East Reservoir Project DEIS

Chapter 3

Affected Environment and Environmental Consequences

INTRODUCTION

This chapter summarizes the physical, biological, social and economic environments of the project area (from now on referred to as the analysis area) and the effects of implementing each alternative on that environment. It also presents the scientific and analytical basis for the comparison of alternatives presented in the alternatives chapter.

Chapter 3 describes the environment (including its human elements) in and around the analysis area and discusses the environmental consequences by resource that may result from implementation of each of the alternatives. It provides the scientific and analytic basis for the comparison of alternatives presented in Chapter 2. Maps referred to in the analysis are located at the end of this document.

The Council on Environmental Quality Regulations (CEQ) recognizes three types of effects:

- **Direct Effects** are caused by an action and occur at the same time and place.
- **Indirect Effects** are caused by an action but occur later in time or farther removed in distance.
- **Cumulative Effects** result from the incremental impact of an action when added to other past, present, and reasonably foreseeable future actions, regardless of what agency or person undertakes the other actions (40 CFR 1508.7 and .8). Since the results of past actions are already included in the affected environment, the cumulative effects analysis builds upon this existing condition assessment by considering the incremental addition of direct and indirect effects of the proposed action as well as ongoing and reasonably foreseeable actions.

PAST, PRESENT AND REASONABLY FORESEEABLE ACTIONS

Analysis of cumulative effects presented in this chapter considered past, present, proposed and reasonably foreseeable activities that could affect the issues pertinent to this analysis. Activities on public and private lands have been considered.

Reasonably foreseeable actions include those management activities that are on-going or scheduled to occur within the next five to ten years and for which a proposed action has been developed. These activities may occur regardless of which alternative is selected for implementation.

The environmental analysis required under NEPA is forward-looking, in that it focuses on the potential impacts of the proposed action. Past and present activities and natural events have contributed to creating the existing condition and trends across the Kootenai National Forest (KNF). In order to understand the contribution of past actions to the cumulative effects of the proposed action and alternatives, this analysis relies to a large extent on an examination of the current environmental conditions in order to highlight the impacts of past actions. This method is useful because existing conditions reflect the aggregate impact of all prior human actions and natural events that have affected the environment and might contribute to cumulative effects. Additionally, some of these activities, as well as reasonably foreseeable activities, may continue to produce environmental effects that overlap in time and space with issues or resources relevant to the proposal. Therefore, past, present and reasonably foreseeable activities have been considered in the cumulative effects analysis for each resource area relative to potential future effects of the proposal.

The cumulative effects analysis in this Draft Environmental Impact Statement (DEIS) is consistent with regulations at 36 CFR 220.4(f) (July 24, 2008) in accordance with the CEQ Memorandum, *Guidance on the Consideration of Past Actions in Cumulative Effects Analysis*, which state, in part:

> "The analysis of cumulative effects begins with consideration of direct and indirect effects …agencies then look for present effects of past actions that are, in the judgment of the agency, relevant and useful because they have a significant cause-and-effect relationship with the direct and indirect effects of the proposal for agency action and its alternatives. CEQ regulations do not require the consideration of the individual effects of all past actions to determine the present

effects of past actions. Once the agency has identified those present effects of past actions that warrant consideration, the agency assesses the extent that the effects of the proposal for agency action or its alternatives will add to, modify, or mitigate those effects. The final analysis documents an agency assessment of the cumulative effects of the actions considered (including past, present, and reasonable foreseeable future actions) on the affected environment. With respect to past actions, during the scoping process and subsequent preparation of the analysis, the agency must determine what information regarding past actions is useful and relevant to the required analysis of cumulative effects. Cataloging past actions and specific information about the direct and indirect effects of their design and implementation could in some contexts be useful to predict the cumulative effects of the proposal. The CEQ regulations, however, do not require agencies to catalogue or exhaustively list and analyze all individual past actions. Simply because information about past actions may be available or obtained with reasonable effort does not mean that it is relevant and necessary to inform decision making. (40 CFR 1508.7)"

During the scoping process and subsequent analysis of this project, the Forest Service (FS) determined that the following activities, decisions, information and environmental documents are applicable to all or portions of the National Forest Service (NFS) lands included in the analysis area for this DEIS. As appropriate, they were considered during the cumulative effects analyses discussed in this chapter. This section also lists known past activities identified by resource specialists as being pertinent to an analysis of cumulative effects for the East Reservoir project. There are marked differences between past and current land management practices and policies. The evolution that has occurred in land management practices is the result of science, our ongoing monitoring actions, and changing public values.

A cumulative effects map showing considered activities is included in the project file.

The following discussion identifies those past, present, and foreseeable actions that have occurred within the East Reservoir analysis area. Data on private lands within the subunit has a moderate level of accuracy, and is the best available information obtained from those landowners and field verified information.

Land Ownership: Total acres and percent of total land in the Cripple Planning Subunit by landowner are displayed in Table 3.0.

Table 3.0 - Acres by Land Owner and Percent of Total Land in Analysis Area

LAND OWNER	TOTAL ACRES	% OF TOTAL LAND
USDA Forest Service	78,546	85.0
Plum Creek Timber Company	7,672	8.3
Montana Department of State Lands	4,032	4.4
Other Private	1,355	1.4
US Army Corps of Engineers	802	0.9
Total Acres	**92,407**	**100**

Past Harvest: Table 3.1 displays harvest history in the East Reservoir analysis area by landowner, by decade and by acres of harvest type.

Table 3.1 - Harvest History of the Cripple Planning Subunit

LAND OWNER	YEAR	TYPE of HARVEST (acres)			TOTAL
		INTERMEDIATE	LIBERATION	REGENERATION	
Forest Service	1960-1969	1,418	46	2,542	4,006
	1970-1979	2,698	372	1,873	4,943
	1980-1989	1,014	704	8,486	10,204
	1990-1999	78	6,773	4,080	10,931

LAND OWNER	YEAR	TYPE of HARVEST (acres)			TOTAL
		INTERMEDIATE	LIBERATION	REGENERATION	
	2000-2009	0	1,639	412	2,051
	2010-2019	0	0	2,932	2,932
Plum Creek Timber Company	1950-1959	20	0	0	20
	1960-1969	18	105	0	123
	1970-1979	355	38	64	457
	1980-1989	1,293	33	1,127	2,453
	1990-1999	1,384	121	684	2,189
	2000-2009	176	0	371	547
	2010-2019	0	0	0	0
Private	1970-1979	277	0	0	277
	1980-1989	140	374	0	514
	1990-1999	0	115	0	115
Montana Dept. State Lands	1970-1979	111	0	0	111
	1980-1989	905	24	106	1,035
	1990-1999	578	0	187	765

A listing of all past timber sales by names and the year those sales were sold is included in Table 3.2. This table does not contain every timber harvest activity in the subunit because some harvesting took place that did not have a timber sale name.

Table 3.2 - Past Timber Sales on USFS Lands within the Cripple Planning Subunit

SALE NAME	YEAR SOLD	ACRES		SALE NAME	YEAR SOLD	ACRES
Canyon Creek	1976	257		Hornet Power Poles	1990	1
Stenerson	1977	325		Old Nag Salvage	1990	8
Ant Hill	1981	317		Out Of The Black PC	1990	40
Lost Margaret	1981	365		Patches PC	1990	20
Tidy Bowl	1981	82		Sten Again Salvage	1990	166
Davis Mountain	1982	501		Grimm OSR	1990	58
Cripple Larix	1982	87		Blowout Salvage	1991	17
Five Mile Davis	1982	266		Dry Fork Roadside	1991	4
Gone To The John	1982	25		Blue Sky Bugs Salvage	1991	5
Warland Cripple	1982	366		Five Mile Pulp Salvage	1991	32
Warland Davis Bugs	1982	167		Cripple Land STR	1991	252
Bornite OSR	1983	85		DWS Heli Salvage	1991	182
Canyon Creek	1983	954		Head of 5 Mile PC	1991	580
Cripple Fish	1983	9		Lake Creek Insect Salvage	1991	20
Juicy Davis	1983	40		Snag Roadside Salvage	1991	84
Hornet Power	1983	62		Tucan STR	1991	48
Killum Horse Cleanup	1983	11		Wipeout Salvage	1991	37
LA Bootleg	1983	35		Wyoma Pine	1991	78
Looky Lou	1983	185		Huckleberry PC	1991	175
Blas Production	1984	19		5 Below Down Salvage	1992	117
Chromite STR	1984	47		Boof	1992	21
Galena	1984	28		Grimm Falls Salvage	1992	12
Magnetite STR	1984	40		Canyon YCH STR	1992	261
Molybdenite STR	1984	197		Go For It LP Salvage	1992	22
Snag Park	1984	1,311		High Five PC	1992	36
Swamp Mtn Pest	1984	23		Shore Line Salvage	1992	170
Yarnell Cripple Horse PC	1984	1,446		Back to Canyon STR	1993	253
Canyon Bait and Salvage	1985	15		I Am Bushed STR	1993	38
Dunn Creek PC	1985	523		Horn It Out	1993	75
Horsebait PC	1982	27		Broomtail Salvage	1993	34
Mallard STR	1985	28		Buckshot STR	1993	73
Red Fever	1985	9		Keep It Going Blow	1993	28

SALE NAME	YEAR SOLD	ACRES		SALE NAME	YEAR SOLD	ACRES
Redhead STR	1982	19		Duck Neck Post and Pole	1993	1
Wolf STR	1985	124		Five Mile Helicopter	1993	165
Scuzzite	1985	98		Lake Creek Salvage	1993	21
Summit Springs Bait	1985	14		Lookout Salvage	1993	34
Syrup Redemption PC	1985	101		Mineral Sheep	1993	53
Dunn Away PC	1986	37		Cripple Cord	1993	3
Pintail STR	1986	78		Old Weezer STR	1993	132
Scarlet Wyoma PC	1986	368		Lake Mtn Salvage	1993	13
Stan's Demand STR	1986	81		S Cripple Horse Rdsd Salvage	1993	26
Ucan PC	1986	37		Wag Salvage	1993	193
Warhorse PC	1986	27		Why Not STR	1993	318
Canyon Pine Salvage	1987	133		Dunn Down	1994	13
Canyon Z PC	1987	186		Heli House Salvage	1994	305
Dry Three Mile PC	1987	283		Lake Creek	1994	57
Nutria STR	1987	118		Loner STR	1994	144
Sore Feet PC	1987	52		Summit Cord	1994	4
Tangled Elk PC	1987	59		Weigel House Salvage	1994	46
Al's Finale	1988	331		YCH Roadside Salvage	1994	80
Buggy Five PC	1988	80		Ant Wildlife	1995	46
Canyon Finale	1988	153		Backus Roadside	1995	3
Canyon Salvage	1988	204		Cripple Peak Heli Roadside	1995	81
Cherry PC	1988	145		Movie Spur Salvage	1995	27
Cripple Pine PC	1988	104		Canyon Area Salvage	1996	453
Grim Creek	1988	69		Wag 2 Salvage	1996	20
Hidden Gorge	1988	2		Fly It Out Heli Salvage	1996	188
N Fork 5 Mile PC	1988	156		Hiper Roadside Salvage	1996	11
Scoodles PC	1988	195		Out the Door Roadside Salvage	1996	51
Son of Wolf Ins Salvage	1988	36		Two Stooges Salvage	1996	83
South Dunn PC	1988	459		Sheep Mountain	1996	41
Stenerson Salvage	1988	76		Stenerson Saddle	1996	18
Warout PC	1988	209		Done Creek Salvage	1997	371
Billy Gobbler PC	1989	63		Huff Puff Heli Salvage	1997	35
Canyon Creek	1989	92		Snag STR	1997	261
Crossroads Salvage	1989	82		Spring Loaded	1997	38
Freckled Horse PC	1989	511		Upper 5 Mile Salvage	1997	739
Giesville Pine PC	1989	100		Warland Salvage	1997	197
Sheep Creek	1989	101		Bed Springs BD	1998	3
Smokeys Despair	1989	63		Swamp Ridge	1998	30
Stump Holes and Ash	1989	78		Wolf Davis Rdsd Heli Salvage	1998	13
Toasted Board Salvage	1989	116		Boundary Mtn Salvage	1999	358
Warland PC	1989	548		Cripple Horse Salvage	1999	597
Waron Bugs	1989	127		Twisted Knee Salvage	1999	2
Ant Out	1990	179		Weigel Salvage	1999	86
Black Bush Salvage	1990	116		Yarnell STR	1999	129
Black Horse Salvage	1990	154		Canyon II Salvage	2000	250
Can Horn PC	1990	22		So Fork 5 Mile Salvage	2000	118
Canyon Post and Pole	1990	5		3 Dog Down Blowdown	2000	9
Cripple Hot Salvage	1990	16		Grimm Lake Salvage	2000	33
Bound Up STR	1990	116		Dry Pocks Salvage	2001	26
Down Home Davis	1990	14		Stenerson Cliff Salvage	2001	30
Devastation Alley	1990	244		Can IT Salvage	2002	297
Green Burnt Salvage	1990	88		Reservoir East Re-Ad	2010	69

PC = Pest Control STR = Seed Tree Removal BD = Brush Disposal Heli – Helicopter Rdsd – Roadside
OSR – Overstory Removal

Forestwide Fuels: In 2011, three Forestwide Fuels units (2001 Forestwide Fuels Reduction and Wildlife Habitat Enhancement EA) were slashed in preparation to be burned (910 acres). These units are FWF545

(Gopher Hill) which is 265 acres, FWF536 (Warland Peak) which is 195 acres and FWF52403 (Warland Peak) which is 450 acres. These units are scheduled to be underburned between 2013 and 2015. In 2010, 170 acres of FWF589 was slashed. Twenty-five of those acres are in old growth and are expected to be burned in 2013.

REASONABLY FORESEEABLE ACTIONS

Reasonably foreseeable actions include continued forest management on private and Forest Service land in the Cripple Planning Subunit that are on-going or scheduled to occur within the next five to ten years These activities are expected to continue to occur and have been included in the analysis of cumulative effects. A large amount of private industrial lands are included in this analysis area. Data on those lands has a moderate level of accuracy, and is the best available information derived from those landowners and field verified information.

Actions on Private Lands: Continued development of private lands within the analysis area is expected. Development is expected to include commercial timber harvest, land clearing, home construction, road construction, septic field installation, water well drilling, livestock grazing, pile burning and stabilization of migrating stream banks.

Table 3.3 shows the foreseeable activities within the next ten years on State of Montana lands within the East Reservoir analysis area. This information was requested from the State of Montana Department of Natural Resources and Conservation (DNRC) when the analysis of this project began.

Table 3.3 – State of Montana Department of Natural Resources and Conservation Activities

LEGAL LOCATION	SECTION	HARVEST TREATMENT	ACRES
T31N, R29W	12	Regeneration	198
ACTIVITY		MILES	
New Road Construction		0.84	

Regeneration Harvest Treatments: Shelterwood w/Reserves, Seedtree w/Reserves or Clearcut w/Reserves

U. S. Corps of Engineers: The Dunn Creek Watershed Connectivity Project has been proposed. Depending on the level of restoration implemented, the following may occur; the historic railroad concrete box culvert would be removed or bypassed; the culvert under Hwy 37 would be replaced or modified to accommodate aquatic organism passage; and the last ½ mile of Dunn Creek would be fully restored to return stream function as well as aquatic organism passage; large eroding banks two miles upstream of Hwy 37 would be stabilized.

Precommercial Thinning: Approximately 760 acres of precommercial thinning has been approved and contracts have been awarded in the Cripple Horse and Canyon Creek drainages. This thinning is will be on-going over the next 5 years.

Forestwide Fuels: The three Forestwide Fuels units (2001 Forestwide Fuels Reduction and Wildlife Habitat Enhancement EA) that were slashed in 2011 will be underburned between 2013 and 2015 (910 acres).

Outfitter and Guide Activities: One outfitter holds a permit for hunting activities within the Reservoir East analysis area. That outfitter has had camps in Dunn Creek (2) and the South Fork Cripple Horse in previous years but currently none are planned or approved. If camps are proposed and approved, the outfitter is allowed two motorized trips per camper year behind gates, one trip prior to hunting season to move in camp and one trip after hunting season to move out. Clients move in/out of camp by horse drawn wagon intermittently during the hunting season.
Small Sales: Small fuels reduction projects may be authorized in the analysis area through separate decisions.

Data Gathering Activities: Field surveys to gather resource data are likely to occur within the analysis area within the next five years. Types of data collection may include vegetation surveys, fire history sampling, cultural resource surveys, ecodata plots, wildlife habitat surveys, noxious weeds surveys, stream surveys, road maintenance surveys, and fuels surveys.

Road Activities: Routine road maintenance is likely to occur as needed on existing roads in the analysis area. The roads most likely to receive maintenance are those open to vehicle traffic.

Fire Suppression Activities: If conditions are such that there are fire starts within the analysis area, efforts will be made to suppress any and all fires.

Weed Control: Spraying to control weeds is ongoing within the subunit area under the Kootenai National Forest Herbicide Weed Control Plan Environmental Assessment and associated Decision Notice and Finding of No Significant Effect, 1/97. Noxious weed management activities may also occur on PCTC lands, state lands and private property. Approximately 183 acres was sprayed in the Cripple Planning Subunit (Weeds project file) in 2010.

Minerals Activities: There are ten gravel pits within the East Reservoir analysis area. Table 3.4 displays the names of the gravel pits and what their status presently is. The gravel pits are located on National Forest Service lands. Three of these active pits still have reserves of material. Gravel pit locations are shown on the cumulative effects map in the project file.

Table 3.4 – Gravel Pits in East Reservoir Analysis Area

GRAVEL PIT NAME	STATUS
Fivemile Creek	Reclamation
Ant Hill Quarry	Active
Cripple Horse	Reclamation
Lower Cripple Horse	Active
S Fork Cripple Horse	Reclamation
Middle Cripple Horse	Reclamation
Gopher Hill Pit	Reclamation
West Dry Fork Quarry	Active
Hornet Ridge Quarry	Reclamation
Dunn Creek Quarry	Pending

The Libby Ranger District has received interest for small sales of building and landscape stone from the Cripple Horse Area. Stone sales would be small in nature – generally for 20 – 200 tons. There are several sites adjacent to the main Cripple Horse Road #835 from milepost 5 – milepost 7.5 that would be appropriate for this activity. Equipment may be used to load heavy stone or pallets of stone onto a vehicle for transport offsite. No road building would take place.

Special Use Permits: There are ten special use authorizations within the East Reservoir analysis area. Linear uses consist of authorized rights-of-way for roads, water developments, and utility corridors. Most road uses are short segment roads that were built to access private land/residences from major Forest roads. Water developments normally consist of a spring developments and water transmission line crossing NFS lands leading to a residence for domestic potable and non-potable uses. Electric and telephone utility corridors are normally buried in the right-of-way adjacent to major Forest roads.

Area uses include marina, cultivation and experimental authorizations. Cultivation authorizations usually allow the use of NFS lands for hay or other cultivation. The Libby Dam has experimental or demonstration authorizations which allow the use of NFS lands as a location for some sort of scientific

monitoring station or apparatus.

Marina authorizations include access to a body of water on NFS lands, and can also include associated uses such as lodging, guiding, sales, etc. The Koocanusa Marina plans to expand its camping sites during 2013. This expansion includes 33 new seasonal RV camping sites, a new septic system and a new well. There will be selective tree and vegetation removal allowing for the construction of the access road and sites, while providing screening for the sites. The sites will be situated on an additional loop road – portions of which will be reconstructed road and new road construction. An extension to the existing waterline will service the new RV sites, and a new septic and drainage lines will be installed. An additional well will be drilled, and a new pump house will be built in place of the existing one.

The proposed expansion will ideally take place in the fall of 2012 and spring 2013, with the new sites being opened summer 2013.

Another project planned for this summer/fall of 2013 is the Marina repaving project, which will chip seal approximately 0.9 miles of the access road and the parking lot.

State Designation of Hwy 37: Hwy 37 has been designated a State Scenic byway. An interagency team is working on proposed interpretive and developed sites.

Grazing: There are four grazing allotments in the analysis area. They are Fivemile, Warland, Cripple Horse and Canyon Creek. Cripple Horse and Canyon Creek allotments have been closed through the administrative closure process due to declining transitory range, lack of demand and riparian area concerns. Cripple Horse and Canyon Creek have been inactive for over 10 years. The Warland Creek Allotment has been vacant for 6 years; the permit was waived back to the Forest Service in 2010. It will be maintained as a vacant allotment with potential for grazing in the foreseeable future. Fivemile is an active allotment that supports 17 cow/calf pair with a grazing season of June 1to October 15. Much of the grazing is on private land owned by the permit holder along Fivemile Creek and upland areas adjacent to Blue Sky Road #6271. A Designated Monitoring Area (DMA) was established during the 2010 grazing season on Fivemile Creek immediately below the permit holder's private land boundary. Monitoring of the DMA and accompanying fish habitat monitoring would establish trend information for the riparian and stream channel conditions on the Fivemile Allotment. All four allotments were included in the Reservoir Range Environmental Analysis (EA) completed in 1997/1998. The Reservoir Range EA permitted grazing on all four allotments from 1998-2008.

Public Activities Likely to Occur: Firewood and Christmas tree cutting is likely to continue to occur along open roads. Recreational use of the area will also continue and includes driving open roads, snowmobiling, hunting, hiking, berry picking, and other activities.

VEGETATION RESOURCE INTRODUCTION

The forests of the Inland Northwest, including the drainages along the east side of the Koocanusa Reservoir, are ecologically diverse in many aspects. This diversity stems from complex ecological interactions between forest tree species and climate, geology, soils; and disturbance patterns such as logging, insects, disease, fire and extreme weather events. These elements combine with productive growing conditions and ample available moisture to create some of the most varied and productive forest communities in the Inland Northwest. These forest communities are dominated and defined by conifer trees such as western hemlock (WH), mountain hemlock, western redcedar, grand fir, Douglas-fir (DF), western larch (WL), western white pine (WWP), lodgepole pine (LPP), ponderosa pine (PP), subalpine fir (AF) and Engelmann spruce; and associated shrub and herbaceous plant species.

The following vegetation analysis describes the existing condition and effects of the alternatives to vegetation and ecological processes in Fivemile Creek, Warland Creek, Cripple Horse Creek, Canyon Creek, Dunn Creek, as well as associated face tributaries to Koocanusa Reservoir. This section will address the vegetation treatments in regard to the identified purpose and need to:

- Re-establish, restore and retain landscapes that are more resistant and resilient to disturbance (insect and disease infestations, fire) and uncertain environmental conditions (climate change) by enhancing species diversity and managing density;
- Reduce hazardous fuels adjacent to private property and across the landscape and re-introduce fire to the ecosystem;
- Restore, maintain or improve wildlife habitat;
- Improve recreation settings, opportunities and experiences;
- Provide amenities, jobs and products to the communities and maintain an adequate, balanced transportation system.

REGULATORY FRAMEWORK

Federal

The regulatory framework providing direction for the management of forest vegetation is provided through the National Forest Management Act of 1976 (NFMA) and the Forest Plan for the Kootenai National Forest (KNFP) (1987). NFMA provides for balanced consideration of all resources and requires the Forest Service (FS) to plan and manage for diversity of plant and animal communities. The KNFP, in compliance with NFMA, establishes forestwide management direction, goals, objectives, standards and guidelines for the management for forest vegetation and plant communities. Silvicultural Practices Handbook (FSH 2409.17) gives direction on vegetation management practices.

State

HB-731, Montana Stream Management Zone Law for vegetation management within Stream Management Zones (SMZs), defines sideboards for management activities within the SMZ. In general, this act is overshadowed by the Inland Native Fish Strategy (INFS) on National Forest Service (NFS) lands because INFS requires even larger protection zones for streams than that prescribed by the Montana Stream Management Zone Law.

ANALYSIS AREA

The East Reservoir analysis area lies within timber stand compartments 56, 57, 58, 59, 60, 61, 62, 63 and 64, covering approximately 92,400 acres. The potential environmental effects (direct, indirect and cumulative) of the proposed action and alternatives on the vegetation will be discussed.

The defined boundaries provide an appropriate analysis area for the vegetation resource related to characteristics such as species composition, forest structure and patterns, and disturbances such insect, disease and fire. The scale of analysis also provides an appropriate size area to monitor changes in vegetation trends over time, natural or human-caused. The time frame for this effects analysis would extend out to the expected ecological rotation age of the typical forested communities in the area.

ANALYSIS METHODS

This analysis will review the existing and historical conditions, trends and desired future conditions in the analysis area, focusing on proposed activities that may have a measurable effect on vegetation.

District vegetation databases (FACTS, FSVeg), a R1 Summary Database and field reconnaissance were utilized to generate information on forest vegetation attributes such as forest cover type, stand density and successional stage, the vegetation response unit (VRU) classification, incidents of insect and disease, as well as information on past activities. Annual aerial observations of insect and disease activities were also evaluated to facilitate understanding of longer term fluctuations in insect and disease dynamics across the landscape. Aerial photographs, both historic and contemporary were used at various stages of the analysis. Scientific literature, field reviews and subsequent silvicultural assessment were also used in the analysis. These analysis tools were used to identify site-specific treatment needs that address the purpose and need for the project.

The inherent limitations to the database and models are recognized. Not all surveys and subsequent data come from the same time period, with some surveys over 20 years old. The data is used primarily for broad generalizations, arithmetic sums and means, and to supplement current, site-specific information gathered at each proposed unit and area of interest. R1 FSVeg has adequate resolution and accuracy for applications required in this effects analysis discussion.

This effects analysis relies in part on the Montana Habitat Type system as described by Pfister et al. (1977) because this part of Montana supports very similar ecological conditions.

The habitat type information helped guide stand-level diagnosis and analysis, for development of proposed treatments, and to better understand potential effects. For more broad scale evaluations and planning, habitat types were grouped, referred to as VRUs, to facilitate landscape-level analysis based on similar environments and vegetation characteristics such as productivity, disturbance regimes, stand dynamics, susceptibility to insect and disease, forest cover types, structural stages and successional pathways.

Proposed treatments were identified by a silvicultural forester based on observed insect and disease activity and potential risk; existing vegetation conditions; desired stand conditions based on interdisciplinary evaluation; and potential contribution to the larger landscape desired condition (Project File). Desired stand conditions and potential treatments to obtain them are ecologically compatible with the site, and the current and reference disturbance patterns and successional pathways of the landscape's vegetation. These desired stand conditions are also based on the KNFP management area direction, and site-specific objectives recommended by the Interdisciplinary Team (IDT). Recommendations from site visits by Region 1 Forest Health Protection specialists, Forest Silviculturist and Forest Leadership Team were incorporated into the proposed treatments.

Indicators are used to examine how management actions would possibly address the purpose and need, and to aid in analyzing potential environmental effects to vegetation. These indicators and the units of measure for each are:

1) Implement activities that trend tree species composition towards the reference tree species composition for each VRU. The reference composition was more resistant and resilient to disturbance (insect and disease infestation, fire and uncertain conditions such as climate change). This will be measured by showing the acres that are treated (either through thinning or regeneration followed by planting of the desirable species) to increase the relative composition of rust resistant western white pine, larch and ponderosa pine.

