the land starts to re-vegetate and forest stands regenerate, the colors and textures return to a more natural state reducing the contrast to the adjacent environment.

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Developments

One power-line utility has been developed through portions of the project area. While this feature is striking during aerial photo interpretation, from a viewshed perspective this development is largely irrelevant as only very small portions can be seen from only the most elevated and well orientated observer points.

Red Lodge Mountain resort is the most striking development within the cumulative effects analysis area and is visible from large portions of both analysis areas. Cut runs and road development for mountain operations have the most contrast with surround vegetation.

Wildland Fire

Wildland fire has and will continue to be the dominate variable that has the potential to affect the viewshed of the analysis areas. No recent visual effects from wildland fire have occurred within the project area. Historic fire in the cumulative effects analysis area has completely revegetated creating stands of even-aged Lodgepole pine with continuous canopy cover. The Cascade fire only affected small acreage at the highest elevations in the cumulative effects analysis in the recent past and is largely non-visible.

Noise

Current activities that generate noise within the project area include:

- Traffic associated with administrative use, firewood permits and grazing management
- Firewood harvesting
- Recreational use such as biking, horseback riding, hiking and hunting

Current activities that generate noise within the project area include:

- Traffic associated with trail use, residential access and commercial use on private, state and federally owned roads
- Construction activities, agricultural activities and recreational activities

Within the project area post and pole harvesting is the most significant contributor to noise. This activity occurs at a low level with only a permit or two issued a year. The activity is typically limited to fall months of any given year and rarely is there multiple firewood collectors operating at the same time.

The cumulative effects analysis area encompasses a greater variety of activities not uncommon to any part of the Beartooth Front, and no single activity contributes at a level that is unusual. The highest noise levels would be produced in the summer and fall in association with peak recreational periods and agricultural industries.

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Environmental Consequences

--Direct and Indirect Effects of the No-Action Alternative

No harvest activities would occur. The viewshed would have the potential to change noticeably due to the effects from the mountain pine beetle and/or wildland fire. No change in noise levels would be expected.

--Direct and Indirect Effects of the Action Alternative

Visual Quality

Implementation of the action alternative will result in a net increase in harvest unit visibility ranging from zero percent to 21 percent dependant on observer location. The largest increase in visibility would be from the Sheep Mountain observer point. Increases in harvest unit visibility for the various observer points are displayed in *TABLE AS04 – ACTION ALTERNATIVE VISIBILITY* below. A pictorial representation of the visible acres from the Sheep Mountain observation point is presented in *APPENDIX A2 – SHEEP MOUNTAIN OBSERVATION POINT* at the end of this document.

TABLE AS04 – ACTION ALTERNATIVE VISIBILITY

Viewshed	Feature	Existing Harvest Visibility (acres)	% of Visible Project Area	Visible Harvest Action Alternative (acres)	% of Visible Project Area	% Increase
Luther	Point	0	0%	0	0%	0%
Upper Luther Rd at HWY 78	Point	34	6%	99	16%	11%
Grizzly Peak	Point	52	3%	145	7%	5%
Sheep Mountain	Point	0	0%	249	21%	21%
Hwy 78	Linear (8.4)	62	3%	273	13%	10%
Upper Luther Rd	Linear (6.1 mi)	41	2%	300	13%	12%
Upper Red Lodge Creek Rd	Linear (2.6 mi)	0	0%	52	19%	19%
Lower Luther Rd	Linear (2.4)	6	1%	60	12%	11%
Barlow Creek Rd	Linear (1.8 mi)	0	0%	15	5%	5%
Luther-Roscoe Rd	Linear (1.0 mi)	0	0%	13	15%	15%

Immediately following the harvest the visual effect will be dramatic, especially in the stands that have clearcut with reserves harvest prescriptions. The rapid reduction in vegetative cover and ground disturbance associated with the harvest will contrast starkly to the previous forest condition and surrounding vegetation. Within 2 to 3 years the new vegetation will become established allowing the harvest design mitigations to be a more effective buffer to the visual quality of the harvest.

A significant portion of the roads associated with the harvest are located within the boundaries of the harvest units displayed in TABLE AS04 –ACTION ALTERNATIVE VISIBILITY above and are incorporated into this visual quality analysis. The small portion of roads located outside harvest units (<10% of the total) are located on low slopes which require minimal cut and fill construction. These roads are also located on contour further diminishing the visibility of these segments.

Considering this information, implementation of the action alternative will result in low level direct and indirect effects to the visual quality of the area for a short period of time until ground cover revegetates (2-3 years) and forests stands regenerate (10-15 years).

Noise

Noise would be generated by harvest operations, harvest related traffic, road construction and administrative oversight. This could be expected to be present for the entire season of harvest, typically from mid-June through mid-March of the following year, for the duration of the harvest of 2 to 3 years.

Activities would mostly occur during the typical business work week (Monday through Friday) and cease each day by evening except for occasional operations. Road construction, harvesting operations and timber hauling are expected to be louder that other harvest-related traffic.

--Cumulative Effects of the No-Action Alternative

Under the No-Action Alternative, no harvest-related activities would occur. Therefore, no cumulative effects to visual quality and noise levels as a result of the No-Action Alternative would be expected.