Species composition or forest type of the stand is determined from the greatest amount of square feet of basal area of the total live component of the stand. Basal area (BA) is the cross-sectional area of a tree

at diameter breast height (DBH). The BA of a forest stand is found by adding the basal areas of all of the trees in an area and dividing by the area of land in which the trees were measured. Basal area is expressed as square feet per acre.

2) Implement activities that trend stand-level tree density (BA) towards reference density condition by VRU. Stand density was determined from the amount of total live square feet of basal area per acre. The reference density levels are more resistant to insect and disease infestations, fire and uncertain conditions such as climate change. This will be measured by showing the treatments by number of acres that reduce basal area by VRU.

Total live basal area per acre was then put into the following density classes for this analysis:

TOTAL LIVE SQUARE FEET OF BASAL AREA PER ACRE
Less than 20 feet
20-50
51-80
81-120
Greater than 120

3) A landscape that is closer to reference conditions will be more resilient, resistant and better adapted to disturbance due to diversity of stand successional stages across the landscape. This indicator will display changes in the successional stages by VRU across the landscape as a result of proposed activities and compare the current and future percentages of successional stages by VRU to the reference percentages.

Successional stages were determined by grouping ages into classes to describe Early- successional, Mid-successional, Late-successional and Very-late successional (Table 3.5).

Table 3.5- Age Class as Estimate of Stand-level Successional Stages

AGE CLASS	SUCCESSIONAL STAGE
0-40 years old	Early-Successional
41-100 years old	Mid-Successional
101-150 years old	Late-Successional
+151years old	Very Late Successional

Vegetation Response Unit Characterizations and Target Landscape Prescriptions (USDA 1999) are used to define groupings of Habitat Types into VRUs. The Region 1 Habitat Type Groups were the foundation for this VRU classification. To a large degree, the habitat type groups do a very good job of describing disturbance probabilities and vegetation responses (USDA 1999).

Table 3.6 - VRU Groups and Fire Regimes

VRU GROUP	CONSTITUENT VRUS	ACRES	% OF PA	FIRE REGIMES
Moderately Warm/Dry	VRU 2S	16,532	21	I
Moderately Warm/ Moderately Dry	VRU 3	17,467	22	III
Moderately Warm/ Moist	VRU4N	7,847	10	V
Warm/Moist	VRU 5	946	1	V
Cool/ Moist	VRU 7	22,453	29	III and IV
Cool/Moderately Dry	VRU 9	10,252	13	III and IV

The VRU is intended to be an aggregation of land having similar capabilities and potentials for management. As mapped polygons, these units have similar patterns in potential natural communities (habitat types), soils, hydrologic function, landform and topography, lithology, climate, climate air quality and natural disturbance processes (fire regimes, succession, productivity, nutrient cycling). The interaction of all these processes creates a mosaic across the area landscape. Within individual polygons

of any VRU over time, the proportion of age and size classes, succession stage and impacts of fire and/or disease will be dynamic as natural and managed disturbances occur (USDA 1999).

FIRE DISTURBANCE REGIMES

Four different fire regimes occur on this landscape. A natural fire regime is a general classification of the role fire would play across a landscape in the absence of modern human mechanical intervention, but including the influence of aboriginal burning (FRCC 2005).

Fire Regime I occurs on the warm and dry south and west aspects, and consists of frequent low severity fires on a frequency of 0-35 years (average of 22 years). This is a low severity (non-lethal) to mixed severity fire that consumes accumulated litter and undergrowth but leaves the majority of the overstory intact. At times these non-lethal burns may have created small, mosaic type openings (USFS 1999, page 6, FRCC Analysis, page 2-1, 4-22). The non-lethal burns interrupted the succession of Douglas-fir and were an important agent in controlling density and species composition in VRU 2.

Fire Regime III occurs on the moderately dry north and east aspects within VRU 2N and 3, and moderate to gentle topography within VRU 4 and 5, and is dominated by infrequent mixed severity, mosaic fires on a frequency of 35-100+ years. The average fire return is 59 years. These fires typically burn in a mosaic (USFS 1999, page 6, FRCC Analysis, page 2-2, 4-22). These fires would creep along the surface and occasionally flare up, killing trees in patches and favoring the fire tolerant western larch and ponderosa pine. During fire-free periods, the density of the more tolerant species would increase in the understory. The overstory trees become susceptible to crown fires when this occurs, as the ladder fuels provide access to the crowns in an otherwise surface fire. This condition can result in severe stand replacing fires.

Fire suppression activity has disrupted the low severity and mixed severity fire regime and has moved the landscape to one dominated by overstocked Douglas-fir, grand fir (GF), and other tolerant species stands that are at risk for severe, larger scale stand replacing fires.

Fire Regime IV is a high severity, stand replacing fire, on a frequency of 35 to 100+ years with an average return interval of 111 years. These fires typically kill more overstory than the mixed severity burns. High severity fires burn in a mosaic creating larger patches of openings and leaving variable portions of the forest structure intact. Quite often, unburned patches occur in predictable micro-sites (USFS 1999, page 6 and 7, FRCC Analysis, page 2-2, 4-22). The function of high severity, non-uniform burns is to replace the existing stand and move the vegetation back to the early successional stage. This regime is common on steeper slopes in VRU 4 and 5, and on all but the riparian areas and gentle and protected topographic areas in VRU 7 and 9.

During fire-free periods, dense thickets of lodgepole pine regenerate and develop into dense stands with inter-connected crowns with shade tolerant Douglas-fir, grand fir and subalpine fir in the understory. These stands are then more susceptible to crown fires when fire does occur, as the ladder fuels provide access to the inter-connected crowns. Fire suppression activity has resulted in little disruption to the high severity fire regime; however these stands are ripe for another stand replacing event due to the mortality in the lodgepole pine and the associated high down fuel loadings, and the fuel ladder provided by the tolerant species in the understory. Functionally the majority of this landscape type is moving towards the outer end historic range of variability. However; some of the mid elevation lodgepole pine stands that have a moderate component of western larch and Douglas-fir (50+ basal area), may trend towards more mixed severity fire cycles, and longer periods between high severity fire events. Therefore, some of this area may be within the historic range of variability for high severity fire, but towards the outer range for mixed severity.

Fire Regime V is a high severity, stand replacing fire, on a frequency of 200+ years with an average fire return interval of 223 years. These fires typically kill more overstory than the mixed severity burns, and average 77% stand replacement. High severity fires burn in a mosaic creating larger patches of openings and leaving variable portions of the forest structure intact. Quite often, unburned patches

occur in predictable micro-sites (USFS 1999, page 6 and 7, FRCC Analysis, page 2-2, 4-22). The function of high severity, non-uniform burns is to replace the existing stand and move the vegetation back to the early seral stage.

This fire regime generally occurs on flat to moderately steep ground in the mid to upper elevations and is commonly within the riparian influence areas within VRU 4, 5, 7, and 9. Fire suppression activity has resulted in little disruption to the high severity fire regime in these areas.

AFFECTED ENVIRONMENT

The analysis area is included in the Northwestern Montana Forest Region described by Pfister et al. (1977) and refined by Arno (1979). These landscape conditions are reflected in the Vegetation Response Unit Characterizations and Target Landscape Prescriptions (USDA 1999) which is used for target stand development and is a useful reference to describe the departure from historical conditions in the following sections. Map 6 shows the distribution of the vegetation response units (VRUs) within the analysis area.

Historic Range of Variability

The overall climatic condition on the Kootenai National Forest (KNF) has remained relatively uniform for approximately the past 1,400 years (Chatters and Leavell 1994). Within this time frame, disturbance processes together with landform and other environmental elements formed the major factors influencing the patterns of vegetation types across the landscape. Species abundance, distribution and viability resulted from this dynamic pattern. Native plants and animals throughout this time period and prior to changes brought about by modern day settlement and management, adapted to the rate of these climatic and disturbance regimes.

The Historic Range of Variability (HRV) is the context in which current and future conditions can be evaluated. For example, the condition and treatments of vegetation can affect the:

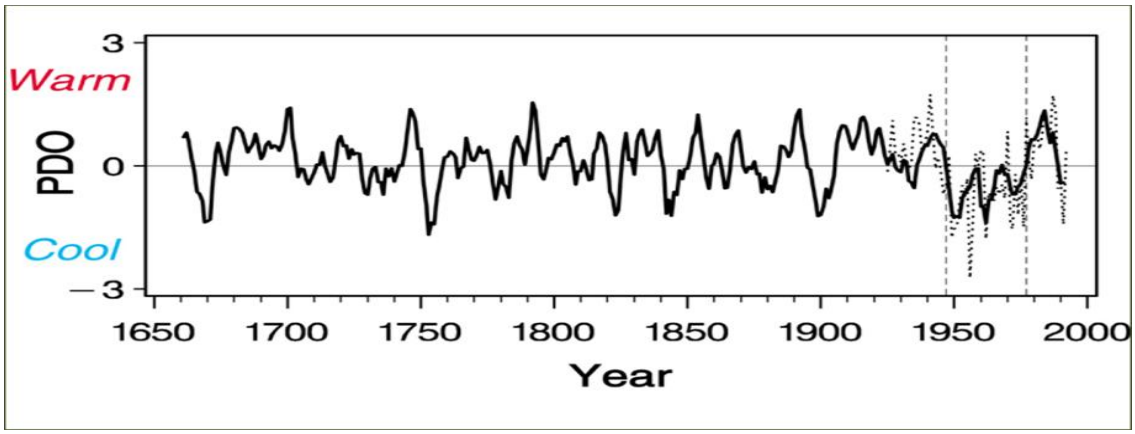
- Departure from forest species composition;
- Departure from stand density;
- Departure from successional stages.

Departures from HRV result in changes to one or more ecological components including vegetation characteristics, fuel composition, fire frequency, severity and pattern and other associated disturbances such as insect and disease, grazing, harvesting, etc.

Reference Conditions

Reference conditions refer to past or historic conditions of an ecosystem. HRV and Natural Range of Variability (NRV) are terms found in the literature that describes historic (reference) conditions. The purpose of describing reference conditions is to explain how conditions have changed over time as a result of human and natural disturbance, and forest succession. This information provides insights to important questions such as recent (past 150 years) frequency, intensity and scale of disturbances, abundance and rareness of plant and animal species, and the age-class and composition of trees (Kaufman et al. 1994). Fire, wind, insects and disease are important disturbance processes which create a dynamic mosaic of forest conditions. These natural events can occur in small, localized areas or impose changes over broad landscapes. Species composition, habitat diversity, age class distribution and stand structure are direct results of disturbances, which includes natural and human influenced disturbances.

There is support for managing ecosystems within the range of variability that has occurred during the past 2,000 years to sustain native species and maintain ecosystem integrity (Leavell and Chatters 1994). While dominant native species presence was sustained; managers must acknowledge that climate was not static within this time period. Throughout centuries, shifts in climatic conditions played a critical role in how landscapes develop over decades or centuries. The use of the Pacific Decadal Oscillation (PDO) provides a look into the changes that occur over centuries.



As an example, severe fire years tend to occur almost exclusively when warm weather spikes follow cool wet weather cycles. This correlation is also supported by a recent study of climate and fire correlations across the Northern Rockies by Heyerdahl, Morgan and Riser - Ecology 89(3) 2008. Climatic patterns are a major driver of insect infestations and wildfire effects and therefore have a strong influence on the landscape patterns and forest structure.

We are not attempting to recreate past conditions, and do acknowledge that the modern human imprint cannot be eliminated. Our proposal to restore ecosystems within a broad historical range is an attempt to keep all the parts, and to maintain a sustainable and resilient ecosystem, based on coarse filter management theories.

Proposed management activities are designed to fit within acceptable and manageable historic ranges (reference conditions) we have identified, and are designed to foster the processes and patterns that make up the ecosystem. Knowledge of historic conditions and natural disturbance processes, as described in the VRUs later in this analysis, can help clarify the types, extent and causes of ecosystem changes, and can help identify management objectives and restoration priorities (Brown 2004). It is hypothesized where community composition and structure occur within a historic range of conditions, the function of the landscape community will also be maintained within its historic range. It is important to note that function cannot be maintained by restoring the vegetation structure, composition and patch size without restoring fire on the landscape. No mechanical means alone can duplicate the unique ecological effects of wildland fire, such as soil heating, nutrient recycling, and the resulting effects to the community composition and structure (Kauffman 2004, pg. 880).

Reference conditions provide insights to important questions such as natural frequency, intensity and scale of disturbances, abundance and rareness of plant and animal species, and the age-class, size classes, and tree species composition (Kaufman et al. 1994). They also provide a valuable tool when combined with other information gathered from a variety of sources, such as site-specific investigation, old timber type data, old photos, fen (bog) sediment analysis, fire scar analysis, historical and research references, and inferences from VRU classifications designed for the Kootenai National Forest.

East Reservoir Analysis Area

The vegetation in the East Reservoir landscape is dominated by conifer forest. Major forest types include Douglas-fir mixed with ponderosa pine on the drier slopes and true firs, Douglas-fir, western larch, lodgepole pine and Engelmann spruce on the cool moist sites. Natural grass/shrub lands intermixed with rock outcrops make up a moderate portion of the landscape, and natural meadows, riparian zones, wetlands, and aspen groves, make up a minor but important portion of the landscape.

As described in the section on Reference Conditions, the cumulative influence of natural and human-

caused disturbances define the species composition, forest density and function of the landscape. Historically, wildfire and Native American burning played a role interrupting forest succession and creating much of the existing vegetation diversity. Since the mid-1900s harvest disturbances have played an increasing role.

DISTURBANCE AGENTS

The forest communities are dynamic and changing systems. Disturbances characterize all forest types. Effects from disturbances vary from minor (slow) changes to drastic (quick). In addition, continuous landscape alterations can range from small to very large, encompassing a few to thousands of acres. These disturbances historically include fires (wildfire and human-caused), domestic livestock grazing, insect and disease epidemics, floods, windstorms, timber harvesting and permanent land clearing.

Species composition, habitat diversity, age class distribution and stand structure are direct results of such disturbances, creating a dynamic mosaic of forest conditions. Since plants and animals adapt to habitat and disturbance conditions, it is considered desirable to manage towards a broad range of historic conditions. Restoration and managing for resilience is not just recreating historical conditions, but it provides a baseline range of conditions to evaluate how existing conditions depart from historic conditions that resulted largely from natural and historic human induced processes.

Insects and Disease

Most insects and diseases (pathogens) have integral functions in the forest ecosystem. They play a role in the fire ecology of northwestern Montana by creating areas of dead conifers that fuel large, stand-replacing fires. In general, where fire is removed from the natural processes, stand density would increase, composition moves towards shade tolerant species, and the probability of insect and disease outbreaks increase as populations increase and stress increases (Waring and Schlensinger 1985).

Historically, the most conspicuous insects and diseases in the forest were bark beetles, defoliators, stem decays and root disease. Root disease commonly thinned the Douglas-fir and grand fir from early seral stands of white pine, ponderosa pine and western larch. The early seral species have a high level of resistance and were able to capitalize on this reduced competition. The fires of the 1890s, selective harvest, fire suppression and the introduction of white pine blister rust has removed much of the intolerant species and reduced the opportunity for early seral species to become naturally established in some root disease areas. Root disease can predispose trees to attack by insects such as bark beetles.

Mountain pine beetle (MPB) was a large mortality factor in the LPP forest, with periodic infestations on PP and white pines. Douglas-fir beetle periodically caused significant mortality in late seral stands with a large diameter Douglas-fir component. Stem decays were common in Douglas-fir, grand fir and subalpine fir.

The major insects and diseases found within the analysis area affecting forest composition, stand structure, and fuel loads are described later in this analysis. There are other active insects and diseases within the analysis area, but levels are generally low and not considered as threatening to forest composition or stand structure. Many of these agents found affect species composition, but are considered within the "normal range" of a natural process. A consideration of forest health emphasizes prevention as opposed to suppression as a management strategy for insects, pathogens and natural disturbances that are considered detrimental to resource production. This emphasis is made with recognition of their beneficial role with regard to resources and ecosystem functions.

Forest insect and disease activity has been monitored via aerial observations for many years in Region 1. The 2009 and 2010 flights revealed MPB affecting the PP and LPP, western spruce budworm and some Douglas-fir beetle affecting Douglas-fir in the analysis area (project file map). In comparing the 2009 flight to the 2010 flight MPB in PP and LPP was about the same between the years with 2-10 trees

infested per hot spot. Western spruce bud worm intensity has varied across the analysis area with larger areas affected in 2010(many in the draw bottoms). Douglas fir-beetle was not detected in the analysis area in 2009 but was detected slightly in 2010.

Mountain Pine Beetle (*Dendroctonus ponderosae*) is a bark beetle that generally attacks mature and over-mature stands of LPP and other pine species. Outbreaks usually develop where average tree diameters are greater than eight inches, average stand age is 80 years or more, and in stands with extreme stocking. During major outbreaks, like those experienced on the KNF between1978 to 1985, the majority of pine trees over seven inches are generally attacked. This analysis area had very high infestations in the 1980s. The impacts of this very high infestation of mountain pine beetle were and still are very significant impact to the landscape of East Reservoir.

Mountain pine beetle infestations are rarely seen in PP stands where average tree diameter is less than six inches in diameter but are common in stands with average diameters between 8 to 12 inches in diameter (Sartwell and Stevens 1975). Outbreaks in ponderosa pine have historically not been as widespread as in LPP stands, but can kill ponderosa pine as young as 30-40 years of age. Most MPB outbreaks occur in even-aged, high density stands. For PP, stands with BA exceeding 150 square feet per acre, and average diameters greater than eight inches are considered highly favorable for MPB outbreaks (Schmid et al. 2007). Schmid et al. (2007) found that unlike in lodgepole pine, MPB in ponderosa pine attack a range of diameters. MPB activity in ponderosa pine often begins in densely stocked small and mid-size diameter classes and then moves into the larger size classes.

Schmid et al. (2007) and Olsen et al. (1996) found that MPB attacked trees that occurred in clusters and that hazard rating for stands with clumpy distributions is higher. In other words, even if a stand has a BA of 80 square feet per acre but has denser clumps distributed within, significant MPB-caused mortality may occur in those clumps and lead to additional mortality within the stand. Olsen et al. (1996) suggested that the competition between trees in the clusters placed stress on individual trees predisposing them to attack. A more even spacing within a stand leads to less inter-tree competition, and different microclimates. It may also lead to an increase in the amount of time that it takes for a low density stand versus a high density stand to become susceptible to significant MPB infestation.

The relationship between LPP and MPB has been extensively researched and is fairly well understood. Endemic populations of MPB allow for natural thinning of LPP stands, resulting in large expanses of mortality. Lodgepole pine surviving large infestations continue to grow until another beetle infestation occurs. This cycle continues on a 20 to 40-year interval, depending on the size and growth of trees, until LPP is eventually eliminated (Amman 1977). When MPB infestations occur in these LPP areas, heavy fuel accumulations follows. Since the most significant fuel component in these LPP forests is dead, woody material (Lotan, Brown and Neuenschwander 1984), heavy fuel accumulations result in very hot fires spreading over large areas (Amman 1977). MPB infestations are expected to increase with the predicted climate change. Also, when trees must compete for resources in overcrowded conditions, bark beetles can more easily overcome these stressed trees' defenses and initiate a severe outbreak.

A site visit of a regional entomologist confirmed that "MPB is at low and scattered levels on the Libby Ranger District." This is an opportune time to reduce potential impacts of MPB through silvicultural thinning treatments. Removal of infested trees and reducing stocking densities can increase the effectiveness of suppression techniques.

Douglas-fir Bark Beetle (*Dendroctonus pseudotsugae*) is a bark beetle that generally attacks large diameter, mature and over-mature Douglas-fir in dense stands. Characteristics usually found where Douglas-fir beetle epidemics occur are: stands with a component of Douglas-fir greater than 14" dbh; over 100 years old; and overstocked (greater than 140-150 basal area). Conditions that contribute to Douglas-fir bark beetle epidemics are any that weaken the tree and make it more susceptible to attack such as fire, windthrow and root disease.

Drought during the summer of 1998 increased the severity of the Douglas-fir Bark Beetle outbreak. The

occurrence of Douglas-fir Beetle on the KNF has been recorded since about 1950. The 1998 outbreak is considered to be the most significant, although during the years 1950-1952 a major outbreak was noted for Region 1 as a whole. The outbreak slowly dissipated and beetle populations are considered endemic now, although surrounding forests are still reporting beetle populations (USDA 2009). Douglas-fir Beetle infestations are expected to increase with the predicted climate change. Though numbers are now endemic, it should be noted that a large portion of the East Reservoir analysis area is composed of Douglas-fir that is of age and size to move into a moderate level of risk.

Western Spruce Budworm (*Choristoneura occidentalis*) is a defoliator which prefers to feed on true fir, Douglas-fir, spruce and larch foliage. Observations in this analysis area indicate only true firs and Douglas-fir are being attacked. The larvae mine the buds and old needles in the spring, and then consume new needles as they emerge. After several years of heavy defoliation, branch dieback and top kill, tree mortality can occur (USDA 2003). Mortality is rare for overstory trees as the larvae's defense against predators (birds) is to drop out of the tree via a silk thread to the lower canopy or understory trees. If mortality occurs, it is more common in these understory trees. According to the Forest Health Protection Annual Aerial Detection Survey of Western Spruce Budworm (WSB), intensity has varied across the analysis area with larger areas affected in 2010 (many in the draw bottoms). Although some understory tree mortality has been observed, few overstory trees have died. Stand conditions that are conducive to the budworm are high density, multi-layered canopies of desired species – a common characteristic in the riparian areas. Discussions with regional entomologists indicate that this outbreak could be related to delayed effects of drought in the mid-part of this decade, and that a return to normal moisture level may likely cause the budworm population to subside. The effects of WSB may weaken the overstory trees and pre-dispose them to other insect and disease infestation.

Dwarf Mistletoe (*Archeuthobium sp.*) is an endemic parasitic plant that depends on a host species (primarily western larch and LPP in this area) for water, carbohydrates and minerals. Effects on the host tree are reduced height and diameter growth, weakening trees, decreasing cone and seed production, top kill, which can lead to mortality. The typical lateral spread within the tree is 1-2 feet per year and seed spread is up to 100 feet from an infected tree. On-the-ground observations show that dwarf mistletoe is moderate in the western larch in some stands and as an occasional infection of LPP was found in the analysis area.

Root Diseases. On May 17 and 18, 2011, a Plant Pathologist from the Coeur d'Alene Field Office visited several proposed treatment areas across the analysis area with a special focus of identifying root diseases. In general, a fairly low level of root disease was found in the areas visited. Considerable time was spent in the proposed Fivemile Recreation Area due to the need to retain firm trees near campsites. In the proposed recreation site, both *Phaeolus schweinitzii* root and butt rot and Armillaria root disease were observed in Douglas-fir and western larch. The Armillaria root disease was isolated to one pocket of Douglas-fir at the eastern end of the north side of the proposed recreation area. *Phaeolus schweinitzii* is not usually considered an aggressive tree killer; rather it is relatively slow acting with the result in a gradual expression of symptoms. Seedlings can be infected and occasionally killed. However, it is generally in mature trees that root deterioration causes a measureable decline in tree vigor or increased likelihood of windthrow. *Phaeolus schweinitzii* is a major concern in recreation areas with a significant component of older Douglas-fir and western larch due to the high risk of windthrow and breakage. Development of recreation sites with *Phaeolus schweinitzii* should focus on retaining the most vigorous Douglas-fir and western larch, those exhibiting full crowns and good growth. After tree removal, it is advisable to allow the area to go through a winter season, when most wind and storm events occur, before the public is invited to camp. This should assist in determining the wind-firmness of the leave trees.

White Pine Blister Rust (*Cronartium ribicola*) was introduced to the west coast from Europe and Asia in the early decades of the 20th century. It spread quickly throughout most of the range of five-needle pines, where it has substantially reduced the populations of these pines throughout most their ranges in the west. This is an exotic pathogen that has not co-evolved with its hosts, and because of the

importance of white pine to forest diversity, there is great interest in managing to re-establish rust-resistant strains of this once widespread tree. Western white pine i not common in the analysis area.

Wind

Wind and the resulting windthrow is an important natural disturbance process in northwestern Montana ecosystems. High-intensity windstorms can heavily impact whole stands. Lower intensity windstorms destroy stands with a high percentage of defective or dead trees or those occupying particularly wind-prone sites. Wind throw resistance is somewhat similar to fire resistance, with certain species or individual trees more susceptible than others. When trees grow within an open canopy forest, growth is concentrated near the base of the tree as compared to a tree that is grown in closed conditions whose growth is concentrated in height because they are forced to grow tall to compete for light. Growth at the base of the tree results in increased strength against the forces of wind. Trees that have grown in dense stands are particularly susceptible to wind-throw when surrounding trees are removed (Waring and Schlesinger 1985). Trees growing in areas with shallow rooting zones (high water table or bed rock) are more susceptible to wind throw than trees in soils with a deeper rooting zone.

Fire Ecology and Fire History

Fire has been a major influence on vegetation patterns, composition, structure, function, age and development of both individual stands and the larger landscape (Habeck and Mutch 1973; Arno 1976; Arno 1980; Fischer and Bradley 1987). The intensity and frequency of historic fires and the resulting patch size and vegetation succession are predictable based on the biological, physical and climatic factors of the landscape. Forest vegetation adapted to these disturbance processes. For example, fire adapted species like western larch, Douglas-fir and PP have evolved thicker bark and a deeper root system that allow them to withstand frequent fires of higher intensity more effectively than species with thin bark and shallow roots such as LPP and true firs. Historically, stand-replacing fires often left the fire-adapted species as single standing trees or groups with an open canopy (Smith and Fisher, 1997). These stands would then reproduce under the open canopy, thereby perpetuating the seral fire-adaptive species.

Historically, the influence of fire created a mosaic of stands with a variety of vegetation species, sizes, ages and structures, as well as variable patch sizes. Prior to European settlement of the western states, the landscapes of western Montana were largely characterized by the natural and Native American induced fire regime; influenced by varying moisture, temperature and vegetation composition. The availability of seed from LPP with serotinous cones meant rapid restocking of burned sites – especially in the mid- to upper elevations. Persistent, large diameter fire survivors of western larch, Douglas-fir and ponderosa pine helped to maintain a mix of species.

Disruption of historic fire cycles and the associated increase in stand density and tolerate conifer species (Douglas-fir, etc.) has likely contributed to increased incidence of insects and disease across the landscape.

See Fire and Fuels Section for fire history for the East Reservoir analysis area.

Climate Change

Over the next 50 years, the United States, as a whole, is projected to be warmer and wetter. This could lead to increased forest growth, density and competition, then consequently demand and stress during water limited periods. Wildfires and insect outbreaks in the western United States are projected to increase over the next 50 years. In the last 10 years, forest fires annually burned 0.9% of forested land in the United States, with the largest fire year (2006), burning 1.3% . This corresponds to an overall average return interval of 100 years for U.S. forest fires. If fires become more severe, especially where ecosystems are not adapted to severe fire, the likelihood that fire would change forests to shrublands or meadows would increase.