--Cumulative Effects of the Action Alternative

Visual Quality

The Custer National Forest has proposed forest management activities adjacent to the Palisades project area that considers numerous commercial and non-commercial treatments. Non-commercial treatments generally include prescribed fire and thinning from below that would have negligible effects to the aesthetic quality of the area. When considering the commercial harvest activities the Custer National Forest is proposing in conjunction with State actions the visual extent of potential impacts increases. The amount of the cumulative effects analysis area that is visible from each viewshed as well as the cumulative total of harvest acres that would be visible from that position is presented below in *TABLE AS5 – CUMULATIVE EFFECTS VISIBILTY*.

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TABLE AS5 – CUMULATIVE EFFECTS VISIBILTY

Viewshed	Feature	Visible Cumulative Effects Analysis Area (acres)	% Visible (51,767 acres total)	Potentially Visible Harvest (acres)	% of Visible Cumulative Effects Analysis Area
Luther	Point	7670	15%	0	0%
Upper Luther Rd at HWY 78	Point	8820	17%	292	3%
Grizzly Peak	Point	13932	27%	197	1%
Sheep Mountain	Point	14865	29%	812	5%
Hwy 78	Linear (8.4)	27443	53%	716	3%
Upper Luther Rd	Linear (6.1 mi)	24157	47%	701	3%
Upper Red Lodge Creek Rd	Linear (2.6 mi)	12291	24%	380	3%
Lower Luther Rd	Linear (2.4)	14393	28%	203	1%
Barlow Creek Rd	Linear (1.8 mi)	9574	18%	43	0%
Luther-Roscoe Rd	Linear (1.0 mi)	13441	26%	245	2%

The net cumulative effect to visual quality when considering all past, present and proposed future actions results in a small portion of the analysis area impacted from forest management activities. Most impacted viewsheds would be located at elevated positions with unobstructed lines of sight. This small area of visual impacts from forest management considered in conjunction with development along the Beartooth Front in the form of ski resort, industrial, agricultural and residential development results in a low level cumulative effect to visual quality.

Noise

Cumulative effects to noise during the daytime and on weekends would be expected to increase beyond current levels found within the cumulative-effects analysis area. Noise emanating from the harvest activities associated with the proposed action would be concentrated in the areas surrounding the proposed harvest units and roads. Cumulative effects to noise during the evenings would not be expected to increase beyond current levels found within the area.

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Economics

Analysis Areas

The analysis area used to determine direct, indirect, and cumulative economic effects include a multi-county area containing the immediate project area in Carbon County, and supportive entities to the timber industry located in nearby counties including potentially Yellowstone and Park Counties.

Analysis Methods

This economic analysis primarily focuses on income, including revenues generated for trust beneficiaries, and employment opportunities occurring as a result of the proposed action. The methodologies used to determine direct and indirect income and employment begin with the estimation of resource production. Cumulative effects are considered as well and include those related to later stages of production and the greater Montana forest products industry.

Total income, defined as income earned in all stages of the forest products economy up to the point of industrial processing, is estimated by multiplying reported regional gate prices (the delivered log price paid by industrial wood processors), by the total harvest volume expected in the proposed timber sale. Stumpage prices, the contractual price paid for standing timber, are analyzed to determine the portion of total income earned by the trust beneficiaries. Stumpage prices are estimated through transaction evidence from comparable timber sales, analyzing unique characteristics of the proposed sale (i.e. species mix, wood quality, stand density and diameter, terrain, development requirements such as road building, and proximity to markets). State trust management expenses are estimated from annual cash-flow records from DNRC TLMD forest management program.

Direct employment opportunities are estimated using employment multipliers published by the University of Montana's Bureau of Business and Economic Research (BBER). Additionally, data sources for the economic analysis include the DNRC's TLMD, the Department of Labor and Industry, Research and Analysis Bureau, the Western Wood Products Association (WWPA) and Random Lengths (RL).

Issues

The following issues concerning economics were raised during internal and external scoping and will be analyzed in further detail in this analysis:

- The project may not profit the trust beneficiaries due to significant project costs including road development, and the project might move forward regardless of these costs and benefits.
- The project may not sell in current markets

Measurement Criteria

Quantitative and qualitative changes to the following measurement criteria are intended to 'measure' the extent of the potential direct, indirect, and cumulative economic effects the proposed action may have.

- For all income, revenues, and prices the measurement criterion is current U.S. dollars.
- For employment, the measurement criterion is full-time jobs sustained for one year.

Affected Environment

The proposed action would take place on forested state trust lands managed by the Southern Land Office of Montana's DNRC. Timber sales in this region supply raw materials for nearby and statewide forest products firms producing framing lumber, boards and beams, posts and poles, house logs, home improvement products, furniture, fuels and paper products.

Timber harvest in Montana varies year to year, responding to industry, government and market trends. *FIGURE E1 – MONTANA ANNUAL TIMBER HARVEST* shows total timber harvest in Montana over 32 years. Total harvest declined over the past two decades due to declining sale volumes from USFS land followed in recent years by declining harvest on private lands. Currently, DNRC maintains an annual statewide sustainable yield of 56.7 MMbf contributing its highest percentages of the total Montana log supply in the most recent years. These market share trends have increased DNRC's relative importance in maintaining a viable timber supply for manufacturers in Montana. Additionally, significant price increases in wood products have been observed across U.S. markets in the last two quarters and from this DNRC is situated to generate exceedingly positive revenue with timber sale contracts in upcoming fiscal years.

From the sale of timber resources DNRC generates significant employment and income in Montana. Estimating the number of jobs sustained by DNRC's annual sustainable yield can be approximated using a job multiplier from the Bureau of Business and Economic Research (BBER). BBER estimates that for every one million board feet of harvest, 9 direct and indirect industry jobs are sustained for a one year period across all related sectors from logging, milling, and other value adding stages. (Spoelma et. al., 2004) This multiplier can be interpreted to indicate that approximately 500 forestry, logging, and forest products industry jobs are sustained by timber harvested under the TLMD forest management program.

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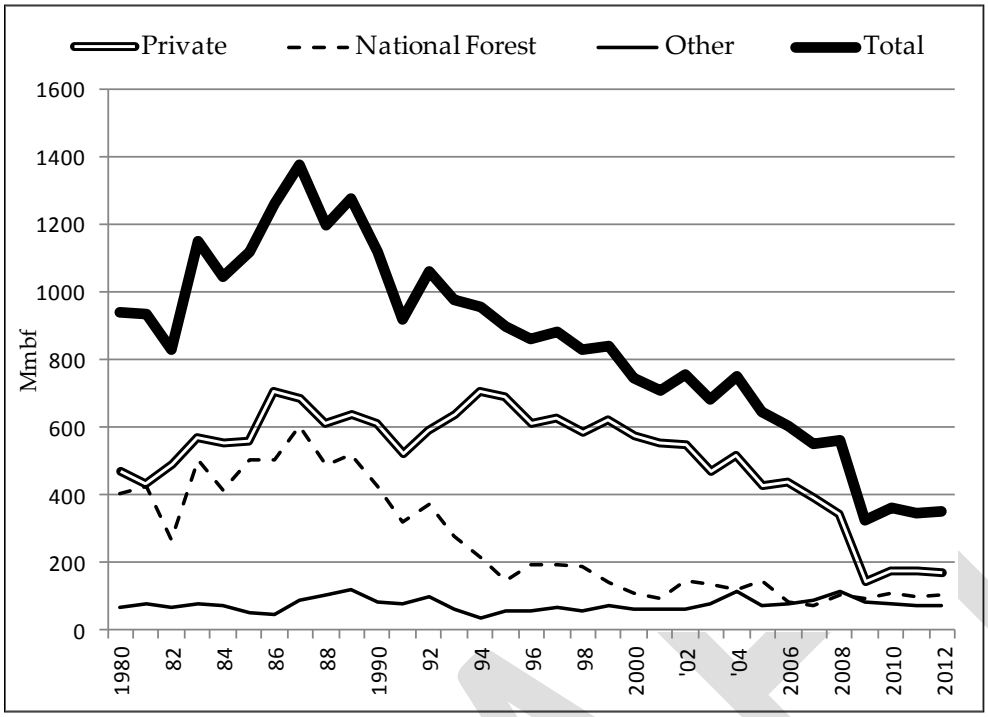
FIGURE E1 – MONTANA ANNUAL TIMBER HARVEST



In addition to jobs, state-managed forests generate direct and indirect income including revenues distributed to state trust beneficiaries. Timber sale revenue distributed to trust beneficiaries varies depending on the harvest volume and stumpage prices established through sealed bidding on timber sale contracts. *TABLE E1 – TLMD FOREST MANAGEMENT REVENUES* shows fluctuations in total revenues from DNRC timber sales and the forest improvement (FI) revenues accounted for over the last several fiscal years. These accounted revenues reflect cash flows from a mixture of contracts sold up to three years prior to each reported fiscal year. In the most recent years timber sale revenues have been lower due to recession depressed lumber prices. As housing and construction markets have more recently rebounded, revenues from timber sales will soon follow.

TABLE E1 – DNRC FOREST MANAGEMENT REVENUES

Fiscal Year	Timber Sale Revenue	Forest Improvements	Total Revenue
2012	$5,514,781	$1,564,015	$7,078,796
2011	$8,559,990	$1,936,240	$10,496,230
2010	$8,044,850	$866,122	$8,450,677
2009	$7,584,555	$1,098,577	$11,099,302
2008	$10,000,724	$1,316,404	$8,799,298
2007	$7,482,894	$2,875,277	$15,875,626
2006	$13,000,348	$1,850,022	$16,585,882

FI fees are kept as a separate revenue stream and used to finance projects that improve the health, productivity, and value of forested trust lands. FI activities may include the piling and disposal of logging slash, reforestation, thinning, prescribed burning, site preparation, noxious

weed control, seed collection, acquiring access and maintaining roads necessary for timber harvesting, and monitoring.

-Environmental Consequences

Direct economic effects are those that alter the direct forest products economy income and employment. Indirect economic effects are those that alter other economic sectors within the multi-county area. Cumulative economic effects are typically seen as those that contribute to long-term changes in any part of the economy.