Intense fires and insect outbreaks over large areas would increase carbon losses. Long-term fire effects on carbon stored in forests are minor; if the forest regenerates, regrowth recovers the carbon lost in the fire and in decomposition if the trees are killed by fire. If fires convert forests to meadow or shrublands, losses of carbon can be considerable (Ryan 2008).

Disruption of historic fire cycles combined with the predicted climate change, may also contribute to accelerated insect and disease infestations. Warming climatic conditions appear to be accelerating seasonal insect growth and development (Logan 2003). Northern and high-elevation species are expected to experience greater effects than southern or low elevation ones (Logan 2003). The majority of research on the effect of climate change on forest insect pests indicates that insect attacks will intensify in severity, frequency and size (acreage) (Logan 2003). This result is logical because stressed trees are more likely to succumb to insect and disease attacks, and climate change would likely result in stress to at least a portion of the current forest. Current research on MPB, gypsy moth, spruce beetle and spruce budworm confirm this prediction (Logan 2003).

Bark beetle outbreak dynamics are complex, but climate change is one factor that appears to be driving the current bark beetle outbreaks. Temperature influences everything in a bark beetle's life, from the number of eggs laid by a single female beetle, to the beetles' ability to disperse to new host trees, to individuals' over-winter survival and developmental timing. Elevated temperatures associated with climate change, particularly when there are consecutive warm years, can speed up reproductive cycles and reduce cold-induced mortality. Shifts in precipitation patterns and associated drought can also influence bark beetle outbreak dynamics by weakening trees and making them more susceptible to bark beetle attacks. Bark beetles respond to landscapes of drought-stressed trees, contributing significantly to the widespread tree mortality. Because elevated temperatures potentially influence the number of generations of these species reproducing in a single year, future outbreaks will occur as precipitation and temperature patterns continue to shift (Bentz 2008).

Human Influences

Long fire return intervals, greater than 100 years, found across most of the analysis area have allowed shade-tolerant species to become well established in the understory of stands, and generally allowed stand biomass, ladder fuels and downed woody fuel loadings to increase in some areas beyond what these sites likely experienced historically. It is important to emphasize the wide range of conditions in these forest types, and extreme conditions are not unusual. These stands are more likely to experience high intensity fires with greater mortality due to high biomass, less heterogeneity, increased ladder fuels and crown bulk densities, and high down woody fuel loadings. Such densely stocked stands are also more susceptible to insect and disease problems such as root disease, dwarf mistletoe and bark beetle mortality therefore more susceptible to fire.

A big change in the analysis area over the last 100 years has been to the lower elevation dry sites (VRU2 and VRU3). Historic logging focused on removing the shade intolerant species (western larch and ponderosa pine) and fire suppression efforts have affected these sites. Absence of non-lethal low severity fires across the drier sites (VRU2 and VRU3), have altered insect and disease regimes, increased stand density, and favored more shade tolerant and less disease resistant species such as Douglas-fir and grand fir. Maturing stands dominated by Douglas-fir, PP and LPP become at risk as hosts to their respective bark beetle pests of Douglas- fir beetle or MPB.

Substantial changes in the analysis area occurred with the MPB infestation of the late 1970s and early 1980s, and the timber harvest that followed. Thousands of acres of LPP in the analysis area were killed. The Dry Fork Fire of 1988 burned 13,000 acres of which 3,400 acres are within the analysis area. Salvage of mortality from the MPB and fire killed timber resulted in harvest activities over 27% of the NFS land within the analysis area from 1980-1999. Regeneration harvest occurred over 15% of the analysis area as

a result of these salvage activities. Most of these treatments occurred in the upper basins of the drainages in the cool and moist types that carried a high percentage of lodgepole pine (Table 3.1).

EXISTING SPECIES COMPOSITION, FOREST DENSITY and SUCCESSIONAL STAGES

Fifty percent of the East Reservoir analysis area is dominated by moderately warm and dry and moderately warm and moderately dry stands on the lower elevations of the analysis area. The moderately warm and dry sites across the landscape are no longer dominated by open park-like stands. Many of these areas have missed one to six periodic low severity fire disturbances causing an increase in density, ladder fuels and a shift of species more toward Douglas-fir. Historically, there was a mix of PP, western larch and Douglas-fir occurring on these sites. However, now Douglas-fir dominates these stands with a much smaller portion of PP and western larch. Historic logging focused on the removal of mature western larch. On the moderately warm and moderately dry sites, fewer fire disturbances have been missed, only one to two fire cycles. Timber harvest has resulted in uniform, medium sized patches instead of a mosaic of patch sizes that occurred with the mixed lethal fire regime. Currently, stand densities are high and there is a predominance of Douglas-fir. Historically, these stands had a predominance of ponderosa pine and western larch.

Twenty nine percent of the analysis area can be described as cool and moist, and is located at the upper elevations. With past harvest activities, patches have become more uniform in size (30-40 acres). The cool and moist areas experienced significant mortality in the LPP from MPB in the late 1970s and early 1980s. In addition, other stands have been salvaged, removing the dead LPP and retaining the remaining stands. Currently, 39% of this VRU7 is in the early-successional stage. The mid-successional stage is low (9%) as compared to the desired condition for the cool and moist VRU. The late-seral successional stage is high (44 %) and the very late-successional is low when compared to the desired condition (Table 3.9).

The remaining area (moderately warm and moist; 10% of the area) is a transition zone between the lower and upper elevations. The cool and moderately dry area (13% of the area) is located on the upper elevation and ridge tops.

Vegetation Response Units (VRUs)

This section includes a brief summary of the VRUs, on FS lands, in the East Reservoir analysis area and displays the difference between existing condition and reference/desired condition for these VRUs. Comparing reference conditions of a given vegetation bio-physical unit such as a VRU to current conditions can provide ecological insight into landscape management. During the analysis of the existing conditions for this project area, vegetation management was identified as a need because the current forest conditions have shifted away from historic conditions (or reference conditions). This issue was used to develop the desired conditions by VRU (Table 3.7).

Table 3.7 displays the existing species composition by VRU in comparison to the desired condition within the analysis area. The current species composition is based on the stand dominate forest type. Information on Table 3.7 is from USDA Forest Service, 1999 and the FSVeg database.

Table 3.7 - Comparison of Current Condition Overstory Composition to Desired Conditions

VRUS	CONDITION	OVERSTORY SPECIES COMPOSITION					% OF VRUS
VRU2S	desired	50% PP; 20% WL; and 30% DF (approximately)					23%
	current	21%PP	6%WL	71%DF	2%LPP		
VRU3	desired	Predominance of PP & WL w/lesser amounts of DF and GF					22%
	current	6%PP	32%WL	40%DF	22%LPP		
VRU4	desired	Predominance of WL, LPP, DF, PP w/lesser amounts of GF & WWP					10%
	current	2%PP	53%WL	37%DF	7%LPP	0%GF	
VRU5	desired	WL, DF, WWP, LPP					1%
	current	47%WL	23%DF	22%LPP	0%WWP	2%WH	

VRUS	CONDITION	OVERSTORY SPECIES COMPOSITION					% OF VRUS
VRU7	desired	Predominance of WL, WWP, DF & LPP.					29%
	current	47%WL	12%DF	28%LPP	0%WWP	12%AF	
VRU9	desired	Predominance of LPP with some DF, WL and AF.					13%
	current		27%WL	24%DF	37%LPP	0%WWP, 11%AF	

Numbers highlighted grey indicates current conditions outside desired conditions.

In comparing the current and desired conditions, it is apparent that there is a desire to increase the amount of ponderosa pine and western larch and decrease the amount of DF within VRU 2 and 3. Table 3.7 does not display percentage levels for desired species for VRUs 5, 7 and 9, however it does display a desired species present to compare to the current. For VRUs 5, 7 and 9, comparing current to desired conditions there is a desire to increase western white pine and to decrease the amount of subalpine fir. The desire for LPP is to keep at current levels. The species desired to increase are drought resistant and fire-tolerant, with good resistance to insects and disease. The species desired to decrease are drought and fire-intolerant with greater susceptibility to various insects and disease. Changing vegetation composition toward desired levels would increase resistance and resiliency, reducing effects from drought, fire, insects, disease and climate change.

Table 3.8 displays the stand density by VRU in comparison to the condition of all suitable land within the analysis area. The current density by VRU is based on the total live square feet of BA per acre of the stand within the analysis area. The desired condition densities by VRU are for mature stands. Information in Table 3.8 is from USDA Forest Service 1999 and the FSVeg database.

Table 3.8 - Comparison of Current Condition Density Classes to Desired Conditions

VRUS	CONDITION	DENSITY (square feet of basal area/acre)						% OF VRUS
		UNDEFINED*	<20	20- 50	51-80	81-120	>120	
VRU2S	desired		Densities ranged from 60-100 sq. ft./acre					23%
	current	1%	2%	12%	23%	36%	25%	
VRU3	desired		Densities ranged from 80-120 sq. ft./acre					22%
	current	2%	3%	29%	15%	27%	24%	
VRU4N	desired		Densities ranged from 80-200 sq. ft./acre					10%
	current	2%	1%	23%	18%	30%	26%	
VRU5	desired		Densities ranged from 150-200 sq. ft./acre					1%
	current	10%	0%	27%	6%	34%	20%	
VRU7	desired		Densities ranged from 80-120 sq. ft./acre (open enough to encourage two to multi storied stands)					29%
	current	3%	6%	37%	14%	18%	22%	
VRU9	desired		Densities ranged from 80-120 sq. ft./acre (open enough to encourage two to multi storied stands)					13%
	current	3%	4%	28%	21%	23%	21%	

* "Undefined" are acres where no BA/acre was documented. Grey numbers indicates current conditions outside desired conditions.

The density of forest vegetation can influence everything from the health and vigor of individual trees in a forest stand to the composition of plant species in the community, which affects whether or not the stand is suitable for certain wildlife species. Tree density also affects the susceptibility of the trees to drought, insects and disease, wildfires and other disturbance events, as well as influencing the rate of plant succession. It is difficult to quantify historical forest densities, however general ranges can be made based on the knowledge of historical disturbance regimes and forest succession. See Table 3.8 for desired density ranges by VRU.

In general, the denser the forest the greater likelihood that the fuel characteristics could support a fast moving intense crown fire. The susceptibility of a forest to insect and disease is heavily influence by density and its impact on tree vigor. As the density increases, a deficit of soil moisture develops and trees lose their ability to withstand attacks by insects, diseases and parasites (Powell 1999, Safranyik et al.

1998). Density related tree mortality from insect, disease and competition leads to increased dead fuel quantities and higher fuel hazards.

In comparing the current to the desired conditions, there is a desire to decrease density in VRU 2 and 3 on the warmer and drier sites. There is also a desire to decrease density in lynx habitat (VRU 7) therefore encouraging development of multi-storied lynx habitat within 20-50 years. Reducing density of these stands would create an environment for regeneration to occur in varying stages moving the stand into multi-storied condition in the future. Without reducing density on these heavily stocked stands they would likely move into the stem-exclusion stage and then would not develop into a multi-storied condition without disturbance.

Table 3.9 displays the existing successional class distribution in comparison to the desired successional class distribution within the analysis area. The distribution of current successional classes is based on stand data and year of origin and put into age classes. The desired ranges represent an approximation of the historic range of successional stage distribution. Information in Table 3.9 is from USDA Forest Service 1999 and the FSVeg database.

Table 3.9 - Comparison of Current Conditions of Successional Stage to Desired Conditions

VRUS	CONDITION	EARLY (0-40 YRS)	MID (41-100 YRS)	LATE (101-150 YRS)	VERY LATE (150+ YRS)	UNEVEN AGED	% OF VRUS
VRU2S	desired	15-25%	15-35%	10-30%	20-50%		23%
	current	5%	20%	47%	23%	4%	
VRU3	desired	15-25%	20-40%	15-35%	15-40%		22%
	current	5%	17%	45%	10%		
VRU4N	desired	15-25%	20-40%	15-35%	10-40%		10%
	current	20%	16%	57%	7%		
VRU5	desired	10-20%	15-35%	10-30%	25-55%		1%
	current	31%	9%	54%	5%		
VRU7	desired	15-25%	20-40%	15-30%	15-45%		29%
	current	39%	9%	44%	8%		
VRU9	desired	20-40%	40-60%	15-20%	5-10%		13%
	current	27%	11%	50%	10%		

Numbers highlighted grey indicates current conditions outside desired conditions.

In a comparison of the current to the desired conditions, it is apparent that there is a need to increase the amount of very late (150+ years) successional stages and increase the mid-successional stages in all the of the VRUs. There is a need to increase the distribution of acres in the early successional stages of the warmer and drier VRUs and decrease the acres in VRU 5 and 7. In addition, in all VRUs the late successional stage is high currently compared to the desired condition. Successional stages are more difficult to trend toward desired in the short-term. Changing distributions of acres of successional stages is a long-term goal to trend toward. Taking a closer look at the distribution of acres within the early successional stage the majority of the acres are greater than 15 years and trending toward the mid-successional stage. Increases in early successional stages in the cool and moist VRU (7 and 9) would have a beneficial effect for lynx forage, providing a pulse of habitat for snowshoe hare.

VRU2S

Moderately Warm and Dry Habitats Settings with inclusions of VRU 1 (warm, dry), Fire Regime I

This vegetation response unit (VRU) is found on 18,314 acres of the analysis area. It is characterized as moderately warm and dry, but is a transitional setting that includes warm, dry grasslands and moderately cool and dry upland sites. Occurring primarily on south and westerly aspect, these dry, lower elevation open sites are composed of mixed Douglas-fir and ponderosa pine in well stocked and fairly open grown conditions. Moist, upland sites and dense draws also include WL and LPP, with lesser amounts of PP.

Tree regeneration occurs in patches and is largely absent in the understory (USDA 1999). The aspect in this VRU, along with its associated habitat types, plays a role in this setting. The nonlethal fire regime is representative of VRU2S on moderately warm dry sites (USDA 1999). Lodgepole pine is typically seral on Douglas-fir/dwarf huckleberry habitats. Both lodgepole pine and western larch occur on moist sites. Western white pine and grand fir are minor components on some mesic sites and not common over the VRU. Douglas-fir and ponderosa pine are common serals on dryer sites.

Stand structure is a product of frequent low severity surface fires (every 0-35 years), and occasional mixed (15-45 years) and non-uniform stand replacement events (+200 years). This VRU is generally made up of a mosaic of stand ages and forest types. Multi-storied stands representing late successional stages also occur as stringers in protected areas that burned less frequently. Patches of even-aged, single storied stands develop after severe burning conditions within a dense understory or an overstocked pole stand after a long fire-free period (USDA 1999). Historic patch sizes were less than five acres within 20 to 200 acre patches. Overall, these stands are a diverse mix of open stands with well-spaced trees (15-30 trees per acre (TPA) interspersed with larger openings and dense patches with multi-aged and 1-2 storied stands. Desired basal area densities are 60 to 100 sq. ft./ac. in mid-to-late successional stage stands, and 65-150 on Douglas-fir/pine grass habitat types. Coarse woody material naturally occurs on these sites at 5-9 tons/acre in VRU2S.

Comparison of Current to Desired (Reference) Conditions: Effective fire suppression has basically eliminated frequent low intensity (surface) fires and mixed lethal underburns in the analysis area. This has altered the species composition and stand structure. Species composition has changed from primarily PP and WL with DF to stands that are primarily composed of Douglas-fir with ponderosa pine and Western larch being less of a component of the stand, (see Table 3.7). Stand structure has changed from open park-like stands of large PP and Douglas-fir to two to three storied stands composed of predominately DF. The lower canopy is composed of a dense understory of smaller Douglas-fir. These high-density understories can provide a fuel ladder to the crowns of larger trees, and increase the potential for lethal stand replacing fires. The overall current densities average 120-130 BA, while historically mature stands carried 60-100 sq. ft. of BA, see Table 3.8. Factors of most influence are timber harvest and fire suppression, replacing the frequent low intensity burns. Stands have a higher density of middle successional trees, with a more closed canopy and uniform stand structure.

The effect of missed fire intervals is evident given a lack of early successional class in this VRU. A larger percentage (47%) falls into the late successional class in this VRU as a result of the fires of the late 1880s. During the early 1900s, the early logging focused on the removal of the large diameter older trees and left the co-dominate trees leaving a smaller portion (23%) falling into the very late successional stages of this VRU.

VRU 3

Moderately Warm and Moderately Dry Habitat Setting, Fire Regime III

VRU 3 occurs on 17,467 acres of the analysis area. This VRU occupies a moderately warm and moderately dry habitat between the drier, warmer sites featuring the DF series (VRU 1, VRU 2) and the moderately warmer and moist sites of VRU 4. This often occurring on moderately steep, northerly slopes and some lower valley sites, VRU3 contains a highly variable assemblage of habitat types, reflective of its wide environmental distribution (USDA 1999). Western larch, Douglas-fir and ponderosa pine are dominant species at lower elevations and western larch, Douglas-fir and lodgepole pine dominate the moist uplands. This VRU does include grand fir and lesser amounts western white pine and occasional western redcedar.

A combination of fire regimes, mainly low to moderate intensity (35-100+ years), has shaped VRU3. These fires typically burn in a mosaic, creeping along the surface and occasionally flare up, killing trees in patches and favoring the fire tolerant western larch and ponderosa pine. During fire-free periods, the density of the more tolerant species would increase in the understory. The overstory trees become

susceptible to crown fires when this occurs, as the ladder fuels provide access to the crowns in an otherwise surface fire. This condition can result in severe stand replacing fires. Fire has been an important agent in shaping the species composition of this landscape. Characteristic low to moderate severity fires favor western larch and ponderosa pine over Douglas-fir. The less common severe fires favored the development of single species stands, especially LPP. The diversity of this transitional VRU is reflected in the range of associated fire intervals and severities.

Stand structure is a product of mixed severity fires and occasional stand replacement events; this VRU is generally made up of a mosaic of stand ages and forest types. Historic patch sizes were variable within 20 to 200 acre patches created by mixed and lethal fires. Structure is variable with gaps to large even-aged single storied patches. Desired basal area densities are 80 to 120 sq. ft./ac. Coarse woody material naturally occurs on these sites at 10-20 tons/acre.

Comparison of Current to Desired (Reference) Conditions: Frequent low and mixed severity fires, and infrequent large-scale stand-replacing fires have been eliminated from this landscape for at least 200 years. The result is much denser stands (+120 square feet of BA) than the desired condition that have a much higher species composition of DF and less of PP overstory (than the desired condition) with dense thickets of Douglas-fir and grand fir to a lesser degree in the understory (see Tables 3.7 and 3.8). Stands generally consist of even-aged or two-aged stands. A high buildup of ground and ladder fuels has occurred over the majority of this type, due to mortality and the lack of mixed lethal fire.

Past timber harvest in this more productive VRU is shown in the high percentage (27%) of early successional class in this VRU. A low percentage (10%) of very late successional is a result of this past timber harvest and the 1889 burns. In addition, the early logging of 1910 and 1920s focused on the removal of the large diameter older timber leaving the younger co-dominates. Currently 45% is in the late successional stage in this VRU.

VRU4N

Moderately Warm and Moist Habitat Settings, Fire Regimes V

VRU 4N occurs on 8,133 acres of the analysis area. VRU4N is ecologically influenced by the moderating effects of the inland maritime climate (USDA 1999). In this analysis area, it is typically bounded by warmer and drier upland sites (e.g. VRU 2 and 3). Large valley bottoms were often composed of fairly open grown, mature WL with younger LPP, Douglas-fir and grand fir in the understory. Upland sites had a mixed species composition with a narrow age class distribution and few canopy strata (USDA 1999).

Grand fir is common in many areas of this VRU, however due to slower initial establishment and growth; it is usually subordinate to Douglas-fir and western larch. Douglas-fir is a major seral on most sites. Engelmann spruce and lodgepole pine occur on the wet, colder habitat types. Western larch occurs sporadically other than where fire created desirable conditions. Western white pine and ponderosa pine are scattered but are a minor component. Western redcedar and western hemlock appear as incidentals. Historically, fires occurred as high severity, stand replacing fire, on a frequency of 200+ years with an average fire return interval of 223 years. These fires typically kill more overstory than the mixed severity burns, and average 77% stand replacement. High severity fires burn in a mosaic creating larger patches of openings and leaving variable portions of the forest structure intact. Quite often, unburned patches occur in predictable micro-sites. The function of high severity, non-uniform burns is to replace the existing stand and move the vegetation back to the early seral stage. Fire suppression activity has resulted in little disruption to the high severity fire regime in these areas. This VRU has a higher potential for insects and disease outbreaks due to the longer fire free intervals and high densities of shade tolerant trees.
Comparison of Current to Desired (Reference) Conditions: Effective fire suppression and reduction has altered the species composition and stand structure in some of the areas. The stand structure has changed from mid and late development open stands of large WL and WWP to two to three storied stands composed of predominately WL, DF, grand fir, hemlock, LPP and Engelmann spruce. The lower canopy

is frequently composed of an understory of smaller grand fir and hemlock with some western redcedar. Based on FSVeg Stand data of stand in VRU4, there is currently minimal very late successional (7%, 151+ year old age class). There is 20% in the early successional due to past harvest and past fires. A majority of the area, 57%, is represented by the late successional (between 101 and 150 year old age class) and 16 % is mid-succession (40-100 year old class). Multi-storied stands do not occur due to fire suppression eliminating the mixed severity fires. Western white pine is not common.

Fire, including moderately frequent mixed severity with infrequent, large scale stand-replacing events, is the primary ecological process that developed patch size in this area. Populations of native plants and animals have responded and adapted to this disturbance process, and associated patch size. Species abundance and distribution are a result of these dynamic processes, and the resulting vegetation patterns. Historic patch size varied from 100 to up to 10,000 acres. The higher patch size was generally on the steeper slopes that maintained the lodgepole pine type. The majority of the harvest within this area on NFS lands has fragmented the landscape due to the 40 acre opening limitation.

VRU5N
Moderately Cool and Moist Habitat Settings, Fire Regimes V

VRU5N occurs on 946 acres of the analysis area, at 1%, it occupies the second smallest percentage of the analysis area. This VRU has some of the highest biological productivity on the Forest and occurs commonly along benches, stream bottoms and many of the mid-slope settings. VRU5N is ecologically influenced by the moderating effects of the inland maritime climate, and is typically bounded by more moderate sites (VRU3 and VRU4) and some cooler sites (VRU7). The environmental conditions within VRU5N and VRU5S are very favorable for vegetation growth, species diversity and habitat variety. Species found in low elevation riparian zones and moist slopes found in VRU5N are: mature western redcedar and western hemlock, with co-dominant Douglas-fir and western larch.

In general, fires in VRU5N can be characterized as non-uniform with infrequent but often extensive stand replacing fires on an average frequency > 200 years. Historic patch sizes ranged from 100 to 300 acres or larger. The more exposed upper slope ridges and the more protected riparian areas, north slopes, toe slopes and benches are the areas with the highest likelihood of avoiding lethal fires (Zack 1994).

Comparison of Current to Desired (Reference) Conditions: Effective fire suppression and reduction has altered the species composition and stand structure in some of the areas. The stand structure has changed from mid and late development open stands of large western larch and western white pine to two to three storied stands composed of predominately western larch, Douglas-fir, grand fir, hemlock, lodgepole pine and Engelmann spruce. The lower canopy is frequently composed of an understory of smaller grand fir and hemlock with some western redcedar. Multi-storied stands do not occur due to fires suppression eliminating the mixed severity fires. Western white pine is not common.

Fire, including moderately frequent mixed severity with infrequent, large scale stand-replacing events, is the primary ecological process that developed patch size in this area. Populations of native plants and animals have responded and adapted to this disturbance process, and associated patch size. Species abundance and distribution are a result of these dynamic processes, and the resulting vegetation patterns. Historic patch size varied from 100 to up to 300+ acres. The higher patch size was generally on the steeper slopes that maintained the lodgepole pine type. The majority of the harvest within this area on NFS lands has fragmented the landscape due to the 40 acre opening limitation.

Based on FSVeg stand data, of the 946 acres of suitable timber in VRU5N there is currently and minimal very late successional (5%, 151+ year old age class) and a high percentage in the early successional (31%, 0-40 year old age class). A majority of the area is represented by 54% mid-to-late-succession (9%, between 101 and 150 year old age class).

VRU7

Cool and Moist Habitat Settings, Fire Regimes III and IV

VRU7 occurs on 22,453 acres of the analysis area. This VRU occurs in the upper basins of each of the drainages. This landscape is typically bordered by warmer sites (VRU 5) and cool, drier subalpine sites (VRU 9) and includes characteristics of each. Vegetation productivity is moderate to high due to the high moisture-holding capacity and nutrient productivity of loess deposits, adequate precipitation and a good growing season. The predominant conifer species are subalpine fir, lodgepole pine, Engelmann spruce, with white pine, Douglas-fir and western larch.

Moisture and temperature gradients create a complex influence on the fire ecology and the vegetation response in VRU7. Fires in this VRU generally burn non-uniformly and are more intense but less frequent than that of VRU 9. Research demonstrates that infrequent stand replacement fires on a 100+ year fire return interval (Arno and Davis 1980) were the most common, occurring within a mosaic of nonlethal and mixed lethal burning. Well-drained upland sites experienced a higher percentage of stand replacement fires.

Cool and moist conditions, coupled with broken topography and lush understories, undoubtedly limit fire spread and create non-uniform conditions. With fuels drying out slowly, under most conditions, fires either burn very small areas or burn large areas in a patchy pattern (Smith and Fisher 1997). However, because much of this VRU is relatively narrow and is often flanked by riparian areas this fire regime is strongly influenced by that of neighboring landscapes.

This VRU is a combination of Fire Regime IV and V. Fire Regime IV is a high severity, stand replacing fire, on a frequency of 35 to 100+ years with an average return interval of 111 years. These fires typically kill more overstory than the mixed severity burns. High severity fires burn in a mosaic creating larger patches of openings and leaving variable portions of the forest structure intact. Fire Regime V is a high severity, stand replacing fire, on a frequency of 200+ years with an average fire return interval of 223 years. These fires typically kill more overstory than the mixed severity burns, and average 77% stand replacement.

Comparison of Current to Desired (Reference) Conditions: A huge impact in this VRU occurred with the MPB infestation of the late 1970s and early 1980s and the timber harvest that followed. Many acres of LPP in the acres were killed. Shortly following the infestation, the Dry Fork Fire of 1988 occurred in the project acres in this VRU. Salvage of mortality from the MPB and fire killed timber resulted in 27% of the NFS land being harvested during the 1980s to 1999, with 15% of the area resulting in a regeneration harvest. Much of these treatments occurred in the upper basins of the drainages in this VRU that carried a high percentage of LPP. Some current patterns of natural disturbance in the analysis area are consistent with those described for desired conditions of the broader geographical area. However, the result from the majority of the past timber harvests is a fragmentation of the landscape. FS policy and the NFMA direction limiting opening size to 40 acres in areas that historically had patch size of up to 10,000 acres, has resulted in a fragmented landscape with scattered openings that are much smaller than desired conditions.