--Direct and Indirect Effects of the No-Action Alternative

Information organized in *TABLE E2 – DIRECT AND INDIRECT ECONOMIC EFFECTS* shows that under the No-Action Alternative income effects from the project area would not be realized at this time. However, if timber from this project is not sold, equivalent volumes would need to come from sales on other trust forestlands in the state, lending to income and employment effects of an unknown scale to occur elsewhere. Mills in proximity to this proposed sale area may have to adjust procurement plans in the short run to substitute the loss of delivered logs from the proposed project.

Negative economic effects can also occur from a No-Action Alternative concerning salvage condition trees where a particular forest stand is left unmanaged in a dead or dying state. Leaving beetle-infested pine unmanaged would represent a significant economic loss to the trust beneficiaries because instead of appreciation in value by growing, dead and dying stands depreciate rapidly as the wood rots losing its structural and therefore marketable qualities. Additionally, unmanaged dead stands could produce negative externalities and extend economic losses by promoting unwanted silvicultural conditions and slowing down the rate at which a replacement stand matures. The project area is not considered to have dead or dying stands and these effects are not quantified in this analysis, but they do represent an increase in the total economic opportunity costs for a No-Action Alternative decision concerning stands that may be at risk of natural decay.

--Direct and Indirect Effects of the Action Alternative

Direct income effects are estimated with current regional BBER log price data and state revenues are estimated using the transaction evidence appraisal approach discussed earlier. Information organized in *TABLE E2 – DIRECT AND INDIRECT ECONOMIC EFFECTS* shows an estimated total direct income of $2,037,729 would be generated in the harvest and delivery of logs from the Palisades Timber Sale. Much of this income represents the margin for operators to harvest, load and haul the logs to mill locations. The other portion includes revenue for state trust beneficiaries, and infrastructure development and other forest improvements on state forested trust lands. This subtotal income to the state is estimated at $1,030,614 and represents the total revenue received by the state plus additional capitalized value to trust land as a result of the proposed action. Of this, $822,845 is estimated to be received as actual gross revenues, and it is estimated that $381,087 of this would directly profit the trust beneficiaries. The rest would cover the expenses from the state to provide sale preparation and management associated with the proposed action as well as forest

improvement activities. Management expenses are estimated using an average program revenue/cost ratio from annual accounting records highlighted in the formula column of *TABLE E2 – DIRECT AND INDIRECT ECONOMIC EFFECTS*. Direct and indirect employment effects include an estimated 54 full time annual jobs in the logging and forest products industry, as well as other supporting sectors of the economy. Again, the level of employment sustained by this project is estimated using BBER industry research (Spoelma et. al. 2004).

Indirect income effects are not quantified in this analysis, but they represent additional benefits to the economy as income earned from the proposed action is recycled within the multi-county area, buying other goods and services. Assuming a regionally average leakage rate (the rate at which money escapes the local economy and is spent elsewhere) the indirect income effects would be represented by some additional sum of income earned within reasonable proximity to the project area.

TABLE E2 – DIRECT AND INDIRECT ECONOMIC EFFECTS

Measurable Effect	Formula	No-Action	Action Alternative
Total harvest volume (MBF)	[a]	0	6,011 MBF
Delivered Log Price ($/MBF)[1]	[b]	$0	$339/MBF
Total Resource Value ($)	= [a] * [b]	$0	**$2,037,729**
Contract Stumpage ($/MBF)	[c]	$0	$134.89/MBF
FI Revenue ($/MBF)	[d]	$0	$2.00/MBF
Development Costs ($/MBF)	[e]	$0	$34.56/MBF
Total Value to the State ($)	= [a] * ([c] + [d] + [e])	$0	$1,030,586
Total State Revenues	[f] = [a] * ([c] + [d])	$0	$822,845
Total Trust Revenues[2]	= [f] – ([f] * 0.53)	$0	**$381,087**
Direct Industry Jobs Supported[3]	= [a] * (.009)	0	**54 Jobs**

1 BBER 2013 1st quarter market price for delivered sawlogs in Eastern Montana.
2 State management expenses estimated with the revenue and cost summary in the 2010 SFLMP Monitoring Report
3 Direct full time logging and forest products jobs per MBF annually; not including indirect jobs, or forestry and forest management jobs. (Spoelma et. al. 2004)

--Cumulative Effects of the No-Action Alternative

DNRC has a statewide sustainable-yield annual harvest goal of 56.7 MMbf. If this project were not sold, this volume would come from sales elsewhere. The substituting timber sale may be from other areas and not benefit this region of the state.

--Cumulative Effects of the Action Alternative

The Action Alternative would contribute volume to the annual sustainable yield of 56.7 MMbf. This yield establishes a relatively stable supply of state trust land timber for regional and statewide markets. In the past decade, the state's timber market share in terms of log supply has grown from five percent up to nearly twenty percent. This substantial increase in market share is indicative of the greater reliance regional forest product firms are placing on state

supplied timber. Maintaining a stable timber supply is even more critical in recessed markets where other forest land owners have reduced their respective harvest levels.
Overall, the business relationship between state trust land forests and forest products industries is mutually beneficial. Without timber demand from industries forest land assets would be nearly valueless monetarily, failing to provide revenue for the trust beneficiaries, and would remain a fiscal liability to the trusts in terms of maintaining forest health. Similarly, forest product manufacturing sites, which are scaled and financed according to the assessment of available timber supply within an economical operating distance, require a steady supply of timber to remain open and competitive in their respective markets.