Uncharacteristic vegetation-fuel conditions in this VRU are generally the result of the mortality in the LPP in areas that have not been harvested and lack of western white pine in the moister sites. The older WL component in stands is decreasing due to age and mistletoe and the older DF component is also decreasing due to Douglas-fir beetle and some root disease. Increases in subalpine fir and Engelmann spruce with some grand fir increasing. Many of the western larch forest type stands are in plantations ready for commercial thinning.

Based on FSVeg stand data, there are 22,453 acres in VRU7, of which there is currently a high percentage (39%) in the early successional stages (0-40 year old age class), and minimal very late successional (8%,

151+ year old age class). Mid-succession (40-100 year old age class) is 9%. The majority of the area (44%) is represented by the late successional (between 101 and 150 year old age class).

VRU9

Cool and Moderately Dry Habitat Settings, Fire Regimes III and IV

VRU 9 occurs on 10,252 acres of the analysis area. These sites are generally found on rolling ridges and upper reaches of mountain slopes generally above 4,400 feet in elevation. This VRU occurs on all aspects in the lower subalpine zone on gentle to moderately steep slopes. The climate is characterized by a short growing season with early summer frosts. Soils are generally from loess overlying glacial tills. Vegetation productivity is moderate to high depending on the aspect and soil moisture-holding capacity. These settings are very suitable to lodgepole pine and subalpine fir, the most common conifers, with scattered Douglas-fir and larch.

This VRU is a combination of Fire Regime IV and V. Fire Regime IV is a high severity, stand replacing fire, on a frequency of 35 to 100+ years with an average return interval of 111 years. These fires typically kill more overstory than the mixed severity burns. High severity fires burn in a mosaic creating larger patches of openings and leaving variable portions of the forest structure intact. Fire Regime V is a high severity, stand replacing fire, on a frequency of 200+ years with an average fire return interval of 223 years. These fires typically kill more overstory than the mixed severity burns, and average 77% stand replacement.

Lethal and moderately severe fires often create pure even-aged stands of lodgepole pine, as did the fire of 1910. Patch size resulting from stand-replacement events were typically 5,000 to 100,000 acres (USDA 1999). The fire return interval for these large non-uniform fires ranged from 100 to 115 years. The mixed severity, non-uniform fires ranged between 50 and 300 acres, on an fire return interval of 50-71 years.

Comparison of Current to Desired (Reference) Conditions: A big impact in this VRU occurred with the MPB infestation of the late 1970s and early 1980s and the timber harvest that followed. Many acres of LPP in the acres were killed. Shortly following the infestation, the Dry Fork Fire of 1988 occurred in the project acres in this VRU. Salvage of mortality from the mountain pine beetle and fire killed timber resulted in 27% of the NFS land being harvested during the 1980s to 1999. Of this 27%, 15% of the acres within the analysis area resulted in a regeneration harvest. Some of these treatment occurred in this cool and moderately dry VRU however a greater percentage of the LPP salvage occurred on the more productive ground of VRU7. Some current patterns of natural disturbance in the analysis area are consistent with those described for desired conditions of the broader geographical area. However, the result from the majority of the past timber harvests is a fragmentation of the landscape. FS policy and the NFMA direction limiting opening size to 40 acres in areas that historically had of up to 10,000 acres, has resulted in a fragmented landscape with scattered openings that are smaller than desired conditions.

Stand structure is more uniform and less storied, with less shrub field development. Stands have fewer of the large, old overstory trees due to insects, disease, and the fire of 1889. There is more homogeneity as patch sizes are getting smaller and more isolated and there is more uniformity in size and age classes of stands. Western spruce budworm is common, which is a typical result of dense stocking of shade tolerant trees.

Based on FSVeg stand data, there are 10,252 acres in VRU9 of which there is currently 27% in the early successional stages (0-40 year old age class) however, only 1% are in the 0-10 year age class. Currently there is 10% in the very late successional (151+ year old age class) which is within the desired condition. Mid-succession (40-100 year old age class) is 11%. The majority of the area (50%) is represented by the late successional (between 101 and 150 year old age class).
Refer to NFMA Report in the project file for a desired future condition and restoration strategy by VRU.

ENVIRONMENTAL CONSEQUENCES

This section analyzes potential environmental effects related to proposed activities, and provides contrast between the various alternatives described in Chapter 2 of this document. The successional conditions predicted represent the most logical pathways given the existing conditions of stands in the analysis area. Where the effects of the proposed treatments are very similar, the disclosures are combined. These potential effects include direct, indirect and cumulative effects, in full compliance with the National Environmental Policy Act (NEPA) and related law, regulation and policy. This section will also display how each alternative addresses the purpose and need of the project and the major issues identified. The effects of Alternative 1, the no-action alternative, are evaluated at the same level of detail as the action alternatives, to provide a baseline for comparison. Cumulative effects are described and evaluated by putting into context the effects of the proposed action with other past, present and reasonably foreseeable actions.

Past Regeneration Treatments on NFS lands amount to approximately 20,325 acres or 26% of NFS lands. This has created a mosaic of openings in a densely forested landscape. All of the regeneration harvests are in a stand initiation stage, are fully stocked and include a component of intolerant species consistent with VRU objectives. Due to the NFMA requirements that preclude openings in excess of 40 acres, combined with KNFP opening size standards, all existing treatment areas are less than 40-acre openings. The average patch size of the regeneration openings and the location of these patches are not consistent with historic patch sizes and distribution of openings. The effects of these openings are increased amount of edge effect, and increased fragmentation from what would have occurred historically.

Past regeneration harvest on Plum Creek Timber Company (PCTC) lands (2,182 acres) and State of Montana Department of Natural Resources and Conservation (DNRC) (1,943 acres) have also created a mosaic of openings, and reduced stand density in a densely forested landscape. Many of these are connected, and are within the historic patch size on the moist types but on the drier VRU 2 and 3 the patches are larger than historic.

Past Intermediate Harvest (14,742 acres) on NFS lands have changed composition, structure and potentially function by removing the larger more intolerant species. Prior to the 1990s, most of the intermediate treatment was a liberation harvest that removed the larger intolerant species and relic trees. Changes in species composition and structure is trending to a higher than historic component of smaller mid-tolerant to intolerant trees with increased ladder fuels. Despite the removal of the overstory, past intermediate harvest on NFS lands have generally maintained more intolerant species than private lands. In the 1990s most of the intermediate harvest was a commercial thin that retained the best quality of the intolerant western larch, ponderosa pine and Douglas-fir.

Past intermediate harvest on PCTC (3,543 acres) and DNRC (3,693 acres) has also changed stand composition, structure and function by removing the larger intolerant trees as well as much of the co-dominant intolerant trees leaving stands that are often dominated by the mid-tolerant Douglas-fir and intermediate western larch and ponderosa pine as well as a component of other tolerant species. These stands are generally more open than the stands with intermediate treatment on NFS lands, and most are regenerating to mid-tolerant and tolerant species in the understory.

Refer to the harvest by decade Table 3.1 of this report. This information has been incorporated into the existing condition analysis.

Past Slashing and Underburning (16,030 acres)**:** The effects of the slashing and underburning have decreased the understory component of Douglas-fir, reduced stand density and restored fire on the landscape. This treatment improved stand conditions and increased resilience to potential climate change by reducing stocking, decreasing within stand stress, decreasing ladder fuels and increasing species composition of intolerant ponderosa pine and western larch. This burning was the first step, but much of the acreage is still overstocked with smaller Douglas-fir, and would take additional treatment to move the

stands to desired conditions. The majority of this burning was within VRU 2S and VRU 3, treating approximately 43% of these dry VRU groups within the analysis area. These actions have been incorporated into the existing condition analysis.

Weed Control: Spraying with herbicide to control weeds has been ongoing since the mid-1990s. The effects of past herbicide treatments have reduced the existing noxious weed infestations, but have also decreased native shrubs and forbs, and potentially increased native and non-native grasses. These effects are primarily associated with roadside corridors. Approximately 183 acres were sprayed in the Cripple Planning Unit (Weeds Project File) in 2010.

Reasonably Foreseeable Actions

DNRC: Table 3.3 shows the foreseeable activities within the next ten years on DNRC lands within the East Reservoir analysis area. This information was requested from the DNRC when the analysis of this project began. The planned 198 acres of regeneration harvest on DNRC lands are within the warm and moist VRU 4. The regeneration harvest on DNRC lands is consistent with restoration objectives for species composition, but may not be consistent in patch size.

Precommercial Thinning: Approximately 760 acres of precommercial thinning has been approved and let out on contracts in the Cripple Horse and Canyon Creek drainages. This thinning would be on-going over the next 5 years.

Forestwide Fuels: The three Forestwide Fuels (FWF) units (2001 Forestwide Fuels Reduction and Wildlife Habitat Enhancement EA) that were slashed in 2011 would be underburned between 2013 and 2015 (910 acres). The effects of the additional underburning in the Forestwide Fuel units, would decrease the understory component of Douglas-fir, reduce stand density, and restore fire at a moderate scale on the landscape. This treatment would improve stand conditions and increase resilience to potential climate change by reducing stocking, decreasing within stand stress, decreasing ladder fuels and increasing species composition of shade intolerant ponderosa pine and western larch. Between the planned 980 acres and the existing 16,030 acres, approximately 46% of the drier VRUs within this analysis area would be treated. Additional burning or stand density reduction would be required on many of these stands to move the stands to desired conditions.

Actions on Private Lands: Continued development of private lands within the analysis area is expected. Development is expected to include commercial timber harvest, land clearing, home construction, road construction, septic field installation, water well drilling, livestock grazing and stabilization of migrating stream banks.

Fuel Reduction: Small fuels reduction projects may be authorized in the analysis area through separate decisions.

Road Activities: Routine road maintenance is likely to occur as needed on existing roads in the analysis area. The roads most likely to receive maintenance are those open yearlong to vehicle traffic. Typically, these activities do not affect vegetation other than potential weed spread.

Fire Suppression Activities: If conditions are such that there are fire starts within the analysis area, efforts would be made to suppress fires. It is important to clarify that not all fires are extinguished or actively suppressed. Depending on conditions analyzed during a wildfire, some fires are monitored and managed and allowed to burn in prescribed areas.

All alternatives include timber harvest units, precommercial thinning, natural fuel reduction units and other activities as described in Chapter 2. The various alternatives have been described in Chapter 2 and this information will not be repeated here.

ALTERNATIVE 1 (No-Action)

Direct and Indirect Effects

The effects of the no-action alternative provide a baseline from which to compare the action alternatives relative to fulfilling the purpose and need of the project. The following trends have been discussed previously in the Affected Environment section**.**

No prescribed burns (except FWF units), tree harvest or fuels reduction would take place with this alternative other than those described in reasonably foreseeable actions. Species composition, density and successional stages would continue to trend away from desired conditions. Only natural processes and fire suppression would occur, dramatically affecting the stand density, species composition and forest succession and health as described previously. This alternative would not contribute to the purpose for this project. Specifically, it would not create vegetation patterns and structure in-line with desired conditions, reduce fuel near private land and promote fire-adapted species. Stands dominated by mature Douglas-fir or LPP would not benefit from silvicultural treatments to reduce stand densities, improve growing conditions and increase the diversity of tree species in the area. Nor would these stands benefit from increased successional stage diversity in the analysis area, or improve forage production and quality through the use of such treatments as commercial timber harvest, slashing and prescribed fire. Also, this alternative would not meet the purpose and need to provide local employment related to forest management and restoration activities and to supply forest products.

Fire Ecology and Forest Resiliency

With continued fire suppression and lack of prescribed fire understory trees would continue to grow into the general canopy as well as expand in scope. This condition, with continued encroachment of fire intolerant species, would potentially increase fire severity. The quality and quantity of wildlife forage would continue to decline. It is important to clarify that not all fires are actively suppressed. Depending on conditions analyzed during a wildfire, some fires are monitored and managed and allowed to burn within prescribed areas.

The current outbreak of MPB (around the state) would continue to impact the immature and mature, overstocked stands of PP and LPP that were not infested in the previous epidemic. Western larch would not be restored to more historic levels in the lower elevations of the analysis area. Species diversity would not increase without timber harvest and planting of western white pine, ponderosa pine and western larch. Western spruce budworm would likely remain as an endemic insect in the analysis area. Defoliation of understory trees would continue; but as stated earlier, little mortality is expected in the overstory of most stands. Root disease would likely increase with increasing density; increasing competition and increasing amounts of tolerant species.

Prescribed fire would not be implemented and managed and fire would not be used as a process to improve ecological integrity. Dryland areas would continue to decline in forage quantity and quality, and hiding cover would increase above desired conditions on the big horn sheep range.

Carbon Flux

Those forest stands not affected by recent disturbance events, such as trees killed by wildfire, insects or diseases, are likely net carbon sinks at this point in their development. Under the no-action alternative, they would continue as sinks until the next disturbance event occurs. Over the long-term (centuries), net carbon storage is often zero if stands regenerate, because re-growth of trees recovers the carbon lost in the disturbance and in decomposition of trees killed by the disturbance (Kashian et al. 2006).

Climate Change

The long-term health of ecosystems may be dependent on the resilience of ecosystems to potential climate changes and the associated climate-related disturbances. Resilience to potential climate change is generally compatible with maintenance of reference and identified desired conditions. But in addition to maintaining resilience to fire, resilience to climate change may require increased forest structural diversity. This would include maintenance of rare habitats and structures, which may potentially be eliminated by climate change; maintaining connectivity for species movement to allow animals and plants to relocate as suitable habitat moves north or south, or up or down in elevation; and increasing resilience

changes in natural disturbance processes. These processes could include increases in insects and disease, larger fires, longer fire seasons, and fires in higher elevation areas.

Another potential ecosystem change as a result of changing climate is expansion of some vegetation types or habitats and reduction of others. Even if maintenance of current native communities becomes impossible with climate change, maintenance of regional biodiversity and ecosystem function is important to promote resiliency on a larger scale (Fox 2007). An integrated ecological approach for managing future landscapes using options that include enhancing resistance to climate change, promoting resilience to change, and enabling ecosystems to respond to change, balanced with society's demand for resources may be required to create landscapes that are sustainable, ecologically viable, and acceptable to society (Keane 2009).

The potential for increased insect levels in untreated stands with predicted climate change is high. Forest pests are an important indicator species for assessing climate change. Assessing pest species response to climate change indicates intensification in all aspects of outbreak behavior, particularly with mountain pine beetle, gypsy moth, spruce beetle and spruce budworm (Logan 2003, pg. 135, 136).

Potential for Increased Insect and Disease Activity

Disturbances caused by insects and diseases occur in all terrestrial ecosystems. Insect and disease are important causes of small to large gaps in forest canopies. They can affect major structural or species changes in the ecosystem. FS reports have consistently shown insects and pathogens cause more loss than any other damaging agent, including fire. Insects and pathogens often interact with each other as well as with climate and fire. Past management practices may increase the frequency, intensity and extent of many outbreaks. Such practices include harvest beyond historic rotation ages for a given species, removing intolerant species and leaving tolerant species not removing diseased overstory trees and suppression of fires. The widespread droughts of the late 1980s to present preceded and predisposed vast areas in the west to insect and pathogen attack (Haack and Byler 1993). Fire suppression increased stand densities that in turn indirectly increased insect and disease populations.

As untreated stands, within the East Reservoir analysis area, progress towards more shade tolerant species, insect and disease occurrences are likely to increase. Grand fir and DF are more susceptible to root and stem decays than are more shade-intolerant species such as WL and PP. On the warm and dry sites, these shade tolerant species would likely be less resistant to insect and disease impacts due to moisture stress during the warm periods of the year. On a given site, the tolerant species are more nutrient and moisture demanding, thus more likely to be stressed on these lower productivity sites and during times of drought. They are therefore predisposed to insect and disease attack due to stressed conditions.

Although it is difficult to quantify the increased risk and effects of defoliators, root disease, bark beetles, etc., that would result in a tolerant stand on a given site, experience on the Boise National Forest, the Idaho Panhandle and the Blue Mountains, shows that vast acres could be lost through insect and disease followed by a high probability of catastrophic fire. Significant problems in these climax species stands started within 60-80 years following fire suppression and harvest activities that increased the tolerant species component.

Forest Ecology by Vegetation Response Unit

The following discussion highlights the changes that are expected to occur, without the proposed silvicultural treatments, within the analysis area. The description of successional pathways outlines stand development that would ordinarily follow natural disturbance processes that include wildfire, insect and disease impacts, blowdown, etc. The descriptions recognize the existence of mosaic or patchy conditions that represent variation in species composition, forest types and stocking levels. Assuming that traditional fire suppression would continue, the successional development that is described for the no-action alternative would not be consistent with ecological processes and would continue the trend of moving outside of reference ranges.

Moderately Warm/Dry and Moderately Warm/Moderately Dry Habitat (VRU2 and VRU3): These

forest settings have historically experienced frequent, low intensity and mixed severity fires as a predominant natural disturbance. Forest species composition, density and succession are driven by disturbance, which can influence ecosystem resiliency. Without disturbance to open the stand structure for reintroduction, representation of ponderosa pine would continue to decline. Ponderosa pine would become a smaller percentage of the species composition as the Douglas-fir and grand fir become more established, especially with mortality from MPB. High densities on these sites would further reduce the ponderosa pines vigor and resistance to attacks from mountain pine beetle. Western larch species composition would remain very low as this species is not restored onto the site from historic logging.

Without fires or associated management actions that disturb portions of the landscape, the extent and intensity of insects and pathogens would undoubtedly increase and result in a forest composition that is less resilient. These consequences may lead to a reduction in site quality and continued shift in species composition. In some stands, the grand fir and Douglas-fir have the physical characteristics that are attractive to western spruce budworm and Douglas-fir beetle. This situation is often the result of stagnated, overstocked and multi-storied conditions.

As this area and these conditions border private landowners and important wildlife winter ranges, the importance of assessing the risks of no-action becomes all the more relevant. A decision not to take action in these specific conditions would not enable the natural process of fire to be re-introduced onto the landscape. Fuels reduction in the private land/forest interface would not be reduced. Habitat diversity would not be enhanced, resulting in more continuous forest patches with less horizontal diversity.

Moderately Warm/Moderately Cool and Moderately Warm/Moist Habitats (VRU4 and VRU5): In comparison with many of the other habitat settings, the influence of no-action and continued fire exclusion on vegetation in many moist landscapes is less significant in the short-term, due to the inherently long fire-free interval. Moist sites found in VRU4 and VRU5 are characterized as having moderate frequency mixed severity fires, and infrequent stand replacement fires within a range that is similar to desired levels. In time however, it is expected that no action and continued fire suppression would promote larger stand replacing fires than typical as forest homogeneity increases.

No-action and continued fire suppression would continue to move Douglas-fir and grand fir composition towards a greater proportion of mid-tolerant and shade tolerant species, which are not as adaptable to fire. Insect and disease problems can become more significant as forest conditions age, particularly with root disease, dwarf mistletoe and bark beetle.

The no-action alternative would limit the opportunity to restore impacted areas to a fire-adapted species composition with greater resiliency to root disease, bark beetle and western spruce budworm. In the near future, the stands at risk would likely be those currently in overstocked conditions where tree vigor is typically low. As a result, overall landscape diversity could be reduced for some time due to less age class diversity and more fuels continuity.

Dwarf mistletoe in western larch has become more significant in some areas with the absence of fire, the age of the trees and continued infestation of mistletoe on understory western larch. Under Alternative 1 (no-action), these trends would continue and without restoration, these important cover types are at considerable risk. Where loss of western white pine due to blister rust has occurred, reforestation with genetically improved seedlings would not occur. In addition, western white pine is a generalist meaning that it does not have specific elevational bands (climate bands) where it grows. Diversifying forests where possible with western white pine provides flexibility for unknown environmental conditions such as climate change. This diversification would not occur in the no-action alternative.

Cool and Moist Habitat (VRU 7): As with VRU4 and VRU5, vegetation trends do not appear as rapidly as dry forest types due to the infrequent nature of stand replacing disturbances. As a result, the effects of no action and continued fire exclusion would be gradual. No action and continued fire suppression would minimize the extent of mixed severity fires, aiding the decline of stand structure variety and increased proportion of fire-intolerant species. Intermediate sized western larch, Douglas-fir and some white pine

are usually favored in the mixed severity fires.

A gradual shift in species composition and higher stocking levels could result in insect and disease problems due to low tree vigor**.** On sites where fire-resistant species are being replaced by shallow-rooted, thin-barked species, there is the potential for a loss of shallow fine roots following a surface fire. This increases the susceptibility to stress and direct entry of root and stem pathogens. Fire-resistant species have lower susceptibility to long-term soil damage from fire as roots are deep and bark is thick. Root disease is expected to continue being a cause of mortality in Douglas-fir and grand fir overstory. Blowdown is more significant in root-disease affected areas and in spruce stands.

Reforestation with genetically improved seedlings would not occur. In addition, WWP is a generalist meaning that it does not have specific elevational bands within species as with most other conifer species. Diversifying forests where possible with WWP provides flexibility for unknown environmental conditions such as climate change. This diversification would not occur in the no-action alternative.

Continued interruption of the natural fire cycle, particularly of mixed severity type, would result in higher stand densities and more continuous, heavy fuel conditions across most of this setting. While not readily apparent, this condition would lead to more intense stand replacement fires. In particular, heavily stocked, pole-sized stands have a high crown fire potential (Davis et al. 1980). A high intensity fire would kill almost all trees in this mid-seral development stage. This could result in a shift back to the herb/shrub phase or facilitate the development of LPP stands. If an area experiences a re-burn within a relatively short interval, the site may revert to a brush field, particularly habitat types such as mid- to upper elevation subalpine fir stands. Neither western larch nor lodgepole pine would likely survive high severity fires in the pole stage.

Cool and Moderately Dry Habitat (VRU 9): Under the no-action alternative, shifts in vegetation patterns, increased fuel loadings and changes in species composition would continue to occur. Mature LPP stands are prime targets for MPB infestation. Given the age of the current LPP stands and the presence of MPB, the stands would continue to decline. This condition would greatly increase the probability of a stand replacement fire, as fuel loadings would be significant. Between significant fire events, lodgepole pine would be replaced by subalpine fir and Engelmann spruce that fill into open growing space. Where it is not frost stunted, some low elevation sites would occasionally have Douglas-fir persist as a seral dominant. The succession to climax dominated by subalpine fir is often very slow either because of lack of seed source or apparent low vigor. With time, surviving lodgepole pine increase in growth and become susceptible again to bark beetle attack.

Contributions to a Sustained Yield of Timber There would be no intermediate or regeneration harvest or precommercial thinning on NFS lands if the no-action alternative is selected. Up to 49 million board feet (MMBF) of timber would not be available for utilization by timber dependent industries or as products for the general public. The long-term growth and health of timber on suitable management areas would not be optimized, and the risk of loss through large scale insect and disease or fire would increase. This alternative is not consistent with KNFP goals for timber or fuel management.

ACTIVITIES and FEATURES COMMON to ALTERNATIVES 2 and 3

Timber Harvest, Precommercial Thinning and Fuel Treatment Activities: See Chapter 2 and the vegetation project file for harvest method by unit by alternative. Placement of harvest and stand improvement treatment locations were designed with consideration to landscape and stand treatment need, opportunity to restore desired species composition, opportunity to restore density to desired condition levels, opportunity to improve stand and landscape resilience to disturbance including insect and disease, fire and potential climate change and other resource needs. On the dry land, harvest and improvement treatments focus on restoring desired conditions such as restoring resilient stands of intolerant species, and buffering old growth, replacement old growth and important riparian habitat with fuel treatments. On the moist forest types, harvest treatment locations were chosen by blocking areas close to past harvests where feasible, restoring resilient stands of intolerant species, buffering old growth,

replacement old growth, and riparian areas with fuel treatments where feasible within other resource needs. Through these considerations, all alternatives meet the objectives of restoring desired conditions and resilient species and forest structures, increasing average patch size, maintaining forest connectivity, reducing fragmentation and buffering important habitat with fuel treatments to some degree.

Stand Improvement (Intermediate Harvest): The improvement treatments are located in stands of moderately warm Douglas-fir types within VRU 2, 3 and 4 that have higher than desired condition density stocking or fuels. The moderately dry Douglas-fir types would be opened up to a BA of 50-70 square feet, and the moist VRU sites would be opened up to a BA of 70-90 square feet. An improvement treatment would remove the majority of the tolerant trees, the smaller DF and grand fir and any insect or disease infested trees. Co-dominant PP, WL and Douglas-fir overstory would be retained. Following treatment, there may be pockets of openings, but these would not exceed 15-20% of the stand. Some commercial harvest treatments in the drier VRUs may be followed by slashing and underburning.

Improvement Harvest with Shelterwood with Reserves: This treatment would occur in moderately dry to moist stands that have higher than historic stocking and or fuels. These sites would be opened up to an average BA of 40-50 square feet on the dry sites and 50-70 BA on the moist sites. The treatment would remove the shade tolerant and mid-tolerant species, and insect and disease infested trees, the smaller intermediate intolerant trees, and leave the majority of the co-dominant PP and WL. Up to 40% of the unit may be in shelterwood openings (25-40 BA) within these units. Shelterwood openings would occur in areas with stagnant DF, grand fir, hemlock, cedar or LPP that lack acceptable leave trees and areas with heavy insect or disease infestations. These openings would be planted with ponderosa pine, western larch or western white pine seedlings. The objective is to improve stand conditions and increase resilience by reducing stocking, decrease within stand stress, decrease ladder fuels, decrease insect and disease and increase the component of ponderosa pine and western larch through improvement and regeneration.

Future Management of Stands with Improvement Treatment: To meet the objectives of a fire resilient landscape over time, continued stand tending activities would occur on these sites. Treatment would include periodic slashing of tolerant in-growth to reduce natural fuels and fuel ladder conditions. Periodic commercial harvest may be required to maintain the open stand conditions over time as the residual stands increase in basal area and crown canopy. Depending on the health, vigor and species composition of these stands some may be treated with a regeneration harvest within the next 20-40 years and some of the stands with a good component of healthy intolerant species may be managed for future old growth replacement.

Shelterwood Harvest with Reserves: The purpose of the treatment is to reduce natural fuels (including heavy down LPP), initiate early successional conditions, restore PP, WL, WWP and improve stand and landscape conditions consistent with desired condition processes. Approximately 20-40 feet of BA of western larch, DF and PP would be retained for seed, structure, shade, genetic seed reservoirs, relic overstory and future snag replacements. The shelterwood treatment would create a regeneration opening. Planting of western white pine, ponderosa pine and or western larch is planned to restore these species, increase stand resilience to potential climate change and assure regeneration on these sites.

Seed Tree with Reserves: The purpose of the treatment is to reduce natural fuels (including heavy down lodgepole pine), initiate early successional conditions, restore ponderosa pine, western larch, western white pine, and improve stand and landscape condition consistent with historic processes. Approximately 10-25 feet of BA (a minimum of 10 TPA) of western larch, Douglas-fir and ponderosa pine would be retained for seed, structure, shade, genetic reservoirs, relic overstory and future snag replacements. Planting of western white pine, ponderosa pine and/or western larch is planned to restore these species, increase stand resilience to potential climate change and assure regeneration on these sites.

Clearcut with Reserves: The purpose of the treatment is to reduce natural fuels (including heavy down LPP), initiate early successional conditions, restore ponderosa pine, western larch, western white pine and improve stand and landscape conditions consistent with historic processes. While they would not be

retained to re-seed the stand, approximately 4-8 trees per acre of western larch, Douglas-fir and ponderosa pine would be retained for structure, shade, genetic reservoirs, relic overstory and future snag replacements. Planting of western white pine, ponderosa pine and or western larch is planned to restore these species, increase stand resilience to potential climate change and assure regeneration on these sites.

Future Management of Stands Proposed for Regeneration Harvest: To meet the objectives of a fire resilient landscape over time, continued stand tending activities would occur on these sites. Treatments may include precommercial thinning at age 15-20, and periodic slashing of tolerant in-growth to reduce natural fuels and fuel ladder conditions over the next 25-30 years. A commercial thinning may occur at age 40-50 to maintain the desired stand conditions over time as the residual stands increase in basal area and crown canopy. Depending on the health and vigor, and species composition of these stands, some may be treated with a regeneration harvest within the next 100-120 years and some of the stands with a good component of healthy intolerant species may be managed for longer rotations or future old growth replacement.

Reforestation: Where regeneration harvest is proposed, planting would supplement the natural regeneration that is anticipated and restore tree species that are presently not sustainable due to inadequate seed source in the residual or adjacent stands. Planted conifer seedlings would assure timely reforestation and contribute towards long-term desired forest conditions stand resilience. Tree species to be planted include ponderosa pine, western larch and western white pine. These species have declined in total area and stand dominance due to advancing succession, lack of natural fire, and insect and disease infestations.

Activity Fuel Reduction and Site Preparation*:* See Chapter 2 and the vegetation project file for specific fuel treatment by unit by alternative. The primary method of activity fuel reduction and site preparation would occur through yarding tops during harvest, and/or slashing of small diameter (un-merchantable trees) and underburning 1-2 years following harvest. Periodic underburning would be planned every 10-30 years on the dry sites to restore historic fire regimes and maintain fuel loading at desired levels. If yarding tops does not remove the activity fuel on units with gentle topography that are not scheduled to be underburned, activity fuel reduction and site preparation would be accomplished through machine (excavator) piling, scarification and burning of those piles.

Natural Fuel Reduction through Slashing and Underburning: Proposed treatments would reduce the amount of stagnant tolerant understory species, recycling nutrients and stimulating browse for wildlife forage. The primary method of natural fuel reduction would be through slashing of small diameter, un-merchantable trees (6 inches in diameter and less) and underburning after allowing the slash to cure from 1-2 years. Periodic underburning every 10-30 years on the dry sites would restore and maintain historic fire regimes, maintain historic intolerant species and maintain fuel loading at desired levels. This treatment would improve stand conditions and increase resilience to potential climate change by reducing stocking, decreasing within stand stress, decreasing ladder fuels and increasing species composition of intolerant ponderosa pine and western larch.

Future Management of Stands with Improvement Treatment: To meet the objectives of a fire resilient landscape over time, continued stand tending activities would occur on these sites. Treatment would include periodic slashing of tolerant in-growth to reduce natural fuels and fuel ladder conditions. Periodic commercial harvest may be required to maintain the open stand conditions over time as the residual stands increase in basal area and crown canopy. Depending on the health and vigor, and species composition of these stands, some may be treated with a regeneration harvest within the next 20-40 years and some of the stands with a good component of healthy intolerant species may be managed for future old growth replacement.

Precommercial Thinning: Precommercial thinning is proposed in overstocked, sapling-size trees that have been initiated in the past 15-25 years. This treatment is intended to reduce tree density, reduce crown continuity, improve growing conditions, restore shade-intolerant species that are more resilient to fire insect and disease, and improve growing conditions of the remaining trees by reducing competition for

light and nutrients. In the oldest stands with heavy stocking, some form of mechanized treatment, either non-commercial removal of biomass or mastication to reduce fuel levels may be required to meet desired conditions.

Future Management of Stands Proposed for Precommercial Thinning: To meet the objectives of a fire resilient landscape over time, continued stand tending activities would occur on these sites. Treatment may include periodic slashing of tolerant in-growth to reduce natural fuels and fuel ladder conditions over the next 20-30 years. A commercial thinning may occur at age 40-50 to maintain the desired stand conditions over time as the residual stands increase in basal area and crown canopy.

Road Access Changes: The activities associated with the proposed road access changes described in Chapter 2 of the DEIS would have little or no effect to vegetation except as described in the Noxious Weed Section and the Proposed, Threatened, Endangered and Sensitive Plant Section.

Trail Access Changes: The activities associated with the proposed trail access changes described in Chapter 2 of the DEIS would have little or no effect to vegetation except as described in the Noxious Weed Section and the Proposed, Threatened, Endangered and Sensitive Plant Section.

Road Storage: The activities associated with the proposed road storage listed in Chapter 2 of the DEIS and have the potential to reduce linear fragmentation in the long-term. These activities would reduce access for vegetation management, salvage and fire suppression activities due to economic cost of access.

Temporary Road Construction: There would be a minimal amount of vegetation fragmentation. This should be mitigated in the long-term once the temporary roads are restored and native vegetation is re-established. It would also affect vegetation as described in the Weed and Sensitive Plant Reports.

Best Management Practices (BMPs): The KNFP states that "Soil and water conservation practices as outlined in the Soil and Water Conservation Practices Handbook (FSH 2509.22, May 1988) would be incorporated into all land use and project plans as a principal mechanism for controlling non-point pollution sources; meeting soil and water quality goals; and to protect resource values." Implementation of BMPs would not impact forest vegetation directly. These practices would benefit vegetation indirectly through protection of soil and water resources.

Reserve Trees and Snags: All harvest prescriptions would emphasize retention and development of trees to function as genetic seed reservoirs, relic overstory and future snag replacements. The number and distribution of these trees would vary with existing stand conditions, safety considerations and site specific resource objectives, but all harvest units would maintain a minimum of 8-10 reserve TPA. Where quality snags are not present, or safety requirements mandate not leaving snags, the 8-10 reserve TPA would serve as long-term replacement snags. Some of these reserve trees may be girdled to create snags or, if they have high levels of mistletoe, they may be girdled to reduce the infection to the understory trees. Whether reserve trees are girdled or not, these trees would eventually contribute to coarse woody debris for future soil organic matter.

Damage to Residual Trees: Residual trees within harvest units are susceptible to damage from normal logging operations. This damage is dependent on the number and distribution of leave trees, topography, species and logging system. The amount of damage to reserve trees would be minimized by favoring intolerant species that are more resistant to diseases after basal scarring, utilizing designated skid trails and utilizing a skyline system on cable ground.

Windthrow: Some leave trees are expected to die or blow down and provide additional snag and down woody debris habitat. Management activities may increase the risk within treatment areas and adjacent to them by opening up the canopy and increasing the wind to individual tree crowns. Landtypes 102 and 351 are both considered as being landtypes with moderate-to-high potential for windthrow. These landtypes are located in proposed Units 4, 28, 51, 142, 147, 148 and COEF8.

Course Woody Debris (CWD): All harvest units would retain 8-33 tons/acre of downed coarse woody material (or recruitment) greater than 4" in diameter to provide nutrient recycling and habitat for mammals and invertebrates. The volume and distribution of material may be subject to specific site conditions and VRU objectives and would be specified in the silvicultural prescription and incorporated into the timber sale contract. The general tons retained by VRU are described in Table 3.10.

Table 3.10 – Coarse Woody Debris by VRU in Harvest Units

BIOPHYSICAL SETTING	TONS/ACRE; >4" IN DIAMETER
VRU 2	8-15
VRU 3, 7, 9	15-20
VRU 5	15-33

Regeneration within Five Years: All regeneration harvest would be designed to assure the units can be satisfactorily restocked within five years after final harvest. Adequate stocking would be defined in the silvicultural prescription and is based on VRU and Management Area (MA) objectives.

Contrasting Effects of Proposed Actions with Past Actions: The project objectives for the East Reservoir analysis area include trending vegetation toward fire resilience in a variety of biophysical or forest settings that have similar developmental and responses capabilities (VRUs).

The majority of the analysis area experienced stand replacing fire in the late 1800s and many of the regenerated stands did not have volume and stand conditions that were conducive to or dictated regeneration harvest until the 1970s and in the late 1980s in response to the MPB infestation. Because of those conditions, there was minimal regeneration harvest prior to the 1970s. The majority of the regeneration harvest in the 1980s and 1990s were designed to salvage MPB infested LPP stands or to regenerate mixed species western larch, ponderosa pine, western white pine and DF stands. While these harvest units restored desired species such as PP, WL and WWP, some of the older stands retained few reserve trees and snags for structural diversity, genetic seed reservoirs and replacement snags; and many machine scarification units had high disturbance and low retention of down woody debris. In addition, because of the 40 acre regeneration opening limitation; big game forage opening size recommendations and other issues, the average unit size during that period was 28 acres**.** Alternative 2 is designed to restore historic patch size on many VRUs. Alternative 3 is consistent with past harvest unit size.

The regeneration treatments proposed in the East Reservoir Project also emphasizes restoration of ponderosa pine, western larch, western white pine and aspen through retention of these species in the overstory, and through natural regeneration and planting. In contrast, proposed regeneration treatments retain a minimum of 8 reserve trees and/or snags per acre to function as genetic seed reservoirs, relic overstory, current and future snags, and long-term coarse woody debris for future soil organic matter. All prescribed site preparation would adhere to BMPs to retain soil productivity, and scarification or mineral soil exposure would be to the minimum level required to meet regeneration objectives. In addition, the harvest units are designed to restore the historic patch size to the degree possible within the 40 acre limitation, to reduce fragmentation, and to buffer important late seral and riparian habitat with fuel treatments.

Prior to the 1980s, the majority of the intermediate treatments within this analysis area were liberation harvests that removed the larger more intolerant species such as ponderosa pine and western larch, and released the developing understory of primarily mid-tolerant Douglas-fir. These stands are trending towards climax conditions at potentially a more accelerated rate than the untreated stands. Species composition and structure are trending to a higher than historic component of smaller mid-tolerant to tolerant trees with increased ladder fuels.

As compared with the past intermediate treatments, the proposed intermediate harvest in East Reservoir analysis area are designed to maintain and improve the resilience, health and sustainability of forest stands and the landscape by retention of the best quality dominant and co-dominant, intolerant fire

adapted species such as PP and WL (with some Douglas-fir), to retain the majority of the intolerant relic trees that survived the late 1800s burn, and to retain desired amounts of coarse woody debris. In addition, clumps and islands may be retained for diversity, wildlife and visual quality objectives.
Silvicultural treatments in the East Reservoir analysis area are expected to improve forest conditions and to increase the stand or forest resilience. Areas or stands would be managed to restore intolerant species, to reduce stand density, improve tree growth and vigor, and to promote more open stand structure that is more resilient to fire, insect and disease and potential climate change. In addition, impacts to soil productivity would be minimized through the adherence to BMPs and disturbance from fuel treatments and site preparation would be to the minimum level required to meet objectives.

ALTERNATIVES 2 and 3

Direct and Indirect Effects

Refer to Chapter 2 for a description of the alternatives, and the project file for a comprehensive summary table of each alternative.

Ecological Integrity

Ecological integrity can be described by comparing forest composition, density, structure, patterns and function, to desired conditions, and analyzing landscape resilience to climate change and disturbances. If ecological systems within a forested environment are operating within a range of desired condition variability, it is assumed to be a healthy, sustainable system (USDA Forest Service, Region 1, Sustaining Ecological Systems 1991; Lindermayer 2000). Analyzing resilience to climate change can be done using current VRU objectives, since these are compatible with stand qualities necessary to survive expected future disturbances. The effects to ecological integrity will be summarized by VRU group as described in the affected environment.

Moderately Warm and Dry VRU 2S (21% of the analysis area)

Because fire return intervals have lengthened due to fire suppression efforts over the past 80 years, particularly in this Fire Regime I (0-35 year low to mixed severity fires), the majority of this VRU is not functioning within the range of desired conditions. Ecosystem sustainability can be promoted by actions that decrease tree density and the Douglas-fir component, decrease natural and ladder fuels and that disturb the existing ground vegetation, allowing a more diverse occupancy of the site by seral grasses, forbs, shrubs, deciduous trees and conifer species. Current conditions are inconsistent with desired conditions, and would not be resilient to potential warmer and drier climates.

Alternatives 2 and 3 would improve ecological integrity, resilience and forest resistance to insect and disease mortality on the moderately warm and dry VRU 2S. Improvements would be accomplished by reducing tree density, changing the early successional stages, reducing natural fuels, reducing ladder fuels and restoring PP and WL, and early seral grasses, shrubs and forbs, through harvest, slashing, prescribed fire and planting. In addition, composition and stocking, early successional stages and fuel reduction would be improved through prescribed fire outside the harvest units. The amount of improvement can be measured by determining the acres of reduced stand density, acres of fuel reduction and the change in successional stages, through harvest and or prescribed fire and the acres of ponderosa pine and western larch restoration. The IDT developed target stands that reflected desired conditions for the VRUs across the East Reservoir Landscape, and these were refined by VRU groups for this analysis. More natural conditions are restored and resilience is increased when the treatment is moving the stand towards the VRU group target conditions, and reducing the departure from desired conditions as measured by the indicators identified.

Increasing resilience based on natural conditions should also increase resilience and resistance to potential climate change to warmer and drier or warmer and moister with higher frost free days, by favoring shade intolerant species that are more resilient to drought, reducing vegetation density on a given site and reducing the probability of a drainage-wide stand replacement in the event of a high severity fire. Restoration of historic landscape patterns is more difficult to measure. The historic landscape condition

was a diverse mix of open park-like stands intermixed with larger openings and dense patches. Restoration of density and species composition across the landscape would restore some of the natural patterns. Due to small past harvest unit size, and the old growth designations within this VRU group, it is not feasible to completely correct existing vegetation patterns with this entry. However, the treatment proposed in the action alternatives would move the landscape toward the historic matrix of natural openings, and open stands intermixed with dense patches, and would increase landscape heterogeneity.

Landscape function refers to the flow of mineral nutrients, water, energy or species across the landscape, and how the compositional and structural elements of a landscape interact and operate. Landscape function is difficult to quantify and it is hypothesized where community composition and structure, and historic disturbance processes such as fire, occur within a desired range of conditions, the function of the landscape community would also be maintained within its desired range. All action alternatives were designed within desired composition, structure, function and patterns of vegetation.

Moving stands toward the desired conditions in the VRU would begin to restore desired condition species composition, density, structure and function, and increase stand and landscape resilience. Refer to indicators on page 9 (Chapter 3). Refer to Table 3.12 for a summary of treatments trending toward VRU2 desired conditions.

TABLE 3.12 - Treatments Trending Toward VRU 2S Desired Conditions (acres)
(Species Composition and Density Changes by Alternative)

TREATMENT	ALT 1	ALT 2	ALT 3	FORESEEABLE ACTIONS	MAXIMUM CUMULATIVE
Ponderosa Pine Restoration through Planting	0	82	108	0	0
Western Larch Restoration through Planting	0	27	37	0	0
Intermediate harvest trending species composition toward VRU desired condition that is more resistant and resilient to disturbance insect and disease infestations and uncertain environmental conditions such as climate change.	0	3,401	3,362	0	0
Intermediate harvest trending density toward VRU group desired condition that is more resistant and resilient to disturbance, insect and disease infestations and uncertain environmental conditions such as climate change.	0	3,401	3,362	0	0
Natural Fuels Reduction trending toward desired condition	7,766	8,592	8,454		8,592

Units within this VRU 2S: Regeneration Harvest: Units 2, 3c, 16, 18, 44, 45b, 147, 170, 193, 207, 219, 220.
Intermediate Harvest Treatments: Units COE1-4, 1, 2b, 2c, 2d, 3a, 3b, 9, 10, 11, 15, 17, 18a 19, 20, 27-32, 33, 34, 42, 43, 44, 45a, 49, 55, 56, 157, 174, 179, 183, 190, 194, 196, 203, 205 209, 219a, 190, 192, 194s, 194t, 196, 197, 305-307, 347
Fuels: Units COE 5, 8, 9, 10, 11, F1, 1OG, 12, 11OG, 13, 14OG, 15-18, 21, 45

Table 3.13- Successional Stage Redistribution in Post-Harvest for Alternatives in VRU 2 (%)

SUCCESSIONAL STAGES	AGE CLASSES (YEARS)	DESIRED CONDITION	CURRENT CONDITION and ALT 1	ALT 2	ALT 3
Early-successional	0-40	15-25	5	6	6
Mid- Successional	41-100	15-35	20	20	20
Late- Successional	101-150	10-30	47	46	46
Very Late Successional	150+	25-50	23	23	23

Numbers highlighted in grey indicate conditions outside desired conditions.

Table 3.14 - Acres of Treatment by Action Alternative for VRU2S

TREATMENT TYPE	ALTERNATIVE 2	ALTERNATIVE 3
Regeneration	109	145
Intermediate	3401	3362
Fuels	8,592	8,454
Precommercial thin	575	570

The treatment alternatives have a slight, measureable effect on the successional stages (Table 3.13.). Table 3.14 displays the acres of treatment in VRU2. These treatments would have a 1% increase in the early-successional stage in both action alternatives for the analysis area. Late-successional stage would decrease by 1% in both action alternatives. Successional stage most often does not change with intermediate harvest or fuels treatment because the age class is determined from the portion of the stand with the greatest basal area and many times this is the older and larger component of the stand. In these treatments, the older trees are the trees that are retained from which the age class is determined. The intermediate treatments would address the majority of departures from desired conditions in these dry types by reducing density and restoring species composition toward desired conditions that are better adapted to these dry sites and therefore improving the resiliency of this VRU.

In Alternative 2, 109 acres of regeneration are proposed and in Alternative 3, 145 acres of regeneration are proposed. The small amount of regeneration acres proposed in this warm and dry VRU does not significantly change successional stages. These acres are proposed for regeneration because their existing condition consisted of mostly older small diameter Douglas-fir and the desired condition is a species composition mix of western larch, ponderosa pine and Douglas-fir. Regeneration treatments would include planting of western larch and ponderosa pine to meet objectives.

Alternatives 2 and 3 are very similar for this warm and dry vegetation response unit. Alternatives 2 and 3 trend similar acres toward desired condition density and species composition through a combination of intermediate harvest and regeneration treatment followed by reforestation of target species. The main difference between Alternative 2 and Alternative 3 is that Alternative 2 includes natural fuels reduction treatments in old growth. Implementation of Alternative 2 has the potential to increase the resiliency and resistance of the greatest acres because it reduces overstocking and improves overall tree vigor and resistance on the greatest number of acres. As a result of this increase in resiliency, Alternative 2 trends a large amount of acres within the analysis area to a condition that is better adapted to climate change. Alternative 2 and 3 both equally treat acres with species composition and density restoration therefore trending equal acres toward the desired condition. Alternative 2 has the greatest number of acres of fuels reduction however this has less impact on trending the VRU toward desired condition species composition and density. Alternative 2 most effectively addresses ecosystem restoration in VRU2 because it addresses species composition and density reduction to the highest degree as it treats the most overall acres.

Moderately Warm and Moderately Dry - VRU 3 (22% of the analysis area)

TABLE 3.15 - Treatments Trending Toward VRU 3 Desired Conditions (acres)
(Species Composition and Density Changes by Alternative)

TREATMENT	ALT 1	ALT 2	ALT 3	FORESEEABLE ACTIONS	MAXIMUM CUMULATIVE
Ponderosa Pine Restoration through Planting	0	242	200	0	242
Western Larch Restoration through Planting	0	362	301	0	362
Intermediate harvest trending species composition toward VRU group desired condition that is more resistant and resilient to disturbance insect and disease infestations and	0	1409	1279	0	1409

TREATMENT	ALT 1	ALT 2	ALT 3	FORESEEABLE ACTIONS	MAXIMUM CUMULATIVE
uncertain environmental conditions such as climate change.					
Intermediate harvest trending density toward VRU group desired condition that is more resistant and resilient to disturbance, insect and disease infestations and uncertain environmental conditions such as climate change.	0	1409	1279	0	1409
Natural Fuels Reduction trending toward desired condition	0 980?	432	429		

Units within this VRU3: **Regeneration Harvests:** Units 1A, 2, 3, 8, 16, 18, 44, 45B, 46, 47, 54, 69, 70, 72, 81, 80, 82, 141, 142, 143A, 144S, 144T, 159A, 170, 188, 207, 208, 214, 362, 363, 364, 365, 367, 367A, 368A, 368B, 368C.
Fuels Treatments: Units F1, 1A, 1og, 3og, 4, 5, 8, 12, 15og, 18, COEF12
Intermediate Harvests: Units 1, 2c, 3A, 3B, 5, 9, 10, 11, 18A, 19, 20, 21, 25, 31, 32, 33, 34, 45A, 49, 55, 56, 158, 173, 174, 179, 182, 183, 195, 205 209, 306, 307, 337, 340, 347, 349, COE6.

Table 3.16 - Successional Stage Redistribution in Post-Harvest for Alternatives in VRU 3 (%)

SUCCESSIONAL STAGES	AGE CLASSES (YEARS)	REFERENCE CONDITION	CURRENT CONDITION and ALT 1	ALT 2	ALT 3
Early-successional	0-40	15-25	27	30	30
Mid- Successional	41-100	20-40	17	17	17
Late- Successional	101-150	15-35	45	42	42
Very Late Successional	150+	15-40	10	10	10

Numbers highlighted in grey indicate conditions outside desired conditions.

Table 3.17- Acres of Treatment by Action Alternative for VRU3

TREATMENT TYPE	ALTERNATIVE 2	ALTERNATIVE 3
Regeneration	604	501
Intermediate	1,409	1,279
Fuels	432	429
Precommercial Thin	2,832	2,832

The action alternatives would improve forest resiliency in the VRU 3 Group, by trending toward desired condition species composition and densities. This would be done by restoring PP and WL through regeneration harvest and planting, restoring species composition through intermediate harvest, restoring desired condition density levels through intermediate harvest, restoring early successional stages of conifers and early seral grasses, shrubs and forbs, through regeneration harvest and reducing natural fuels through slashing and prescribed fire. These treatments are also designed to increase stand and landscape resilience to potential climate change. The amount of improvement can be measured by determining the acres of reduced stand density, fuel reduction and change in successional stages, through harvest and prescribed fire, and the acres of planting ponderosa pine and western larch.

Restoration trending toward desired condition species composition and density would trend this VRU to a condition that is better adapted and therefore more resilient and resistant. In particular, restoration of desired condition density and species condition would improve the resistance to MPB infestations in the PP by spacing the trees out and improving the tree and stand vigor and increasing the VRUs resistance to MPB infestations. Increasing resilience based on natural conditions should also increase resilience and resistance to potential climate change issues and stresses. Restoration of successional stages is more difficult to restore due to past management, that removed the older component, but current treatments are designed to retain acres in the late successional stage and trend more acres to the late successional stage.

Historic timber harvest that focused on selecting western larch, effective fire suppression and the reduction in the mixed severity underburns have altered the species composition and stand structure in many of these areas. The stand structure has changed from mid- and late-development open stands of large ponderosa pine, western larch and Douglas-fir to single to two storied stands composed of predominately Douglas-fir, or a higher proportion of Douglas-fir than would have occurred with more

frequent mixed severity fires. The lower canopy is frequently composed of a dense understory of smaller Douglas-fir and grand fir. These high density understories can provide a fuel ladder to the crowns of larger trees and increase the potential for high severity, stand replacing fires.

Fire, including frequent mixed severity fire and infrequent large-scale stand-replacing fire, is the primary ecological process that developed patch size in this area. Populations of native plants and animals have responded and adapted to this disturbance process, and associated patch size. Species abundance and distribution are a result of these dynamic processes, and the resulting vegetation patterns.

In this VRU group, Alternative 2 most effectively addresses ecosystem restoration and resilience because it treats and trends the greatest number of acres toward the desired condition. Alternative 3 is the second most effective which treat the least acres in this VRU.

Moderately Warm to Moderately Moist - VRU 4 (10% of the analysis area)

TABLE 3.18 - Treatments Trending Toward VRU 4 Desired Conditions (acres)
(Species Composition and Density Changes by Alternative)

TREATMENT	ALT 1	ALT 2	ALT 3	FORESEEABLE ACTIONS	MAXIMUM CUMULATIVE
Ponderosa Pine Restoration through Planting	0	192	137	0	192
Western Larch Restoration through Planting	0	383	274	0	383
Western White Pine Restoration through Planting.	0	191	138	0	191
Regeneration harvest trending species composition toward VRU group desired condition that is more resistant and resilient to disturbance insect and disease infestations and uncertain environmental conditions such as climate change.	0	766	549	198 on DNRC lands	964
Intermediate harvest trending species composition	0	948	820	0	948
toward VRU group desired condition that is more resistant and resilient to disturbance insect and disease infestations and uncertain environmental conditions such as climate change.					
Intermediate harvest trending density toward VRU group desired condition that is more resistant and resilient to disturbance, insect and disease infestations and uncertain environmental conditions such as climate change.	0	948	820	0	
Number of patches created that are consistent with desired condition patch size of 100-300 acres.	0	3	0	0	3
Natural Fuels Reduction trending toward desired condition	0			0	349

Units within this VRU4: Regeneration Harvest: Majority located on the north aspects of Fivemile and Warland Creeks and Boundary Mountain.

Intermediate Harvests: Majority located south of the Cripple Horse Road, lower in the Cripple Horse Drainage (Units 22, 23, 24, 25, 26).

Table 3.19 - Successional Stage Redistribution in Post-Harvest for Alternatives in VRU 4 (%)

SUCCESSIONAL STAGES	AGE CLASSES (YEARS)	DESIRED CONDITION	CURRENT CONDITION and ALT 1	ALT 2	ALT 3
Early-successional	0-40	15-25	20	29	27
Mid- Successional	41-100	20-40	16 (low)	14 (low)	15
Late- Successional	101-150	15-35	57(high)	51(high)	52
Very Late Successional	150+	10-40	7(low)	6(low)	6

Numbers highlighted in grey indicate conditions outside desired conditions.

Table 3.20 – Acres of Treatment by Action Alternative for VRU4

TREATMENT TYPE	ALTERNATIVE 2	ALTERNATIVE 3
Regeneration	766	549
Intermediate	948	820
Fuels	178	261
Precommercial Thin	787	764

The action alternatives would improve forest resiliency in the VRU 4 Group, by trending toward desired condition species composition and densities. This would be done by restoring ponderosa pine, western larch and western white pine through regeneration harvest and planting, restoring species composition through intermediate harvest, restoring desired condition density levels through intermediate harvest, restoring early successional stages of conifers and early seral grasses, shrubs and forbs, through regeneration harvest and reducing natural fuels through slashing and prescribed fire. These treatments are also designed to increase stand and landscape resilience to potential climate change.