Additionally, the proposed action would also contribute proportionally to public school funding. Funds distributed by state trusts partially offset tax dollars needed to fund public education. The cumulative effect of this proposed action in conjunction with revenue-generating activities of other trust land is the continued financial contribution to public education in Montana. Effectively, these revenue contributions represent tax dollar offsets and either work to reduce the overall tax burden for Montanans, or expand the available tax revenue for other public services.

The proposed action would also contribute to the overall size of the FI fund. In the long term, FI funding represents an investment in forest health, future income-generating opportunities, fire protection, and other associated benefits. The economic benefits of work conducted with FI funds cannot be directly measured, but they represent an additional cumulative effect related to the proposed action.

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Air Quality

Analysis Areas

The analysis area used to determine direct, indirect, and cumulative environmental effects to air quality includes airsheds within a 10-mile radius of the proposed project area. This area encompasses airsheds associated with the following towns: Luther and Red Lodge.

Analysis Methods

The methodologies used to determine the environmental effects of the proposed action on air quality within the project and cumulative-effects analysis area include estimating the amount, location, timing, and duration of smoke and dust generated by activities associated with the proposed action. Cumulative effects include consideration of other actions indicated in *Chapter 2 – Relevant Past, Present, and Related Future Actions*.

Issues

The following issues concerning air quality were raised during internal and external scoping and will be analyzed in further detail in this analysis:

- Smoke produced from logging slash pile and broadcast burning associated with this project may adversely affect local air quality.
- Dust produced from harvest activities including: road building and maintenance, and hauling associated with this project may adversely affect local air quality.

Measurement Criteria

Quantitative and qualitative changes to the following measurement criteria are intended to 'measure' the extent of the potential direct, indirect, and cumulative environmental effects the proposed action may have on existing air quality in the area.

- Amount (piles, acres), timing (week, month, season), and duration (weeks, months, years) of prescribed burning (slash pile).
- Amount, timing (week, month, season), and duration (weeks, months, years) of road construction, road maintenance, and harvest-related traffic.

Relevant Agreements, Laws, Plans, Permits, Licenses, and Other Authorizations

Clean Air Act

Congress passed the Clean Air Act in 1963. The purpose of the act is to protect and enhance air quality while ensuring the protection of public health and welfare. *MCA 75-2-101* through *429* is known as the Clean Air Act of Montana and requires the State of Montana to provide for a coordinated statewide program to prevent, abate, and control air pollution while balancing the interest of the public.

Montana / Idaho Airshed Group

The DNRC is a member of the Montana/Idaho Airshed Group which was formed to minimize or prevent smoke impacts while using fire to accomplish land management objectives and/or

fuel hazard reduction (Montana/Idaho Airshed Group 2010). As a member, DNRC must submit a list of planned burns to the Smoke Monitoring Unit describing the type of burn to be conducted, the size of the burn in acres, the estimated fuel loading in tons/acre, and the location and elevation of each burn site. The Smoke Monitoring Unit provides timely restriction messages by airshed. DNRC is required to abide by those restrictions and burn only when conditions are conducive to good smoke dispersion.

Air Quality Major Open Burning Permit

The DEQ issues permits to entities that are classified as major open burners (*ARM 17.8.610).* DNRC is permitted to conduct prescribed wildland open burning activities in Montana that are either deliberately or naturally ignited. Planned prescribed burn descriptions must be submitted to DEQ and the Smoke Monitoring Unit of the Montana/Idaho Airshed Group. All burns must be conducted in accordance with the major open burning permit.

Affected Environment

The analysis area is within the central part of Montana Airshed 10.

Local winds in the area tend to blow towards the west, southwest. Weather occurrences such as cold fronts may cause shifts in local wind patterns.

Air quality within the analysis areas is excellent with very limited local emission sources and consistent wind dispersion. Existing sources of emissions include occasional construction equipment, vehicles, road dust, residential wood burning, wood fires, and smoke from logging slash disposal.

-Environmental Consequences

--Direct and Indirect Effects of the No-Action Alternative

Under the No-Action Alternative, there would be no harvest-related activities and traffic, or road construction and maintenance. Therefore direct and indirect effects to air quality as a result of the No-Action Alternative would not be expected.

--Direct and Indirect Effects of the Action Alternative

Prescribed Burning-Slash Piles

Slash piles consisting of tree limbs and tops and other vegetative debris would be created throughout the project area during harvesting. DNRC would conduct prescribed burning following harvest activities in order to remove residual logging waste.

Amount

Based on an estimate of 8 tons of slash per acre, the proposed action may result in the burning of approximately 6,312 tons of slash over the duration of the project. Tons per acre estimates of logging slash were developed based on tree species being removed and current stocking levels.

Timing
Burning would start approximately one year after a harvest unit has been completed. Due to airshed restrictions limiting available burning days, burning could be expected to last one to 3 years following the completion of a harvest unit.

Duration
Burning would most likely occur from October-February. Actual burning days would be controlled and monitored by DEQ and the smoke monitoring unit of the Montana/Idaho Airshed Group and would meet EPA standards, which would further minimize the direct and indirect effects of burning activities.

Effects
Burning within the project area would be short in duration and would only be conducted when conditions favor good to excellent ventilation and smoke dispersion as determined by the Montana Department of Environmental Quality and the Montana/Idaho Airshed Group in order to meet current air quality standards. The DNRC, as a member of the Montana/Idaho Airshed Group, would burn only on approved days. Thus, direct and indirect effects to air quality due to slash pile burning associated with the proposed action would be minimal.

Road Construction, Maintenance and Log Hauling
Road construction, maintenance and log hauling activities would create localized dust on roads affected by the action alternative.

Amount
The amount of dust generated will vary by season and by activity. Haul roads within the project area are dirt roads that have potential to generate dust but all county roads being utilized are paved which will ensure minimal dust when trucks pass near most residential areas. Therefore, direct and indirect effects to air quality as a result of harvest-related traffic are expected to be localized to the roadways and areas directly adjacent to the roadways.

Vegetative barriers along the roadside and proximity to residential structures are expected to greatly limit the dispersion of particulate matter beyond these immediate areas. Therefore, effects to air quality throughout the analysis area as a result of harvest-related traffic are expected to be minor.

Timing
Road construction and maintenance would take place when soil moisture is less than 20%, which tend to occur fall and summer. Log hauling may take place whenever road conditions are such that rutting or other road surface damage will not occur. This may occur not only in summer and fall but also early spring and during the winter when the ground is frozen and/or snowpacked.

During this period dust production in the dry summer and fall months would likely be higher than during the late fall, winter, and early spring months when frozen ground conditions

and/or higher levels of moisture are expected to abate particulate production. Speed restrictions beyond posted speed limits may be incorporated into contracts to reduce dust production during the summer and fall.

Duration

Road construction and road maintenance activities will be short in duration and may only take 8-12 weeks to complete. However, depending on the activity, these may take place at different periods for the life of the project, which may be 2-3 years.

Log hauling would take place throughout implementation of the project. This has the potential to occur off and on (depending on soil and/or road conditions) for 2-3 years.

Effects

Direct and indirect effects to air quality as a result of road construction, maintenance and log hauling are expected to be localized to the roadways and areas directly adjacent to the roadways. Dust abatement mitigations, such as reduced speed limits for log trucks and winter hauling, are expected to greatly limit the dispersion of particulate matter beyond these areas. Thus direct and indirect effects to air quality throughout the analysis area as a result of road construction and log hauling are expected to be minor.

--Cumulative Effects of the No-Action Alternative

Cumulative effects to air quality as a result of this alternative would not be expected.

--Cumulative Effects of the Action Alternative

Cumulative effects of burning, road construction, road maintenance, and log hauling associated with ongoing and foreseeable actions on DNRC, federal, and private, lands would produce particulate matter. Existing emission sources from occasional construction equipment, vehicles, road dust, residential wood burning, wood fires, and smoke from logging slash disposal would continue. All burning activities by major burners would continue to comply with emission levels authorized by the DEQ, Montana/Idaho Airshed Group, and the EPA.

All above mentioned emissions in conjunction with expected particulate production from the proposed action would occur at higher levels than currently experienced. Providing that speed restrictions for log trucks would be placed in contracts, portions of the project will occur in the winter, construction activities would be short in duration, and emissions produced from burning would be appropriately controlled and monitored, the cumulative effects to air quality are not expected to exceed EPA and DEQ standards.

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Appendices

Appendix S-1 Palisades Project Area Soil Map Units
Appendix S-2 Soil Map Unit Descriptions
Appendix A-1 Aesthetics Analysis areas and observer locations
Appendix A-2 Sheep Mountain Observation Point