Restoration trending toward desired condition species composition and density would trend this VRU to a condition that is better adapted and therefore more resilient and resistant. In particular, restoration of desired condition densities and species composition would improve the resistance to MPB infestations in the ponderosa pine by spacing the trees out and improving the tree and stand vigor.

Alternative 2, proposes treatment patches (Unit 170; unit 73T, 75 and 188; and units 80 and 36) that would be consistent with the 100-300 acre mixed historic patch size therefore this alternative most effectively mimics historic conditions. It is assumed that natural conditions are restored where treatment is moving the stand toward the VRU target conditions and these conditions will be best adapted for future environments.

The larger treatment areas that mimic natural processes proposed in Alternative 2 best address connectivity and fragmentation to the extent possible within these other resource and social needs, and would move the landscape toward the historic matrix of seral stages. In addition, Alternative 2 also treats and trends the greatest number of acres toward historic species composition and therefore trending the greatest number of acres to be more adapted to future environments. Alternative 3 is the second most effective.

Complete restoration of historic landscape patterns was not be feasible due to existing vegetation patterns, past harvest design, old growth designations, 40 acre NFMA opening size limitation and associated public concerns and other resource and social needs. However, the treatments proposed in Alternative 2 address connectivity and fragmentation to the extent possible within these other resource and social needs, and would move the landscape toward the historic matrix of seral stage with the greatest number of acres treated.

Moderately Warm to Moderately Moist - VRU 5 (1% of the analysis area)

TABLE 3.21 - Treatments Trending Toward VRU 5 Desired Conditions (acres)
(Species Composition and Density Changes by Alternative)

TREATMENT	ALT 1	ALT 2	ALT 3	FORESEEABLE ACTIONS	MAXIMUM CUMULATIVE
Ponderosa Pine Restoration through Planting	0	22	23	0	22
Western Larch Restoration through Planting	0	100	59	0	59
Western White Pine Restoration through Planting.	0	52	35	0	52
Regeneration harvest trending species composition toward VRU group desired condition that is more resistant and	0	174	117	0	174

TREATMENT	ALT 1	ALT 2	ALT 3	FORESEEABLE ACTIONS	MAXIMUM CUMULATIVE
resilient to disturbance insect and disease infestations and uncertain environmental conditions such as climate change.					
Intermediate harvest trending species composition toward VRU group desired condition that is more resistant and resilient to disturbance insect and disease infestations and uncertain environmental conditions such as climate change.	0	167	142	0	167
Number of patches created that are consistent with desired condition patch size of 100-300 acres.	0	3	0	0	3
Natural Fuels Reduction trending toward desired condition	0	0	0	0	0

Units within this VRU 5: Regeneration Harvests: Units 147, 148, 149 (all in Fivemile Ck).
Commercial Thinning: Units 311,343, 344.

Table 3.22 - Successional Stage Redistribution in Post-Harvest for Alternatives in VRU 5 (%)

SUCCESSIONAL STAGES	AGE CLASSES (YEARS)	DESIRED CONDITION	CURRENT CONDITION And ALT 1	ALT 2	ALT 3
Early-successional	0-40	10-20	31	50	44
Mid- Successional	41-100	15-35	9	9	9
Late- Successional	101-150	10-30	54	36	42
Very Late Successional	150+	25-55	5		5

Numbers highlighted in grey indicate conditions outside desired conditions.

Table 3.23 - Acres of Treatment by Action Alternative for VRU5

TREATMENT TYPE	ALTERNATIVE 2	ALTERNATIVE 3
Regeneration	174	117
Intermediate	167	142
Fuels	0	0
Precommercial Thin	60	60

The action alternatives would improve forest resiliency in the VRU 5 Group, by trending toward desired condition species composition. This would be done by restoring ponderosa pine, western larch and western white pine through regeneration harvest and planting, restoring species composition through commercial thinning, and by restoring early seral stages of conifers and early seral grasses, shrubs and forbs, through regeneration harvest. These treatments are also designed to increase stand and landscape resilience to potential climate change by regenerating the species best adapted to the VRU desired conditions. Restoration of successional stages is more difficult to restore due to past management. The majority of acres proposed for regeneration harvest in this VRU 5 group would not trend toward late successional stages due to their current stand conditions. For example, (Units 147, 148, 149) over 50% of the stand is dead and down due to MPB mortality leaving this area in an understocked condition. In other areas, small stagnant conditions exist such as small diameters averaging seven inches DBH at 135 years old. These stagnant condition would not likely progress into the late successional stages because they are overstocked and unraveling. Alternative 2, proposes treatment patches that would be consistent with the 100-300 acre mixed historic patch size therefore this alternative most effectively mimics historic conditions. It is assumed that natural conditions are restored where treatment is moving the stand toward the VRU target conditions and these conditions will be best adapted for future environments.

The larger treatment areas that mimic natural processes proposed in Alternative 2 best address connectivity and fragmentation to the extent possible within these other resource and social needs, and would move the landscape toward the historic matrix of seral stages. In addition, Alternative 2 also treats and the greatest number of acres toward historic species composition and therefore trending the greatest number of acres to be more adapted to future environments. Alternative 3 is the second most effective.

Landscape Function: Moving stands toward the desired conditions in this VRU group would begin to

restore historic density, composition and function, and address the potential climate change. Refer to Table 3.21 for a summary of treatments trending toward VRU 5 desired conditions. In this VRU group, Alternative 2 most effectively addresses ecosystem restoration and resilience because it treats and trends the greatest number of acres toward the desired condition.

Cool and Moist - VRU 7 (29% of analysis area)

TABLE 3.24- Treatments Trending Toward VRU 7 Desired Conditions (acres)
(Species Composition and Density Changes by Alternative)

TREATMENT	ALT 1	ALT 2	ALT 3	FORESEEABLE ACTIONS	MAXIMUM CUMULATIVE
Ponderosa Pine Restoration through Planting	0	0	0	0	0
Western Larch Restoration through Planting	0	199	117	0	0
Western White Pine Restoration through Planting.	0	300	176	0	0
Regeneration harvest trending species composition toward VRU group desired condition that is more resistant and resilient to disturbance insect and disease infestations and uncertain environmental conditions such as climate change.	0	499	293	0	499
Intermediate harvest trending species composition toward VRU group desired condition that is more resistant and resilient to disturbance insect and disease infestations and uncertain environmental conditions such as climate change.	0	423	423	0	423
Number of patches created that are consistent with desired condition patch size of 5,000-100,000 acres.	0	0	0	0	0
Natural fuels reduction trending toward desired condition	0	0	0	0	0

Units within VRU7: Units located on the upper elevations, south slopes of Fivemile and Warland Creeks.
Regeneration Harvest: Units 39, 40, 41, 59, 61, 62, 64, 64A, 64B, 150, 151, and 365, 366
Intermediate Harvest: Units 317, 318, 319, 327, 328, 330, 331, 332, 333, 334, 335, 343, 344, 345, 346.

Table 3.25 - Successional Stage Redistribution in Post-Harvest for Alternatives in VRU 7 (%)

SUCCESSIONAL STAGES	AGE CLASSES (YEARS)	DESIRED CONDITION	CURRENT CONDITION and ALT 1	ALT 2	ALT 3
Early-successional	0-40	15-25	39	41	40
Mid- Successional	41-100	20-40	9	9	9
Late- Successional	101-150	15-30	44	42	43
Very Late Successional	150+	15-45	8	8	8

Numbers highlighted in grey indicate conditions outside desired conditions.

Table 3.26 - Acres of Treatment by Action Alternative for VRU7

TREATMENT TYPE	ALTERNATIVE 2	ALTERNATIVE 3
Regeneration	499	293
Intermediate	423	423
Fuels	0	0
Precommercial Thin	2,140	1,173
Western White Pine Daylight Thin	212	0

The action alternatives would improve forest resiliency in the VRU 7 Group, by trending toward desired condition species composition. This would be done by restoring western larch and western white pine through regeneration harvest and planting, restoring species composition through commercial thinning, and by restoring early seral stages of conifers and early seral grasses, shrubs and forbs, through regeneration harvest. These treatments are also designed to increase stand and landscape resilience to

potential climate change by regenerating the species the best adapted to the VRU desired conditions.

Restoration of successional stages is more difficult to restore due to past management. However in Alternative 2, three of the regeneration harvests (Units 62, 40 and 150) are proposed as over 40 acre regeneration but do not mimic the large historic patch size of 5,000 to 100,000 acres. Units 62, 40 and 150 are placed adjacent to past harvest that are recovered but are within the early-successional stage. By these units being blocked up with other early-successional stages this larger block mimics historic conditions and would move into the future as a connected patch of interior forest. Because target stands for each VRU were developed to mimic historic conditions, it is assumed that natural conditions are restored where treatment is moving the stand toward the VRU target conditions.

Many of the stands proposed for regeneration in VRU 7 are in the late successional stage (100 to 150 years). Many of these stands have had past MPB mortality resulting in understocked stands. Currently, the late-successional stage is high (44%) compared to the desired condition of 15-30% but the very late successional stages is low (8%) compared to the desired condition of 15-45%. The majority of the 44% of the late-successional would move into very late successional stage, all but 1-2% (depending on the alternative) would move into the early-successional stage. Also, taking a closer look at the early successional stage age class breakdown, 13% are in the 0-20 age class, 22% are in the 21-30 age class (years) and 4% in the 31-40 age class (years). Depending on the alternative, these regeneration treatments increase the early successional stages by 1-2%, however the majority of this age class would be moving into mid-successional within 10-15 years. Increases in early successional stages in this cool and moist VRU has a beneficial effect for lynx forage, providing a pulse of habitat for snowshoe hare. Both Alternatives 2 and 3 treat 423 acres with a commercial thinning harvest, a type of intermediate treatment. These thinning treatments have the potential to develop into multi-storied lynx habitat within 20-50 years. Thinning the stand would create an environment for regeneration to occur in varying stages moving the stand into multi-storied condition in the future. Without commercial thinning of these heavily stocked stands, they would likely move into the stem-exclusion stage and then would not develop into a multi-storied condition without disturbance.

Complete restoration of historic landscape patterns may not be feasible due to existing vegetation patterns, past harvest design, old growth designations, 40 acre NFMA opening size limitation and other resource and social needs. However, the treatments proposed in the action alternatives address connectivity and fragmentation to the extent possible within these other resource and social needs, and would move the landscape toward the historic matrix of seral stages.

Landscape Function: Moving stands toward the desired conditions in this VRU group would begin to restore historic density, composition and function, and address the potential climate change. Refer to Table 3.24 for a summary of treatments trending toward VRU 7 desired conditions.

In this VRU group, Alternative 2 most effectively addresses ecosystem restoration and resilience because it treats and trends the greatest number of acres toward the desired condition. Alternative 3 is the second most effective in this VRU.

Cool and Moist– VRU 9 (13% of analysis area)

TABLE 3.27 - Treatments Trending Toward VRU 9 Desired Conditions (acres)
(Species Composition and Density Changes by Alternative)

TREATMENT	ALT 1	ALT 2	ALT 3	FORESEEABLE ACTIONS	MAXIMUM CUMULATIVE
Ponderosa Pine Restoration through Planting	0	0	0	0	0
Western Larch Restoration through Planting	0	188	150	0	188
Western White Pine Restoration through Planting.	0	188	151	0	188
Regeneration harvest trending species composition toward VRU group desired condition that is more resistant and	0			0	376

TREATMENT	ALT 1	ALT 2	ALT 3	FORESEEABLE ACTIONS	MAXIMUM CUMULATIVE
resilient to disturbance insect and disease infestations and uncertain environmental conditions such as climate change.		376	301		
Intermediate harvest trending species composition toward VRU group desired condition that is more resistant and resilient to disturbance insect and disease infestations and uncertain environmental conditions such as climate change.	0	55	26	0	55
Number of patches created that are consistent with desired condition patch size of 5,000-100,000 acres.	0	0	0	0	0
Natural Fuels Reduction trending toward desired condition	0	0	0	0	0

Units within this VRU 9: Intermediate Harvests: Units 62A, 62B, 317, 327, 346.
Regeneration Harvests: Units 47, 61, 62, 64A, 362, 363, 364, 369

Table 3.28 - Successional Stage Redistribution in Post-Harvest for Alternatives in VRU 9 (%)

SUCCESSIONAL STAGES	AGE CLASSES (YEARS)	DESIRED CONDITION	CURRENT CONDITION and ALT. 1	ALT 2	ALT 3
Early-successional	0-40	20-40	27	31	30
Mid- Successional	41-100	40-60	11	11	11
Late- Successional	101-150	15-20	50	47	48
Very Late Successional	150+	5-10	10	10	10

Numbers highlighted in grey indicate conditions outside desired conditions.

Table 3.29 - Acres of Treatment by Action Alternative for VRU9

TREATMENT TYPE	ALTERNATIVE 2	ALTERNATIVE 3
Regeneration	376	301
Intermediate	55	26
Fuels	0	0
Precommercial Thin	198	130

The action alternatives would improve forest resiliency in the VRU 9 Group, by trending toward desired condition species composition. This would be done by restoring western larch and western white pine through regeneration harvest and planting, restoring species composition through commercial thinning, and by restoring early seral stages of conifers and early seral grasses, shrubs and forbs, through regeneration harvest. These treatments are also designed to increase stand and landscape resilience to potential climate change by regenerating the species best adapted to the VRU desired conditions. Restoration of successional stages is more difficult to restore due to past management.

Moving stands toward the desired conditions in this VRU group would begin to restore historic density, composition and function, and address the potential climate change. Refer to Table 3.27 for a summary of treatments trending toward VRU 9 desired conditions. Restoration of successional stages is more difficult to restore due to past management. However, in Alternative 2, one of the regeneration harvests (Unit 362) is proposed as over 40 acre regeneration but do not mimic the large historic patch size of 5,000 to 100,000 acres. Unit 362 is placed adjacent to past existing harvests that are recovered but are within the early-successional stage. By blocked up these units with other early-successional stages this larger block mimics historic conditions and would move into the future as a connected patch of interior forest. Because target stands for each VRU were developed to mimic historic conditions, it is assumed that natural conditions are restored where treatment is moving the stand toward the VRU target conditions. Increases in early successional stages in this cool and moist VRU has a beneficial effect for lynx forage, providing a pulse of habitat for snowshoe hare. Both Alternatives 2 and 3 treat 26 acres with a commercial thinning harvest, a type of intermediate treatment. These thinning treatments have the potential to develop into multi-storied lynx habitat within 20-50 years. Thinning the stand would create an environment for regeneration to occur in varying stages moving the stand into multi-storied condition in the future. Without commercial thinning of these heavily stocked stands, they would likely move into the

stem-exclusion stage and then would not develop into a multi-storied condition without disturbance.

Landscape Function: In this VRU group, Alternative 2 was developed to address landscape ecology and resilience. Alternative 2 trends the greatest number of acres toward desired conditions. Alternative 3 is the second most effective in this VRU.

Moving stands toward the desired conditions in this VRU group would begin to restore historic density, composition and function, and address the potential climate change.

TABLE 3.30- Treatments Trending Toward all VRU Desired Conditions (acres)
(Species Composition and Density Changes by Alternative)

TREATMENT	ALT 1	ALT 2	ALT 3	FORESEEABLE ACTIONS	MAXIMUM CUMULATIVE
Ponderosa Pine Restoration through Planting	0	538	468	0	538
Western Larch Restoration through Planting	0	1,259	938	0	1,259
Western White Pine Restoration through Planting.	0	731	491	0	731
Regeneration harvest trending species composition toward VRU group desired condition that is more resistant and resilient to disturbance insect and disease infestations and uncertain environmental conditions such as climate change.	0	2,528	1906	198 on DNRC lands	2,726
Intermediate harvest trending species composition toward VRU group desired condition that is more resistant and resilient to disturbance insect and disease infestations and uncertain environmental conditions such as climate change.	0	6,573	6,140	0	6,573
Acres treated with intermediate harvest trending density toward VRU group desired condition that is more resistant and resilient to disturbance, insect and disease infestations and uncertain environmental conditions such as climate change.		6,573	6,140	0	9,811
Natural Fuels Reduction trending toward desired condition	0	9,811	9,647	0	9,811
Precommercial Thinning	0	5,563	5,563	0	5,563
Western White Pine Daylight Thinning	0	1,060	0	0	1,060

Discussion: Because the alternatives were designed to address ecosystem restoration needs, the differences in ecological restoration between the alternatives are generally proportionate to the acres treated. Alternative 2 most effectively addresses restoration of species composition and density because this alternative treats more acres, moving more acres toward the desired condition.

Alternative 2 moves more acres toward the desired species and density levels therefore having a larger impact on resistance and resiliency. Alternatives 2 reduces effects to the greatest degree from drought, fire, insects disease and climate change as the desired species are drought resistant and fire-tolerant, with good resistance to insects and disease. Alternative 3 is second most effective.
Alternative 2 most effectively addresses restoration needs to trend the greatest number of acres toward desired conditions, therefore trending to a condition that is most adapted and resilient to disturbances from insect and disease infestations and uncertain environmental conditions such as climate change. Alternative 3 trends a large amount of acres toward desired condition species composition and density levels therefore reducing the risk of mortality from MPB.

Alternative 2 most effectively addresses restoration at a landscape level by restoring historic patch size, therefore most effectively mimics historic conditions. It is assumed that natural conditions are restored where treatment is moving the stand toward the VRU target conditions and these conditions would be best adapted for future environments. Alternative 3 is the second most effective, however this alternative does not attempt to restore historic patch size.

Alternative 2 most effectively addresses increases in early successional stages in this cool and moist VRU (7 and 9) which has a beneficial effect for lynx forage, providing a pulse of habitat for snowshoe hare. Alternative 3 also creates a forage pulse for lynx however to fewer acres.

Both alternatives 2 and 3 treat 423 acres with a commercial thinning harvest, a type of intermediate treatment. These thinning treatments have the potential to develop into multi-storied lynx habitat within 20-50 years. Thinning the stand would create an environment for regeneration to occur in varying stages moving the stand into multi-storied condition in the future. Without commercial thinning of these heavily stocked stands they would likely move into the stem-exclusion stage and then would not develop into a multi-storied condition without disturbance.

Landscape Function: All alternatives were designed to address historic composition, structure and patterns within other resource needs, and KNFP direction. All alternatives address the potential for climate change and increase resistance and resiliency to the degree of planned treatments. Alternative 2 most effectively addresses landscape function due to the highest amount of treatment acres, and the largest amount of intolerant species restored and restoration of historic patch size. Alternative 3 is the next most effective

All planned and reasonably foreseeable actions combined with the proposed activities in Alternative 2 or all harvest and prescribed fire would treat up to 24% of the analysis area.

HARVEST

Direct and Indirect Effects

Stand Improvement

Improvement harvests are proposed for stands that have higher than historic density and natural fuels. These sites would be opened up to an average BA of 50-60 on the dryer sites, and 70-90 BA on the moist sites. Ponderosa pine and western larch would be strongly favored for leave where they exist. There may be pockets of open areas but they would generally not exceed 15% of the unit. During implementation, units or portions of units may be dropped where BA reduction is not viable due to harvest economics or lack of adequate leave trees. These residual basal area objectives are consistent with historic stand densities and species composition resulting from mixed severity fire.

This intermediate treatment would not replace the existing stand and would improve the existing species composition and forest health by removing less desirable DF, LPP, grand fir, hemlock, cedar and native non-disease resistant western white pine, and some of the smaller western larch and ponderosa pine, and insect and disease infested trees. The harvest treatment would retain the best Douglas-fir and most of the ponderosa pine and western larch. The residual stand structure would vary in size and arrangement. The remaining overstory would not be evenly spaced, but would be variable based on existing stand structure, condition and species composition. Opening the stand would increase the growth and vigor of the residual conifers and increased sunlight to the forest floor would stimulate growth of understory vegetation.

Prescribed fire or machine piling is planned to reduce natural down and ladder fuels for some units. Spring underburning or grapple piling would reduce the amount of natural fuels, interrupt the succession of the more tolerant species, and help the ponderosa pine and western larch maintain dominance in these stands. Fire would also move the understory shrubs, grasses and forbs back to their early seral stages and increase forage amount, nutrition and palatability. Prescribed fire may be deferred if there is unacceptable risk of killing more than 10-15% of the leave trees either through the fire directly or by stressing the trees and increasing the risk of insect attack.

Yarding tops without prescribed fire or machine piling is planned in units that are too steep to pile, and do not have sufficiently large residual trees that would survive prescribed fire.

Commercial Thinning treatments are prescribed to reduce stand density (of trees) primarily to favor desired species and improve growth and improve forest health. Commercial thinning is prescribed in many

stands with ponderosa pine that are at high risk for losses from MPB as they are currently overstocked and at high risk for mortality. To accomplish these objectives, this treatment would focus on thinning the stands and removing excess and/or poor-quality trees, mid-tolerant or intolerant tree species such as Douglas-fir and grand fir, and smaller diameter trees that are less tolerant of fire. The intention of leaving the best quality tree and the needed spacing of those trees is to produce a more resilient stand condition that are less susceptible to MPB and represent a fire-tolerant tree species and reduced ladder fuels. These units would be whole tree yarded. Several units would require winter logging so as not to exceed the 15% maximum detrimental soil disturbance.

On the cool and moist vegetation types (VRU 7) these thinning treatments have the potential to develop into multi-storied lynx habitat within 20-50 years. Thinning the stand would create an environment for regeneration to occur in varying stages moving the stand into multi-storied condition in the future. Without commercial thinning of these heavily stocked stands, they would likely move into the stem-exclusion stage and then would not develop into a multi-storied condition without disturbance.

Improvement with Shelterwood Harvest

Improvement harvest with shelterwood openings would occur in stands that have higher than historic stocking. These dry DF types would be opened up to an average BA of 40-60 square feet per acre. Ponderosa pine and WL would be strongly favored for leave where they exist. Up to 50% of the unit may be in shelterwood openings (25-40 BA) within these units. Shelterwood openings would occur in areas with stagnant DF that lack acceptable leave trees and areas with heavy insect or disease infestations.

These residual basal area objectives are consistent with historic densities and species composition. This intermediate BA reduction treatment would not replace the existing stands, but would improve the existing species composition and forest health by removing less desirable DF, retaining the best DF and most of the PP and WL. Stand composition would vary from 80-90% DF in the stands with little available ponderosa pine or western larch. The residual structure would vary in size and arrangement. Overstory trees would not be evenly spaced, but would be variable based on existing stand structure, condition and species composition. Opening the stand density would increase the growth and vigor of the residual conifers and increased sunlight to the forest floor would stimulate growth of understory vegetation.

The shelterwood openings would replace the existing stand, but would retain the large overstory trees consistent with historic disturbance patterns. Stand structure would change from mid-late seral conifers to early-seral conifers with reserve mature overstory of Douglas-fir, ponderosa pine and western larch, with BA of 25-40 square feet. Opening the canopy would encourage regeneration of early seral understory vegetation and increased sunlight would stimulate growth and vigor of existing understory vegetation. Prescribed fire to reduce natural down and ladder fuels is planned for all units. Spring underburning would reduce the amount of natural fuels, interrupt the succession of Douglas-fir, and help the ponderosa pine and western larch maintain dominance in these stands. Fire would also move the understory shrubs, grasses and forbs back to their early seral stages and increase forage amount, nutrition and palatability and stimulate any aspen clones within the units.

Natural seeding is expected in these treatment units, but supplemental planting of ponderosa pine would ensure that this species is restored.

Shelterwood with Reserves Harvest

Shelterwood harvest would retain 20-40 BA of mid-late seral overstory to function as a seed source, shade and stand structure, as well as genetic seed reservoirs, relic overstory trees and future snags. Ponderosa pine and western larch would be favored for leave where they exist. In their absence, the larger, most vigorous Douglas-fir would be retained.

These regeneration openings would replace the existing stand, but would retain the large overstory trees consistent with the historic pattern of mixed lethal to lethal fire. Stand structure would change from mid-late seral conifers to early-seral conifers with a reserve mid-late seral overstory of ponderosa pine, western larch and Douglas-fir. The residual overstory would vary in size and arrangement. They would not be evenly spaced, but would be variable based on existing stand structure, condition species

composition and visuals and other resource objectives.

The opening of the canopy would encourage regeneration of early seral understory vegetation and increased sunlight would stimulate growth and vigor of existing understory vegetation.

Site preparation would be through prescribed fire or machine scarification. Spring underburning would reduce the amount of natural fuels, prepare the sites for regeneration, interrupt the succession of Douglas-fir and help the ponderosa pine and western larch establish dominance in these stands. Fire would also move the understory shrubs, forbs and grasses back to their early-seral stages and increase forage amount, nutritional value, and palatability, and stimulate any aspen clones within the site.

Some natural seeding of WL, lodgepole pine and Douglas-fir is expected in these treatment units, but supplemental planting of ponderosa pine and western larch would ensure that these species are restored.

Seedtree with Reserves Harvest

Seedtree harvest would retain 10-25 square feet of BA of mid-late seral overstory to function as a seed source, and stand structure, as well as genetic seed reservoirs, relic overstory trees and future snags. Ponderosa pine and western larch would be favored for leave where available. Where ponderosa pine and larch are not available, the larger, most vigorous Douglas-fir would be retained. A minimum of 10 leave trees per acre would be retained.

These regeneration openings would replace the existing stand, but would retain the large overstory trees consistent with the historic pattern of fire. Stand structure would change from mid-late seral conifers to early-seral conifers with a reserve mid-late seral overstory of ponderosa pine, western larch and Douglas-fir. The residual overstory would vary in size and arrangement based on existing stand structure, condition, species composition and visual or other resource objectives.

The opening of the canopy would encourage regeneration of early seral understory vegetation and increased sunlight would stimulate growth and vigor of existing understory vegetation.

Site preparation would be mostly through prescribed fire in the spring or fall with some grapple piling to prepare the sites for regeneration, interrupt the succession of tolerant to mid-tolerant species, restore ponderosa pine, western larch, or western white pine to a dominant component in these stands. Site preparation through prescribed fire or grapple piling would also move the understory shrubs and grasses back to their early seral stages and increase forage amount, nutritional quality and palatability, and stimulate any aspen clones within the site.

Natural seeding is expected in these treatment units, but supplemental planting of western larch, ponderosa pine, rust resistant western white pine, and potentially aspen on appropriate sites would ensure that these species are restored.

Clearcut with Reserves Harvest

Clearcut harvest would retain 10-15 square feet of BA of mid-late seral overstory to function not as a seed source, but for stand structure, genetic seed reservoirs, relic overstory trees and future snags. Ponderosa pine and western larch would be favored for leave where they exist. Where western larch and ponderosa pine are not available to meet the minimum of 4-8 trees per acre, the largest or most vigorous Douglas-fir would be retained. A minimum of 4-8 leave trees per acre would be retained.
These regeneration openings would replace the existing stand, but would retain the large overstory trees consistent with the historic pattern of mixed lethal to lethal fire. Stand structure would change from mid-late seral conifers to early-seral conifers with a reserve mid-late seral overstory of ponderosa pine, western larch and Douglas-fir. The residual overstory would vary in size and arrangement based on existing stand structure, condition and species composition.