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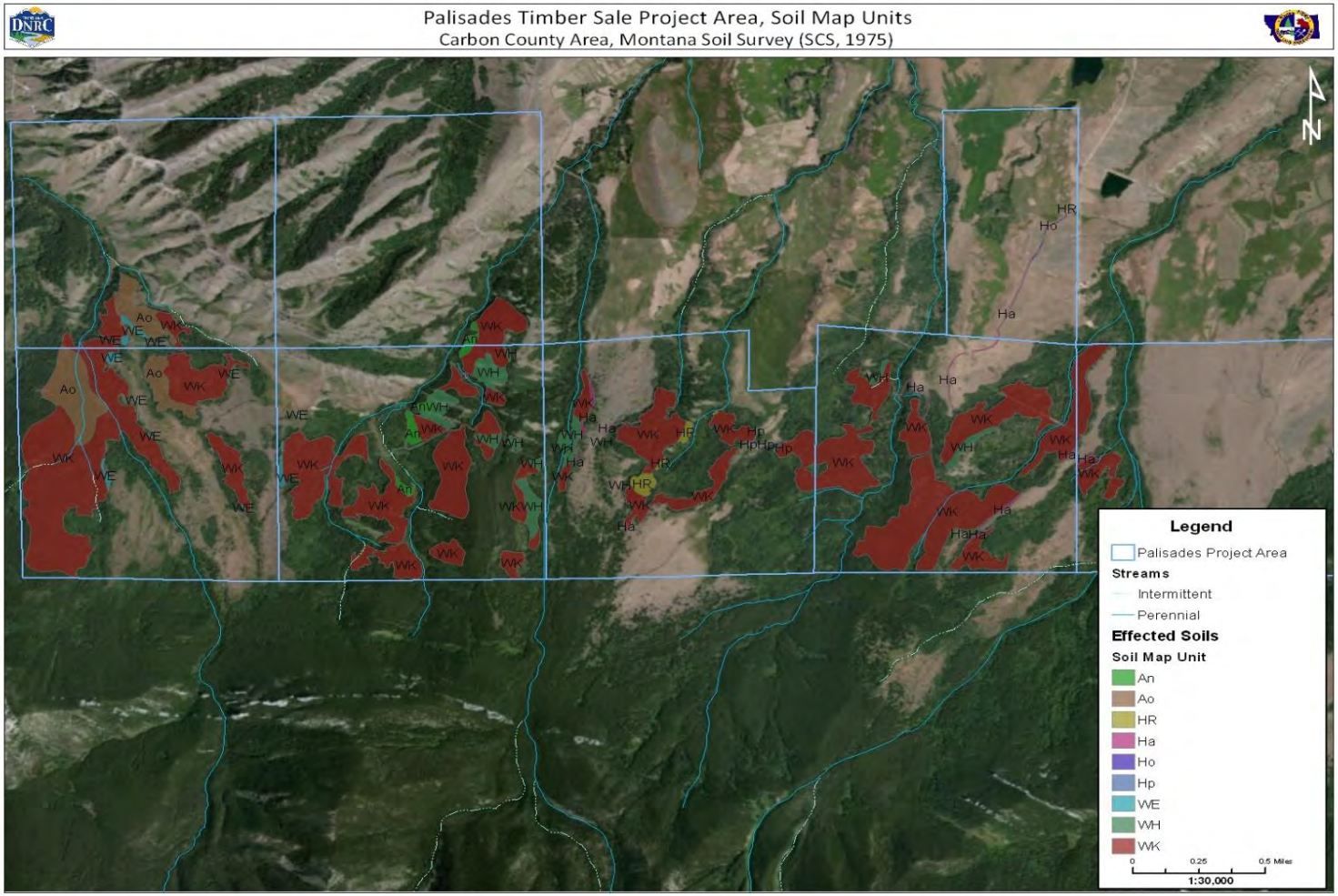
Appendix S-1-Palisades Project Area Soil Map Units



Appendix S-2-Soil Map Unit Descriptions

Map Unit Symbol	Map Unit Name	Acres	% Project Area	Soil Texture	Erosion Hazard	Compaction Hazard	Displacement Hazard
Wk	Woodrock-Rock outcrop association, steep	665.2	83.2%	clay loam	Moderate	Low/Moderate	Moderate
Ao	Adel silty clay loam, 4 to 8 percent slopes	60.7	7.6%	silty clay loam	Moderate	Moderate	Low
WH	Windham cobbly clay loam, steep	38.5	4.8%	cobbly clay loam	Moderate	Low/Moderate	Moderate/High
An	Adel silty clay loam, 0 to 4 percent slopes	10.3	1.3%	silty clay loam	Moderate	Moderate	Low/Moderate
Ha	Hanson clay loam, 4 to 8 percent slopes	8.2	1.0%	clay loam	Low	Low	Low
WE	Windham cobbly clay loam, sloping	7.7	1.0%	cobbly clay loam	Low	Low	Low
HR	Heath-Bynum association, steep	7.1	0.9%	clay loam	Moderate	Moderate	Moderate
Ho	Heath clay loam, 4 to 8 percent slopes	1.0	0.1%	clay loam	Low	Moderate	Low
Hp	Heath clay loam, 8 to 15 percent slopes	0.7	0.1%	clay loam	Low	Moderate	Moderate

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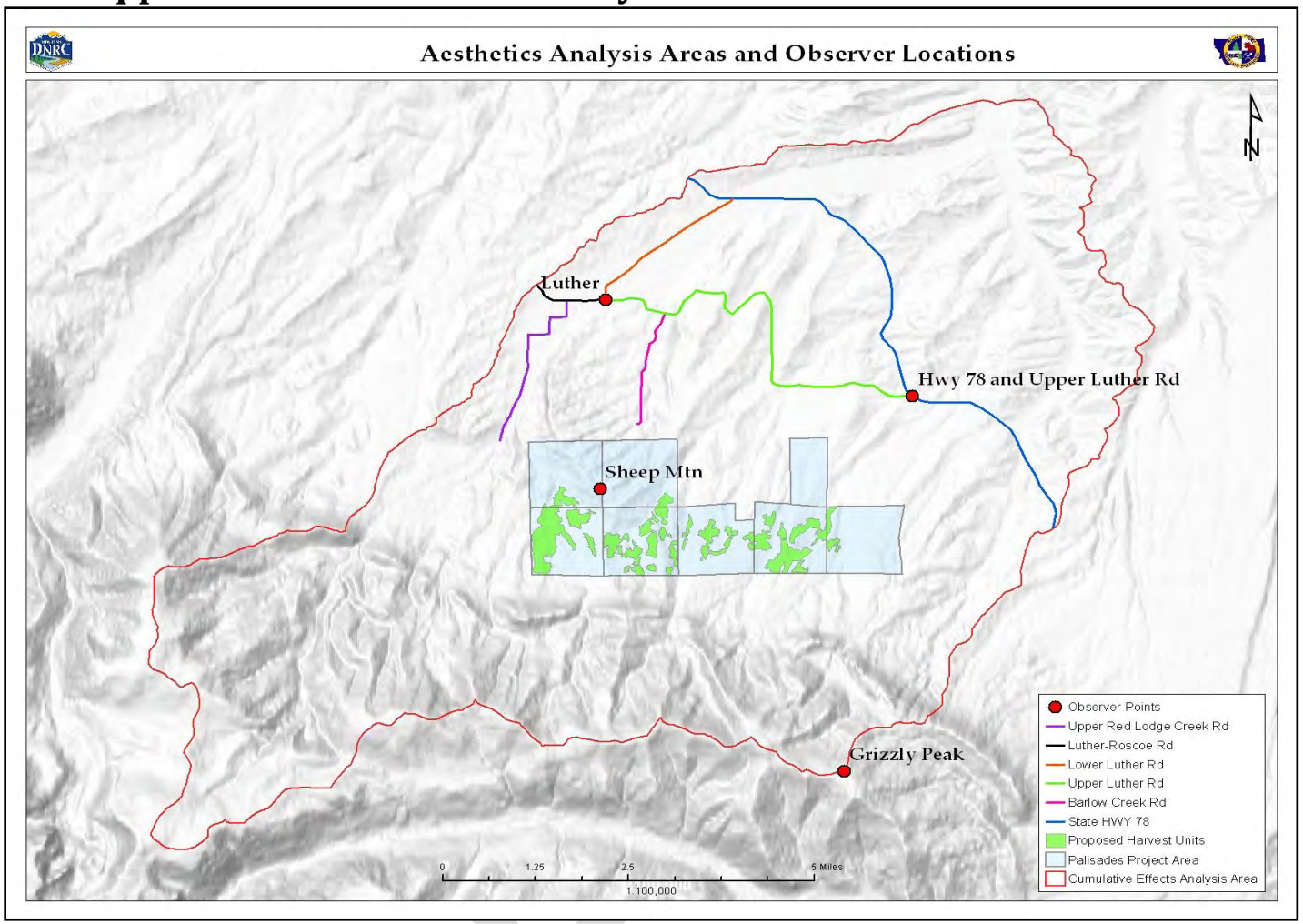
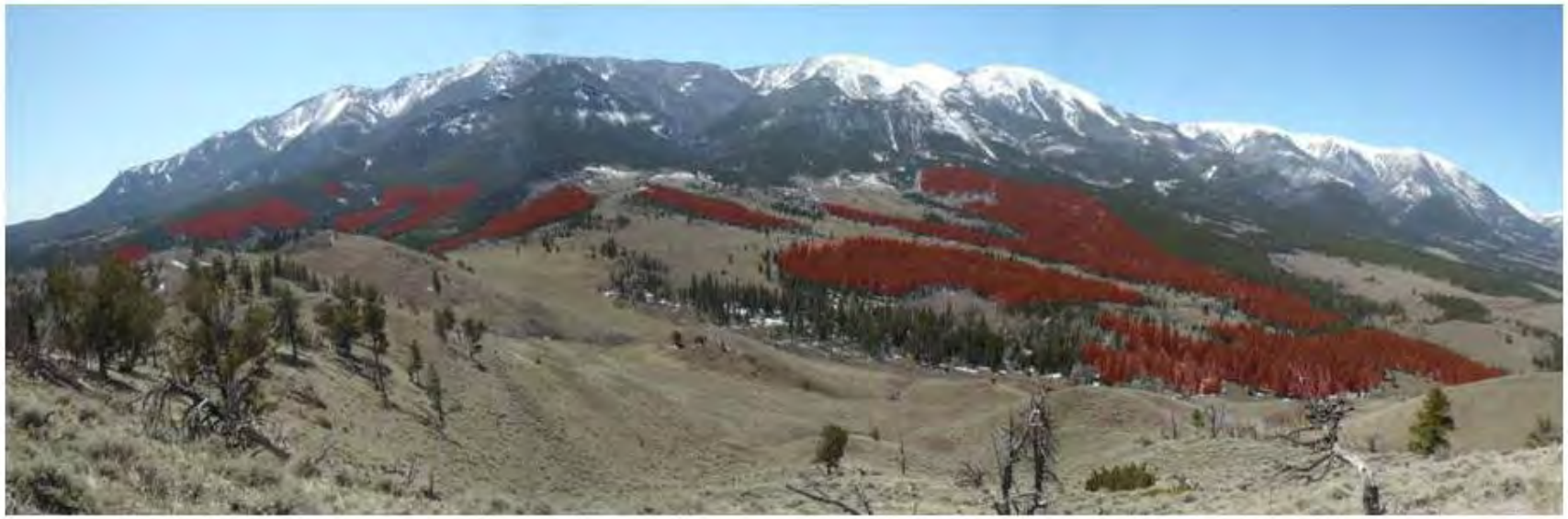
Appendix A-1-Aesthetics Analysis Areas and Observer Locations



Appendix A-2-Sheep Mountain Observation Point



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