The opening of the canopy would encourage regeneration of early-seral understory vegetation and increased sunlight would stimulate growth and vigor of existing understory vegetation.

Site preparation would be mostly through prescribed fire in the spring or fall and some grapple piling to prepare the sites for regeneration, interrupt the succession of tolerant to mid-tolerant species, and restore ponderosa pine, western larch or western white pine to a dominant component in these stands. Site preparation through prescribed fire or grapple piling would also move the understory shrubs and grasses back to their early seral stages and increase forage amount, nutritional quality and palatability.

Some natural seeding is expected in these treatment units, but planting of western larch, ponderosa pine, rust resistant western white pine, and potentially aspen on appropriate sites would ensure that these species are restored, and the sites are adequately stocked.

Combinations of Seedtree/Shelterwood Regeneration Harvest
Regeneration mosaics are proposed for units that vary between a seed tree and shelterwood, depending on the location within the unit. Overall effects would be most similar to a seed tree harvest as described previously.

Harvest Treatments Individually and Collectively
Harvest treatments individually and collectively would create openings between residual trees, retain larger fire resistant trees and reduce fuel loads. These treatments would increase within unit survival rates in the event of a large scale fire, would decrease the likelihood of a crown fire, and to some degree buffer areas on the leeward side of the treated stand. Collectively, the treatments would allow the landscape to sustain itself in the aftermath of a wildfire (Skinner 2008).

Reducing stand density, treating fuels, and maintaining or restoring intolerant and mid-tolerant species such as WL, PP, rust resistant western white pine, Douglas-fir and aspen, combined with the buffering effects, would increase stand and landscape level resistance and resilience to predicted climate change.

NON-HARVEST TREATMENTS
Direct and Indirect Effects
Stand Density-Hazard Fuel Reduction, through a Combination of Slashing and Prescribed Fire
Density reduction and hazard fuel reduction is proposed for stands that have conifer stocking, natural fuels and ladder fuels that are higher than would occur within historic fire regimes. The dry to moderately dry Douglas-fir types would be opened up to an average BA of 40-60 square feet per acre, and the moist VRUs would be opened up to 60-120 BA through a combination of slashing, and prescribed fire. Ponderosa pine and western larch would generally not be slashed. The residual basal area objectives are consistent with historic densities.

This treatment would not replace the existing stands, but would improve the existing species composition and forest health by removing less desirable Douglas-fir and other tolerant species, while retaining the larger thick barked Douglas-fir and most of the PP and WL. Stand composition would vary based on existing stand conditions, but would generally retain 70-80% intolerant to mid- tolerant fire resistant species such as western larch and ponderosa pine. The residual stand structure would be variable based on existing stand structure, condition and species composition. There would be inclusions with BA as low as 20 and as high as 140, but the overall averages would be consistent with the objectives described previously. Opening the stand density would increase the growth and vigor of the residual conifers and increased sunlight to the forest floor would stimulate growth of understory vegetation.

Prescribed Fire
Prescribed fire, following harvest or without harvest, would reduce natural fuels, prepare the site for regeneration of intolerant conifers, interrupt the succession of Douglas-fir and help the ponderosa pine, western white pine and western larch maintain or establish dominance on these sites.

Prescribed fire without harvest treatment would open the canopy through mortality in the smaller trees and the larger tolerant to mid-tolerant conifers, and prepare the site to encourage regeneration of early

seral understory vegetation. The increased sunlight, combined with the consumption of older plant material, would move the understory shrubs and grasses back to their early seral stages and increase growth, vigor, forage amount, nutrient quality and palatability. Species that are maintained by fire disturbance such as aspen, redstem ceanothus and willow may become common across the dryer portions of this landscape, and willows, maples, alder, huckleberry and other shrubs may be common in the drier VRUs.

Prescribed fire may increase susceptibility of ponderosa pine to MPB beetle attack through this additional disturbance. Depending on the site, the prescribed burning would be delayed after the harvest disturbance to reduce susceptibility

Fire Suppression

Fire suppression activities would continue in the analysis area. Composition of the vegetation in untreated areas, including forbs, shrubs and trees, would continue to shift toward a more tolerant, climax condition. This functionally disrupts both the vegetation and animal species that have evolved to depend upon landscape components historically present within the desired condition range of variability. In these areas, natural events such as wind and insects would continue to set the stage for stand replacing fire. The decision to allow natural fire to burn within the analysis area, rather than suppress fire, is beyond the scope of this project.

Precommercial Thinning

Precommercial thinning would occur in overstocked, sapling-size trees that have been initiated in the past 15-25 years. This treatment would reduce tree density, reduce competition, reduce crown continuity, improve growing conditions, restore and favor shade-intolerant species such as PP and western larch and mid-tolerant western white pine, which are more resilient to fire insect and disease, and improve growing conditions of the remaining trees by reducing competition for light and nutrients.

This type of thinning occurs when stands are typically 15-20 years old. The purpose of the treatment is to improve species composition, growth and vigor on the residual crop trees. Trees with poor form and insect and pathogen problems would be removed. Thinning would select for desirable trees with resistance to insects and pathogens. Daylighting of blister rust resistant white pine is proposed in Alternative 2.

Precommercial thinning increases seral species composition of ponderosa pine, western larch and western white pine.

Daylight Thinning of Western White Pine

White pine precommercial thinning and pruning (~ 212 acres) would be done on plantations that are in lynx habitat but have planted rust-resistant western white pine trees. White pine precommercial thinning (daylighting of white pine) clears competing vegetation adjacent to planted rust-resistant western white pine trees at a fixed radius. Daylighting removes competing trees greater than 2 feet in height around desired trees within a 10-12 foot radius circle. Pruning removes the lower branches of WWP trees. Branches infected by blister rust or near enough to the ground to be highly susceptible to infection are removed to prevent spread of the disease to the tree stem. Pruning is done to reduce the potential for mortality caused by blister rust. White pine precommercial thinning is intended to improve the chances of the WWP trees reaching maturity. By daylight thinning and pruning, the white pine would compete better with surrounding vegetation of the stand and maintain lynx habitat. Only 20% of each stand would be thinned in order to be in compliance with the Northern Rockies Lynx Management Direction (NRLMD).

Prescribed Fire Treatments Individually and Collectively

Prescribed fire treatments individually and collectively would create openings between residual trees, retain larger fire resistant trees and reduce fuel loads. These treatments would increase within unit survival rates in the event of a large scale fire, would decrease the likelihood of a crown fire, and to some degree buffer areas on the leeward side of the treated stand. Collectively, the treatments would allow the

landscape to sustain itself in the aftermath of a wildfire (Skinner 2008).

Reducing stand density, treating fuel and maintaining or restoring intolerant and mid-tolerant species such as western larch, PP, rust resistant western white pine, DF and aspen, combined with the buffering effects, would increase stand and landscape level resistance and resilience to predicted climate change.

Planting

Enabling plantations to respond to potential climate change would be addressed by planting a minor component (up to 25%) of the seedlings from a lower elevation seed lot to address the predicted climate change, while ensuring the survival of plantations within the context of historic conditions. This is one strategy to maintain resilient forests for projected future climates of an upward shift of species. Managers need to think of planting stock that would survive now, but still grow well into the future (Fox 2007). All seedlings would be sown from local seed sources and a minimum of 75% of the planted stock would be suitable and adapted to the existing site conditions. Planting rust resistant western white pine would increase the presence of this species on the landscape measurable by the number of acres planted. While the proposed acres are small, they would incrementally increase the presence of this key species. Also planting ponderosa pine and western larch, trending toward desired conditions that are best adapted to disturbance would increase site resiliency.

Effects of Silvicultural Treatment on Genetic Diversity

Genetic diversity is the basis of all biodiversity, because it provides raw material for the adaptation, evolution and survival of species and individuals, especially under changed environment and disease conditions (Rajora 1999). Forest management practices and natural disturbances such as fire can impact genetic variability. Genetic diversity has been measured for various reforestation methods. Naturally regenerated lodgepole pine was found to have slightly lower heterozygosity than planted and unharvested stands (Thomas 1999). Rajora found genetic diversity of natural regeneration to be comparable to old growth, and that plantations had less diversity primarily because the genetic base for reforestation was relatively narrow in white spruce (Rajora 1999). Genetic implications of natural and artificial regeneration following shelterwood and clearcuts were analyzed in coastal Douglas-fir and found that harvesting followed by either natural or artificial regeneration resulted in little alternation of genetic diversity. Artificial regeneration had significantly greater levels of genetic diversity than natural regeneration (Thomas 1999). It appears the consequences of even-age silvicultural systems would have little change in the genetic diversity of forest tree populations at least in one generation because we are retaining leave trees on site and we have seed collection and tree improvement guidelines to ensure we maintain a broad genetic base and meet genetic diversity objectives in our reforestation program (FSH 2409.26f). There is some concern that phenotypic selection for certain qualities that are prescribed in the intermediate harvest could reduce the genetic diversity within a stand. Increased pollen dispersal and edge effect could reduce this potential impact. Retaining relic trees, uncut patches and a second layer of trees as prescribed in the silvicultural treatments should help to maintain the natural gene pool.

Potential for Increased Insect and Disease Activity

Disturbances caused by insect and diseases occur in all terrestrial ecosystems. Insect and disease are important causes of small to large gaps in forest canopies. They can affect major structural or species changes in the ecosystem. FS reports have consistently shown insects and pathogens cause more losses than any other damaging agent, including fire. Insects and pathogens often interact with each other as well as with climate and fire. Past management practices may increase the frequency, intensity and extent of many outbreaks. Such practices include harvest beyond historic rotation ages for a given species, removing intolerant species and leaving tolerant species, not removing diseased overstory trees and suppression of fires. The widespread droughts of the late 1980s preceded and predisposed vast areas in the west to insect and pathogen attack (Haack and Byler 1993). Fire suppression increased stand densities that in turn indirectly increased insect and disease populations.

As untreated stands within the East Reservoir analysis area progress towards more shade tolerant species, insect and disease occurrences are likely to increase. Grand fir, subalpine fire, hemlock and Douglas-fir

are more susceptible to root and stem decays than are more shade-intolerant species such as western larch and ponderosa pine, and western white pine. On the warm and dry sites, these shade tolerant species would likely be less resistant to insect and disease impacts due to moisture stress during the warm periods of the year. On a given site, the tolerant species are more nutrient and moisture demanding, thus more likely to be stressed on these lower productivity sites and during times of drought. They are therefore predisposed to insect and disease attack due to stressed conditions.

Although it is difficult to quantify the increased risk and effects of defoliators, root disease, bark beetles, etc., that would result in a tolerant stand on a given site, experience on adjacent National Forests such as the Idaho Panhandle, the Lolo, Helena, etc., as well as the Boise National Forest, and the Blue Mountains, shows that vast acres could be lost through insect and disease followed by a high probability of catastrophic fire. Significant problems in these climax species stands started within 60-100 years following fire suppression and harvest activities that increased the tolerant species component.

The potential for increased insect levels in untreated stands with predicted climate change is high. Forest insect and disease species are an important indicator species for assessing climate change. Assessing insect and disease species response to climate change indicates intensification in all aspects of outbreak behavior, particularly with MPB, gypsy moth, spruce beetle and spruce budworm (Logan 2003, Pg. 135, 136).

Unless weather patterns change to ones more favorable to their host and less conductive to beetle survival and population expansion, or management activities reduce availability of hosts, MPB populations would continue until few susceptible hosts remain in many stands (USDA FS 2007). Western spruce budworm has been recorded on the KNF over the past few years. The only other time defoliation from budworm was recorded on the KNF in the past 59 years was in the late 70s (USDA FS 2007). There are close to two million acres of Douglas-fir in the state of Montana that are relatively susceptible to Douglas-fir beetle. Preventive management is the key to reducing the outbreak potential (USDA FS 2007). Recent observations in heavily defoliated stands suggest there may be a relationship between heavy defoliation by western spruce budworm and Douglas-fir beetle attack (USDA FS 2007).

Stands proposed for density reduction or regeneration would decrease in susceptibility to most insect and diseases in the long-term due to favoring intolerant species and reducing stress on residual trees through reduction of competition for moisture, light and nutrients. All vegetation treatments in this project are designed to restore historic composition, density, structure and function consistent with historic disturbance processes; therefore the treated areas should be more resilient to insect and disease infestations with or without climate change than the untreated areas.

In the short-term, susceptibility to MPB, Douglas-fir beetle and other secondary insects may be increased following fire induced stress on residual trees.

Partial harvest in Douglas-fir dominated stands may increase the susceptibility of residual trees to root disease. Douglas-fir is more susceptible to root and stem decays than other species such as western larch, ponderosa pine and lodgepole pine. In general, Douglas-fir is not the priority species to retain, but there would be a mix of Douglas-fir within the partially harvested stands.

Windthrow

Proposed treatments may increase windthrow above existing conditions, particularly in areas where regeneration openings are larger than 10 acres, where the unit is topographically unprotected, where density reduction is adjacent to an existing opening, or where leave trees have defective root systems due to root disease or over maturity. Units on more susceptible landtypes (Landtypes 101, 112, 152) have a higher risk of windthrow. Refer to the Landtype summary in the Soils Section of this document. All proposed treatments would open up the existing stand and may increase the risk of windthrow because the winds would move down closer to the ground. Windthrow is not expected to exceed 10-15% of the stand unless there are unusual circumstances.

Other Activities

A combination of additional activities is included in the action alternatives. These include road storage, implementation of BMPs, road reconstruction, recreation improvements and trail construction. These activities would not contribute a measurable effect to forest vegetation because they have a minimal effect on vegetation and ecology.

Forest Carbon Storage

Recent literature shows that regeneration and young stands are generally a carbon source until new trees are established, and their carbon uptake exceeds emissions from decomposing dead organic material. As the stands develop, the carbon sink would increase until peaking at an intermediate age and then would gradually decline. Young dense stands (9-23 years) have a low carbon source, which increases through about 95-106 years and is again low in old stands (Law et al. 2003). Precommercial and commercial thinning may initially decrease the carbon storage by reducing stand density, and by releasing carbon from decomposition of the slash. However, thinning would accelerate the stand growth and should provide a carbon source sooner than an un-thinned stand. Regeneration harvest would reduce on-site carbon storage until such a time that the stand has regenerated and is occupying the site at a similar capacity of the pre-harvested state. There is a potential beneficial role in reducing greenhouse gasses when the treatment reduces the threat of wildfire released carbon or when carbon can be stored in wood products or be used to offset fossil fuel use (Finkral 2008).

Thinning and release are often proposed as forest management practices to increase forest carbon sequestration. Some growth simulation models have indicated that controlling competing vegetation at an early age helps to maximize stand growth and carbon storage in some stands and does not increase carbon storage in other stands and species. However, thinning dense young stands may increase carbon storage over the life of the stand in most stand types (Schroeder 2006). The author also noted that thinning may increase the loss of soil carbon, by reducing canopy cover and disturbing the surface and thus accelerating decomposition rates (Schroeder 2006). In contrast, release in a southern pine ecosystem was found to increase total carbon storage over the life of the stand, and to promote soil carbon storage. Thus, forestry practices that reduce vegetative competition apparently increase carbon sequestration in some circumstances, but not in others, limiting generalizations about their potential for increasing carbon sequestration (Schroeder 2006).

For the mastication fuel treatments, most of the biomass (and carbon) would remain on site, but carbon release would be accelerated because the biomass would decompose more quickly.

Spot grapple piling treatments would only pile the larger slash material in concentrated areas and would leave roots, limbs, leaves or needles, and other advanced decay woody material. Carbon would continue to be released as this material decomposes but at a slower rate than the material that is piled.

Many research studies presume that the carbon from slash is released within a year of the harvest; others presume that it is quickly absorbed by new growth resulting from the treatment. Data on the extent of various slash treatments and on the carbon impacts of the various treatments are sparse (Gorte 2007).

Fires in forests can significantly affect the carbon cycle. Fire is a self-sustaining chemical process that quickly mineralizes organic matter; in minutes, fires convert organic matter into its components - minerals, water vapor and CO_2. The likelihood, extent, and/or frequency of wildfires may be exacerbated by expected climate change (Gorte 2007). Reducing the potential fire severity through fuel reduction is consistent with carbon storage objectives.

There is little literature on forest and forest soil carbon. It is speculated that forestry activities that disturb soils, would likely reduce soil carbon levels (Gorte 2007*).*

Carbon Flux

A comment received on past projects mentioned that forest management should shift from logging to carbon storage. The comment also cites eight published papers to support the assertion that “this type of management has the potential to double the current level of carbon storage in some regions.”

Management of the NFS does not emphasize "logging." Rather, management of all National Forests, including the KNF, emphasizes multiple-use as prescribed by the Multiple-Use Sustained-Yield Act of 1960 and the NFMA. Accomplishment of these statutory objectives is defined in the KNFP. Neither the principal statutes nor the KNFP require or suggest that carbon storage supersede the statutorily defined purposes of national forest management.

Although not a statutorily defined purpose of NFS management, forests provide a valuable ecosystem service by removing carbon from the atmosphere and storing it in biomass. The KNF currently stores an estimated 171.1 (± 3.9) million metric tons (Mt) of carbon[1]. This represents about 0.004 % of the total of approximately 42,654 Mt of carbon in forests of the coterminous US (US EPA 2008). Preliminary estimates indicate that the KNF is a net carbon sink, removing from the atmosphere approximately 31 metric tons of carbon per acre per year.

Sustaining forest productivity and other multiple-use goods and services requires that land managers balance multiple objectives. The long-term ability of forests to sequester carbon depends in part on their resilience to multiple stresses, including increasing probability of drought stress, high severity fires and large scale insect outbreaks associated with projected climate change. Management actions, such as those in the East Reservoir Project, that trend vegetation to a fire resilient landscape, maintain the vigor and long-term productivity of forests, reduce the likelihood of high severity fires and insect outbreaks, and store carbon in harvested wood products, increases the capacity of the forest to sequester carbon in the long-term. Thus, even though some management actions may in the near-term reduce total carbon stored below current levels, in the long-term they improve the overall capacity of the forest to sequester carbon, while also contributing other multiple-use goods and services.

Contribute to a Sustained Yield of Timber

The desired condition is to provide forest products within the sustainable capability of the ecosystem. One of the purposes provided by Congress for the management of NFS land is to "furnish a continuous supply of timber for the use and necessities of the citizens of the United States" (Organic Act, 16 USC 475). One of the objectives of the KNFP is to provide a sustained yield of timber volume responsive to national and regional needs, scheduled to encourage a stable base of economic growth in the dependent geographical area (KNFP page II-1): KNFP management area goals also call for a programmed yield of timber (KNFP, pages II-1, III-43, III-48, III-64, III-69, III-74). There is a need to supply wood products in response to societal demands and contribute to local jobs and income.

Table 3.31 - Harvest Volume and Acres Harvested by Alternative

INDICATOR	ALT 1	ALT 2	ALT 3 (MMBF)
Volume Removed	0	49 (MMBF)	30
Acres Harvested	0	8,845	5,817

Volume figures do not include roundwood volume.

Cumulative Effects

Cumulative effects of the alternatives that would affect vegetation and ecology include past activities and recurring management activities on private lands; and past actions, and pre-approved activities on NFS

[1] This estimate is based on data collected in the 1990S on 351 Forest Inventory and Analysis plots and stored in the Forest Inventory and Analysis database (USDA Forest Service 2006). Calculations are from the Carbon On-Line Estimator (http://ncasi.uml.edu/COLE). The estimate includes total above ground carbon (bole and crown of live trees, bole and crown of aboveground standing dead trees, coarse woody debris, understory vegetation, and forest floor detritus) and below ground carbon in soil and roots.

These estimates are preliminary because two or more directly comparable forest surveys are not yet available for the KNF. In the late 1990s the Forest Inventory and Analysis Program switched from periodic sampling to annual sampling, and established a nationally consistent sampling and plot design (Gillespie 1999; Bechtold and Patterson 2005). A complete cycle of annualized inventory has not been completed yet for the KNF. The reported estimates are calculated by the GForest software program of the National Council of Air and Stream Improvement, Inc., based upon comparison of the annual inventory "panels." The standard error varies by year, and ranges from 1.37 to 2.56 on the KNF. The GForest software program can be accessed at http://ncasi.uml.edu. These estimates are expected to change over the next 5 to 10 years with the completion of repeat inventory of individual plots.

lands, such as, noxious weed treatments, road maintenance and fire suppression. All the past management activities have been incorporated into the existing conditions discussion on vegetation. All planned and reasonably foreseeable actions would be incorporated into the alternatives as cumulative effects.

Table 3.31A - Cumulative Potential Vegetation Treatment Summary (acres)

TREATMENT	ALT 1	ALT 2	ALT 3	ONGOING ON NFS	DNRC LANDS	MAX CUMULATIVE (CUM AND PA)
Regeneration Harvest	0	2,528	1,906	0	198	2,726
Intermediate Harvest	0	6,573	6,140	0	0	6,573
Fuel Treatment by Prescribed Fire	0	15,102	13,205	1,080	0	16,182
Precommercial Thinning	0	5,653	1,695	760	0	5,653
*Western White Pine Daylighting	0	905	0	0	0	1,123
Total Treatment Acres	**0**	**31,661**	**22,581**	**1,670**	**198**	

Harvest on DNRC lands are based on harvest information that the state provided for 2012 and beyond.
*= 20% of the total acres that would be treated.

CONSISTENCY with REGULATORY FRAMEWORK

National Forest Management Act (NFMA) of 1976

In accordance with the NFMA of 1976, timber harvest and regeneration practices shall be designed to assure lands are satisfactorily restocked within five years after final harvest. Restocking is satisfactory when the harvest area contains the minimum number, distribution and species composition of regeneration as specified in a site-specific silvicultural prescription written or reviewed by a certified silviculturist. Five years after final harvest means five years after clearcutting; five years after final overstory removal in shelterwood cutting; five years after seedtree removal cut in seedtree cutting or five years after selection cutting.

In order for a harvest area to be certified as stocked, it must meet the following criteria defined in the FS Silvicultural Practices Handbook, Chapter 2 - Reforestation (FSH 2409.17, 2.72-2):

a. Establishment. Established regeneration, both planted and natural regeneration must have survived at least three growing seasons and be healthy with good buds and leaders.
b. Quantity. The number of established seedlings on the stand meets stocking levels including tree numbers and distribution described in the silvicultural prescription.
c. Future Treatments. The silviculturist has determined that the stand requires no further regeneration treatment or regeneration exams. Seedlings are free to grow and there are no conditions that would affect stocking levels.

In addition, the Kootenai National Forest has reforestation stocking guidelines that identify minimum acceptable stocking (KNF 2010).
Regeneration survey records have been analyzed for each habitat type group affected by proposed units in the project. The results demonstrate assurance that these sites can be adequately restocked within the required timeframes. (Refer to the project file for a summary of past regeneration success on the District by habitat type groups.)

Biodiversity

The NFMA requires that Forest plans "preserve and enhance the diversity of plant and animal communities... so that it is at least as great as that which can be expected in the natural forest" (16 U.S.C. 1604(g)(3)(B)). In order to ensure that viable populations would be maintained, habitat must be provided to support at least a minimum number of reproductive individuals. The habitat must be well distributed so that those individuals can interact with others in the planning area.

The East Reservoir Project ensures that biological diversity is maintained by managing stands, VRUs and the landscape consistent with historical disturbance processes and an assessment of potential future

environments.

All conifer planting would use local seed sources and all seeding of roads, landings, etc. would be seeded with short duration annual weed-free certified seed mixes, an approved native seed mix from local seed sources, or the Standard Kootenai Mix, which has been determined to be a non-invasive mix of annuals, biennials and perennials.

Land Suitability

As a precursor to the diagnosis process, each stand is examined to determine its current condition and to provide a basis for silvicultural decisions. Suitability was determined for each stand in the analysis area in accordance with the KNFP. This determination found each stand proposed for treatment as suitable for timber management based upon the following:

1) Each stand meets the definition of forestland as described in the KNFP.
2) Technological feasibility exists to ensure soil productivity and watershed protection. All sites considered for treatment would use established harvesting and fuel reduction methods. In combination with resource protection standards in the KNFP and applicable BMPs, these methods would be sufficient to protect soil and water resource values.
3) There is reasonable assurance that lands can be restocked within five years of final harvest. Historical records on the Libby Ranger District in this area indicate that most of the stands treated with a final regeneration harvest have either met or are on the proper stocking trajectories to meet specified stocking levels for land management objectives within five years.
4) The stands proposed for treatment have potential growth (cubic/feet/acre/year) that classifies them as suitable for timber harvest in accordance with NFMA Findings - Uneven-age vs. Even-age, Optimality of Clearcutting.

NFMA Findings - Uneven-age vs. Even-age, Optimality of Clearcutting

Target stands as described in the KNF Habitat Type Groups and Target Stands (USDA 1999), and supplemented by the target stands for VRU 1 and 2 in the project file, provide the basis for considering uneven-aged management. If an uneven-aged stand is ecologically feasible on the site and will benefit allocated resources, this target is described and compared to the existing stand.

If uneven-aged management is not ecologically feasible or will not provide forest conditions that benefit allocated resources, an uneven-aged alternative should not be carried forward as a viable alternative. Uneven-aged management in the areas proposed for harvest, is not consistent with the historic range for these sites. Uneven-age harvest would perpetuate regeneration of Douglas-fir, grand fir, subalpine fir, hemlock and cedar, retain the unnaturally high stocking and fuel conditions, and increase the probability of large-scale high-severity fire. Multi-age stands were common on some of the driest sites due to the periodic fire but the classic uneven-age stand is not within historic conditions. Based on this analysis, no uneven-aged management was proposed for this analysis area.

Optimality of Clearcutting

A diagnosis was completed for each proposed unit that considered the historic conditions and target stand for the appropriate VRU. On the sites that even-age or two-age management was the target, a seedtree or shelterwood system was the first option that was considered. Clearcutting was only proposed for units or portions of units that did not have adequate seed trees to regenerate some of the desired species to meet target stand objectives. These units would still have a minimum of 10 overwood trees retained for structure, relic trees and future snags, but these trees would not be relied on for seeding the unit; therefore the appropriate silvicultural system is a clearcut. Refer to the diagnosis matrix in the project file that addresses the process of determining the appropriate silvicultural system and the determination of optimality of clearcutting.

Effects of Exotic Vegetation and Noxious Weeds

Refer to the Noxious Weed Section for additional information.

Effect to Special Communities-Pacific Yew Populations
In 1992 guides were established to ensure the long-term viability of pacific yew. Although there are other sources of yew for extraction, we still continue to disclose possible effects to yew populations. Yew is typically found within Habitat Group D, Warm and Moist VRUs. VRU group 4 and 5 is suitable and as some pacific yew populations primarily associated with riparian areas. No substantial quantities of pacific yew have been noted within any treatment units primarily due to the stand replacing fire in 1910 and the late seral stage that pacific yew is generally associated with.

Effects on Residual Trees and Adjacent Stands (windthrow)
See discussion on page 3-35 of this document.

CONSISTENCY with FOREST PLAN DIRECTION

Proposed harvest treatment areas are within Management Areas (MAs) 10 (Big Game Winter Range), 11 (Big Game Winter Range/Timber), 12 (Big Game Summer Range/Timber), 13 (Designated Old Growth), 15(Timber Management), 16 (Timber/Viewing), 17 (Viewing/Timber), 18 (Minimum Use due to Regeneration Concerns), 19 (Minimum Use Steep Slope), 5 (Viewing Areas), 6 (Developed recreation) and 24 (Low Productivity).

Regeneration harvest is generally proposed within MAs that are suitable for timber management. In Alternative 2, regeneration treatments are proposed in MA 16 and 17. These treatments are designed to mitigate for visual concerns; treatments in all action alternative (2and 3) are designed to improve recreation opportunities

All treatments are designed to restore ecological conditions by moving stands and the landscape toward the VRU target conditions, while improving forest health, resiliency and reducing natural fuels. All actions considered in depth were designed to manage vegetation consistent with big game habitat, and social objectives, and address the potential for climate change.

KOOTENAI NATIONAL FOREST PLAN GOALS and OBJECTIVES
Effects of the Alternatives on Producing a Programmed Yield of Timber
Alternative 2 would harvest and utilize almost 39 million board feet of green and dead timber. Alternative 3 would harvest nearly 34 million board feet. Roundwood volume would be in addition to this estimated sawlog volume. In addition to the amount of volume harvested, the ability to sustain a programmed yield of timber is dependent on good forest management practices. All harvest of green trees is designed to move stands toward VRU target conditions.

Openings Greater than 40 Acres
Alternatives 2 would create openings greater than 40 acres. Alternative 2 would initiate or contribute to an existing early successional patch, 6 openings for a total of 1,118 acres. The purpose of designing large treatment areas is to mimic natural processes of large patch sizes in VRU 4, 5, 7 and 9 that occurred historically. Openings created by Units 36, 73T, 75, 80, 170 and 188 are in VRU 4: Units 147, 148 and 149 are in VRU 5; Units 40, 62 and 150 are in VRU 7 and unit 362 is in VRU 9.

UNIT #	HARVEST METHOD	STAND ID	STAND ACRES	ACRES of EXISITING OPENING	TOTAL OPENING ACRES	RECOVERY PERIOD
#62	Seedtree	55702014 55702021 55702022	23 40 14	0	77 acres	5 years

UNIT #	HARVEST METHOD	STAND ID	STAND ACRES	ACRES of EXISITING OPENING	TOTAL OPENING ACRES	RECOVERY PERIOD
#147 #148 #149 #150	Seedtree	55701013 55701014 55701017 55701086 55701013 55701016 55701010 55701027 55701087 55701018 55701034 55701071 55701074 55701083 55701088	28 42 22 1 3 74 6 57 2 17 5 20 24 8 29	0	338 acres	5-15 years depending on MA
#170	Seedtree	55802061 55802062 55802099	39 41 17		97	5 years
#73T #75 #188 #80 #36	Seedtree/ Shelterwood	56004016 56006020 56006022 56006023 56006026 56006101	21 40 49 45 82 21	0	258	5-15 years depending on the MA
#40	Seedtree	56203011 56203043 56203112 56203113 56203046 56203042 56203016	22 11 25 47 25 11 15	0	156	5 years
#362	Clearcut with Reserves	56307045 56307070 56307044 56307062 56307071 56307046 56307036	22 20 46 14 23 37 30	0	192	15 years
Total Acres = 1,118						

SOILS RESOURCE INTRODUCTION

INTRODUCTION

This section discloses the results for the soils resource in the East Reservoir Project analysis area on soil productivity. Field surveys regarding soils for this project were conducted in 2010 and 2011 using the R1 Soils Protocol (USDA FS 2011a).

REGULATORY FRAMEWORK

The regulatory framework pertaining to soils is summarized here. For additional information, please refer to the Soil and Water Regulatory Framework in the Soil and Water Project File.

STATE and FEDERAL LAWS and REGULATIONS

The regulatory framework providing direction for protecting a site's inherent capacity to grow vegetation comes from the following principle sources:

The Multiple Use-Sustained Yield Act of 1960 (Federal Law) - The Multiple Use-Sustained Yield Act of 1960 directs the Forest Service (FS) to achieve and maintain outputs of various renewable resources in perpetuity without permanent impairment of the land's productivity.

The National Forest Management Act of 1976 (NFMA) (Federal Law) - Section 6 of the NFMA (Section 6(g)(3)) states that harvest cuts shall be "carried out in a manner that is consistent with the protection of soil resources" and that "soil, slope, or other watershed conditions will not be irreversibly damaged". To comply with NFMA, the Chief of the FS has charged each Forest Service Region with developing soil quality standards for detecting soil disturbance and monitoring long-term productive potential.

Regional Soil Quality Standards (2554.03-R1 Suppl. 2500-99-1) - The Regional 1 Soil Quality Monitoring Supplement (R-1 Supplement 2500-99-1) provides soil quality standards to assure the statutory requirements of NFMA are met. Manual direction recommends maintaining 85% of an activity area's soil at an acceptable productivity potential with respect to detrimental impacts, including the effects of compaction, displacement, rutting, severe burning, surface erosion, loss of surface organic matter, and soil mass movement. This recommendation is based on research indicating that a decline in productivity would have to be at least 15% to be detectable (Powers, 1990). In areas where more than 15% detrimental soil conditions exists from prior activities, the cumulative detrimental effects from project implementation and restoration should not exceed the conditions prior to the planned activity and should move toward a net improvement in soil quality. These standards do not apply to infrastructure and intensively developed sites such as permanent roads/landings, mines, developed recreation and administrative sites.

The Kootenai National Forest Plan (KNFP) and **Soil and Water Conservation Practices Handbook (FSH 2509.22 R-1/4 Amendment No. 1 Effective 5/88) -** The KNFP states that soil and water conservation practices (SWCPs) as outlines in Water Conservation Practices Handbook R-1/R-4 Amendment No. 1 (FSH 2509.22) will be incorporated into all land use and project plans as a principle mechanism for controlling non-point pollution sources and meeting soil and water goals, and to protect beneficial uses. Activities found not in compliance with soil and water conservation practices or State standards will be brought into compliance, modified, or stopped (Volume 1 p II-23). Best Management Practices (BMPs) consist of state-of-the-art practices that fulfill KNFP objectives and are designed to minimize soil disturbance during harvest and road construction activities.

The KNFP states that effects on soil productivity will be evaluated for all projects involving heavy equipment and that the total area allocated to concentrated equipment travel should be minimized.

Objectives

Ground-disturbing activities such as road construction, road reconstruction and timber harvest will be accompanied by mitigation measures to prevent or reduce increases in sedimentation and stream

channel erosion. The amount of harvest allowed will depend on the rate of recovery after hydrologic recovery after timber has been removed (Volume 1 P II-7).

Each project plan for which the use of heavy equipment is required shall evaluate the effect of operating that equipment on soil productivity. When it is determined that equipment operation is a hazard to soil productivity that project shall:

- Establish a standard for how much of the project will be allocated to skid trails, landings, temporary roads, or similar areas of concentrated equipment travel. The standard shall minimize the area allocated to those uses to the extent practical.
- Consider the potential hazard to soil productivity before planning the practices requiring the operation of equipment off established roads and skid trails. Practices such as dozer piling of brush or mechanical site preparation shall not be planned without considering the feasibility of limiting the soil conditions under which these practices are applied or alternative practices that do not require the use of equipment (Volume 1 P II-7).

ANALYSIS AREA

The direct and indirect effects of the alternatives will focus on individual activity areas as defined by the Forest Service Manual (R-1 Supplement No. 2500-99-1):

> "**Activity Area:** A discrete land area impacted by a management activity to which soil quality standards are applied. Activity areas include harvest units within timber sale areas, prescribed burn areas, and grazing areas or pastures within range allotments. Inclusion of system roads within the activity area is dependent on the analysis objectives. System roads are often evaluated separately; however, temporary roads, landings, and skid trails are included within an activity area. Riparian and other environmentally sensitive areas may be monitored and evaluated as individual activity areas within larger management areas."

For this analysis, activity areas are the proposed harvest, fuel treatments and stand improvements. All temporary roads, landings and firelines within activity units are considered in evaluating the effect to the soil resource. System roads are not a part of the soils activity areas.

ANALYSIS METHODS

Existing Condition

Existing condition for the soils resource were determined using timber stand records, aerial photography, GIS data and on-the-ground visits. Landtypes and hazard ratings were gathered from landtype descriptions and characteristics found in the Soil Survey of Kootenai National Forest Area, Montana and Idaho (Kuennen and Gerhardt 1995).

All units containing evidence of existing soil disturbance related to past management activities received a full qualitative field survey using R1 Soil Survey Procedures. Field soil surveys consisted of random stratified transect/sample point methods with confidence intervals at or above 80% ± 5% with the majority of surveys being 95% ± 5%. Completed soil surveys can be found in the Soil Project File and/or District Files. Existing detrimental soil disturbance numbers are a result of all currently measureable effects of past actions in each activity area, including but not limited to timber harvest (trails and landings), temporary road construction, management related burns, cattle grazing, off highway vehicles, natural disturbances, firewood gathering, etc. These methods provide data that is used in the analysis to determine if KNFP and Regional Soil Quality Standards would be met.

Field Sampling Procedure

In order to determine the severity and aerial extent of existing soil disturbance from previous forest management activities, randomly selected soil transects were conducted across representative portions of the proposed activity areas (proposed harvest polygons, temporary roads, and landings). Every other step is considered a sample location and sampled using common tile spade shovel to determine the resistance

of penetrating into the soil. Physical resistance to penetration was found to correlate quite well with altered soil conditions related with past management activity. In areas displaying the strongest properties of past management an activity, the shovel blade is only capable of penetrating a short distance into the soil and with great effort.

Field sampled transect points were placed in one of three categories: 1) no disturbance; 2) disturbance present but not detrimental; and 3) detrimental soil disturbance (DSD). The detrimental disturbance category is considered detrimental as defined in FSM 2550 and Region 1 Supplement 2500-99-1. As a result, DSD is defined as the proportion of an activity area that may be subject to displacement, compaction, rutting, erosion, or severe burning due to past management activity (such as harvest, fuels treatment, temporary road construction), exclusive of dedicated resources (such as system roads).

Detrimental Soil Disturbance (DSD)
The soils in an activity area are considered detrimentally disturbed at a given sample point when one or a combination of any of the following attributes listed below is present due to past forest management activities:

a. **Compaction:** A 15% increase in natural bulk density. Soil compaction reduces the supply of air, water and nutrients to plants. Roading, ground based yarding, dozer and grapple piling activities are the major contributors to compaction.
b. **Soil Ruts:** Machine-generated soil displacement having smeared the soil surface in a rut. Wheel ruts at least 2 inches deep in wet soils.
c. **Displacement:** Removal of one inch or more surface soil continuous area greater than 100 sq. feet which often consists of the O and A soil horizons. Displacement removes the most productive part of the soil resource. Temporary roads, skid trails, ground-based yarding, dozer piling and cable corridors are the major contributors to displacement.
d. **Surface Erosion:** Indicated by rills, gullies, pedestals and localized soil deposition.
e. **Severely Burned Soils:** Physical and biological changes to the soil resulting from high-intensity burns of long duration as described in the Burned Area Emergency Rehabilitation Handbook (FSH 2509.13).
f. **Soil Mass Movement:** Any soil mass movement caused by management activity.

The potential detrimental soil disturbance (DSD) values were calculated based on a summation of past monitoring of soil productivity (KNF 1988-present date) within the Kootenai National Forest (KNF) (Table 3.32). The percentage were developed as an average soil disturbance level and equated to harvest equipment type, fuel treatment methods and season of operation as calculated from soil monitoring data collected (2000-2005). Timber removal had always occurred prior to the “post-harvest field surveys” and includes mechanical fuel abatement activities such as excavator piling activity if present. The end DSD figure is a composition of all disturbances and does not separate each category of disturbance values where present within each unit. Thus, the value of 8% DSD for summer tractor is a “statistical summary” which takes into account all activities such as skid trails but temporary roads, mechanized piling and firelines if present within the units being surveyed at that time and date. New temporary roads are considered 100% detrimentally disturbed through the removal organic matter, displacement and/or compaction while re-opening an existing temporary road is considered to have 0% additional detrimental disturbance as such roads are considered to be disturbed for greater than 50 years. Temporary roads yield an average 2 acres of DSD per mile of road. These would be the direct and indirect effects to the soils.

Soils Table 3.32 - Monitoring Results of DSD from Management Activities on the KNF
(Kuennen 2007a)

CATEGORY	SEASON OF OPERATION	DSD COEFICIENTS (%) [2]
Skyline	NA	1
Tractor	Summer	8
Tractor	Winter	4
Forwarder	Summer	4

CATEGORY	SEASON OF OPERATION	DSD COEFICIENTS (%) [2]
Forwarder	Winter	2
Feller Buncher [3]	NA	2
Helicopter	NA	0
Excavator Piling [1]	NA	2
Fire line Construction [1 5]	NA	1
Grazing [1]	NA	2
Tractor 2ndary entry	Summer	4[5]
Tractor 2ndary entry	Winter	2[5]
Forwarder 2ndary entry	Summer	2[5]
Forwarder 2ndary entry	Winter	1[5]

[1] DSD percent is not necessarily additive to other activities. This is because the percentages presented for each management activity included some units with excavator piling, fire line construction, and/or grazing in the data set. In addition, disturbance from these activities within harvest units usually overlaps at least a portion of the skidding disturbance.

[2] The numbers for this document were based on percentages from the last five years. Previous documents have used eighteen year averages. Typically the larger data set is more accurate, but because the eighteen year data set included practices that are not used anymore (i.e. dozer piling) it was deemed more appropriate to use the more accurate information pertaining to modern harvest and slash disposal methods.

[3] Feller Buncher must be operated straight up and down the fall line on slopes not exceeding 45%. Where such harvest activities occur on skyline units an additional 2% DSD is expected to occur.

[4] Fire line construction prior to 1995 included dozer activity while data collected following 1995 generally included handline construction or excavator bucket-width activity. As a result there has been a significant reduction of fire line disturbance in a given unit.

[5] In proposed secondary entry harvest units which currently are equivalent or exceed 8% current DSD the proposed ground based harvest activities are proposed as having approximately a 50% disturbance value compared to similar harvest activities in currently undisturbed soils (Louis Kuennen pers. comm. 2011). This reduction in the anticipated DSD values only applies to ground based harvest operations. It is assumed that units containing less than 8% DSD are more historic in nature and are on a recovery trend as displayed by revegetation of historic skid trails and second-growth stand conditions. As a result the reduction in secondary entry values will not apply to such stands.

Generally, detrimental effects on soils are not permanent and depend primarily on soil texture, parent material, aspect and level of disturbance, i.e. compaction. Recovery begins once activities cease on the site (Kuennen 2007b). However, vegetative recovery time may take approximately 30 to 70 years as the second growth timber becomes established in and around the disturbed areas (Dykstra and Curran 2002; Froehlich and McNabb 1983; Froehlich and others 1983 and 1985). In areas where soil displacement mixes or moves the volcanic ash surface layer and reduces moisture holding capacity and productivity may continue to be impacted far beyond the 70 year timeframe.

Indirect effects may include the reduction of site productivity due to the removal of vegetation and nutrients. Large woody debris (woody residue >3” diameter) and finer organic material are essential for maintenance of sufficient microorganism populations and long-term site productivity. Design features (Table 2.34) are incorporated into the activities to manage large woody debris (LWD) and organic matter as detailed in the research guidelines contained in Graham and others (1994). Where feasible, smaller woody material such as tree tops, foliage and branches would be left to over-winter before fuels treatment, which allows nutrients to leach out of these materials and into the soil.

Cumulative effects include the combination of direct and indirect effects from past, present and reasonably foreseeable activities. Direct, indirect and cumulative effects on soils are measured within each activity area. Existing system roads and designated landings on the National Forest System (NFS) transportation system are considered dedicated lands and are not part of the cumulative effects.

Assumptions and Limitations

The potential detrimental disturbance numbers for each proposed harvest unit are based on empirically derived coefficients that were obtained and averaged from numerous monitored sites throughout the KNF (Kuennen 2003; Kuennen 2007c). The assumptions are limited to the harvest and slash disposal methods for which coefficients have been determined, and its coefficients assume that BMPs will be implemented. The predicted values do not account for changes in soil type, the recovery of soils over time, or existing conditions.

Evaluation of cumulative effects to soil productivity does not require an integrated “watershed scale” assessment because that is not considered an appropriate geographic area. Soil conditions are site-

specific. Loss of soil productivity in one treatment unit would not lead to a loss in soil productivity in an adjacent stand. Soil productivity can vary from one square foot to the next with each area functioning independently. Thus, the highly variable and independent nature of soil productivity requires site-specific analyses to maintain the proper context. Assessments of cumulative effects on soil productivity is retained at the site specific boundary scale since analysis at the watershed scale for soils misrepresent management activity effects by masking and/or diluting site-specific effects across a larger area. In contrast, soil processes such as erosion regime and hydrologic functions occur at a watershed scale and have been analyzed as such in Water Resource Reports.

Scientific Uncertainty and Controversy

Soil productivity relies on complex chemical, physical, and climatic factors that interact within a biological framework. For any given site and soil, a change in a key soil variable (i.e. bulk density, soil loss, nutrient availability, etc.) can lead to changes in potential soil productivity. The intent is to prevent extensive detrimental soil disturbance that would result in a measurable decline in timber productivity for a site. The Region 1 supplement requires that DSD should be limited to 15% of an activity area. The value of 15% is based on the assumption that soil quality and productivity would be maintained if less than 15% of an activity area is detrimentally impacted after disturbance (Page-Dumroese et al. 2000).

Currently the effects of soil disturbance on soil quality are being studied across North America by a cooperative research project called the North American Long Term Soil Productivity Study (LTSP). The study began in 1990 and is currently ongoing in order to provide the best available science to forest managers. Results over the past ten years indicate that there is little evidence of adverse effects of surface organic removal or soil compaction on productivity as measured by total biomass production, and the growth and vigor of planted trees (Powers et al. 2004).

Additional controversy surrounds the use of the term ‘irreversible’ in NFMA. NFMA has guidelines that “insure that timber will be harvested from NFS lands only where soil, slope, or other watershed conditions will not be irreversibly damaged.” The DSD described in this analysis does not necessarily result in permanent or irreversible damage. Detrimental soil damage is reversible if the processes (organic matter, moisture, top soil retention, soil organisms) are in place and time is allowed for recovery.

AFFECTED ENVIRONMENT

SOIL REFERENCE CONDITIONS

The analysis area is underlain by metamorphic sedimentary rock known as the Belt Formation. These rocks were formed approximately a billion years ago from metamorphosed sea beds. These deposits were changed into hard dense rock formations as a result of combined pressure and heat over time. This geologic formation forms a relatively stable foundation which is not prone to failure.

The majority of the land area on the KNF was influenced by glaciers. The glaciation generally scoured the ridge tops and noses and filled the side-slopes and valley bottoms creating a more subdued landscape than had existed prior to the historic glacial activities. Generally, major ridge divides and smaller ridge tops were scoured leaving exposed, scraped rock. The scoured soil material was pushed around and tended to fill in topographic lows (drainage bottoms, etc.). The scouring of the ridge tops and filling of drainage bottoms gave the landscape a rounded appearance. Slopes are gentle within the Analysis Area, ranging from five to 30 percent in the lower elevations to much steeper slopes (30-60 percent) occurring at higher elevations within the Fivemile, Warland, Cripple Horse, Canyon and Dunn Creek drainage basins.

Glacial ice retreated from the area 12,000 to 15,000 years ago. The soil material left in place was composed of silts, fine sands and rounded gravels and boulders. As the ice melted, more landforms were created, consisting of outwash terraces, eskers, kames and lacustrine terraces. Most of these landforms were created in and/or adjacent to the drainage bottoms. The glacial till contains 35 to 45 percent sub-rounded rock and has a light-gray color. The fines within the till are mostly coarse silt.

Those areas not affected by glaciation and/or the scoured ridge tops consist of soils that are weathering "in place" and are referred to as residual soils. The amount of rock present in residual soils is much higher than that associated with a glacial till soil and rock shape is strongly angular.

Approximately 7,700 years ago (Zdanowicz et al. 1999) Mt. Mazama erupted in southwestern Oregon and deposited a layer of volcanic ash-influenced loess over northwestern Montana forming a topsoil horizon in many local areas. This layer is present on all northerly and easterly aspects and the higher elevations (generally 4500 feet or greater) of the southerly and westerly aspects and is important since it increases soil productivity and provides the best rooting environment within the soil profile. The ash cap is light and feathery and ranges from four to 14 inches thick. The uppermost ash is usually enriched with organic matter and has been incorporated into the local soil system. The high soil productivity in the ash-influenced areas is a result of the low bulk density surface soil layer combined with the high water-nutrient holding capacity of the "ash cap" soils. Generally speaking the sub-soil horizons are not as fertile as the surface horizons.

Between the eruption of Mt. Mazama to the early 1900s, the soils were relatively undisturbed. Naturally occurring surface erosion and small-scale landslides probably occurred on occasion, but the overall magnitude of such activities would have been insignificant in terms of long-term soil productivity. Soil recovery in such areas was attained when the slope reached a stable angle and/or naturally revegetated. Soil productivity was maintained over the long-term as vegetative matter slowly decomposed or burned in low intensity wildfires.

Historically, the most prevalent large-scale disturbance was wildfire. Stand replacing fires varied in frequency from 50-300 years, depending on vegetation type and location. Once fire passed through an area, erosion increased, especially on steep slopes in headwater swales where most vegetation was removed, until sufficient forest floor and canopy vegetation had recovered. Soils may have developed hydrophobic conditions following severe fires. However, soils on the KNF have shown little hydrophobicity following wildfires in recent decades, even when those fires burned very intensely; therefore, it is unlikely that this condition was common in the past. More frequent, low-intensity underburns are presumed to have had little effect on soils due to the short contact time and lower temperatures with these fires.

EXISTING CONDITION

Existing condition is the result of the past management activities (temporary road and landing construction, timber harvest, prescribed burning, etc.) and natural events (wildfire, floods, landslides, etc.) that occurred in the analysis area. These activities and events provide baseline conditions for the affected environment in the analysis area.

Soils are the basic support system of forest ecosystems, providing nutrients, water, oxygen, heat and mechanical support to vegetation. Any environmental stressor that alters the natural function of the soil has the potential to influence the productivity, species composition, and hydrology of forest systems. Maintenance of soil quality is dependent upon the protection of surface layers from erosion, displacement, and compaction, as well as the continual cycling of nutrients and organic material. Soil quality refers to the capacity of a soil to function within ecosystem and land use boundaries, to sustain biological productivity, maintain environmental quality, and promote plant and animal health (Doran and Parkin 1994). Various factors influence soil quality. Although management activities do not affect factors such as climate and soil parent material, they can affect physical, chemical, biologic, and hydrologic soil properties.

Three criteria were used to assess existing condition for soil resources:

- Kootenai National Forest Landtypes;
- Identification of Sensitive Soils; and

- Site conditions in the activity area in which proposed activities would occur.

LANDTYPES

Landtypes are units based on soil types. There are 50 recognized landtypes on the KNF. Landtype classification is based on *landforms, geology, soils, vegetation, climate and drainage type*. They describe inherent conditions and do not change as a result of management. The landtypes were compiled in Kuennen and Nielson-Gerhardt (1984), and published in Soil Survey of Kootenai National Forest Area, Montana and Idaho (Kuennen and Gerhardt 1995). Landtype classification helps determine equipment operating limitations, and the production potential of the landscape. It is an important tool for protecting soils during resource management activities. The landtype map is generally quite accurate; however, field verification may indicate some site variability. Refer to Soils Map 1: Landtypes, in Soils and Water Project File for spatial representation of the landtypes in the analysis area. The landtypes in the East Reservoir analysis area were broken down into five generalized groupings or series which include the following:

- **Water influenced Landtypes (100 Series):** Present in very low relief topography which is highly water influenced.
- **Steep topography Landtypes (200 Series):** Exist in very steep topographic lands (60% plus). Such landform areas are usually rocky slopes and may be convex or linear in shape.
- **Glaciated Landtypes (300 Series):** Exists in areas of past glacial deposits and shaped through time by several glacial advances that occurred throughout the KNF. The most recent, the Cordilleran Ice Sheet retreated from the area several thousand years before present. These landtypes includes glaciated slopes, drumlins, and moraines.
- **Alpine till Landtypes (400 Series):** Such landtypes exist in very steep alpine or subalpine locations and consist of glacial cirque headwalls or trough walls.
- **Mid-elevation Landtypes (500 series):** Such landtypes are residual in nature and developed on site and are typically mid-slope in elevation.

The landtypes in the analysis area and their implications are displayed in Soils Table 3.33.

Table 3.33 - Landtypes in the Analysis Area (Kuennen and Gerhardt 1995)

LANDTYPE	ACRES	TIMBER MANAGEMENT		ROAD CONSTRUCTION/ MAINTENANCE		
		TRACTOR OPERATORS	SEDIMENT HAZARD	CUT AND FILL SLOPES	NATIVE SURFACE MATERIAL	SEDIMENT HAZARD
101[2]	452	Soil Damage	Severe	None	Erosion	Severe
102[2]	524	Soil Damage	Moderate	None	Rutting	Severe
103	212	Soil Damage	Severe	None	Erosion	Severe
105[2]	342	N/A[1]	N/A[1]	None	None	Moderate
106[2]	848	Soil Damage	Moderate	None	Erosion	Moderate
108[2]	909	Soil Damage	Moderate	None	Rutting/Erosion	Severe/Moderate
110[2]	626	Soil Damage	Moderate	None	Rutting	Severe
201[2]	2721	N/A[1]	N/A[1]	None	Large Stones	Moderate
251[2]	1103	Slope, Rock	Severe	None	Large Stones	Moderate
252[2]	2980	Slope	Severe	None	Rock Fall	Moderate
301[2]	2879	None	Moderate	Sloughing	Erosion	Moderate
302[2]	7542	Slope	Moderate	Sloughing	Erosion	Moderate
303[2]	4882	Rock	Moderate	None	Large Stones	Slight
324[2]	819	None	Moderate	Sloughing	Erosion	Moderate
329[2]	2014	Soil Damage	Moderate	Sloughing	Erosion	Moderate
351[2]	731	Slope	Severe	Landslides	Erosion	Severe
352[2]	28538	Slope	Moderate	Sloughing	Erosion	Moderate
353[2]	4547	Soil Damage	Moderate	None	Large Stones	Slight
355[2]	26910	Rock	Moderate	None	Large Stones	Moderate

LANDTYPE	ACRES	TIMBER MANAGEMENT		ROAD CONSTRUCTION/ MAINTENANCE		
		TRACTOR OPERATORS	SEDIMENT HAZARD	CUT AND FILL SLOPES	NATIVE SURFACE MATERIAL	SEDIMENT HAZARD
357[2]	1560	Slope	Severe	Landslides	Large Stones	Severe
360[2]	675[2]	Rock	Slight	None	Large Stones	Slight
365[2]	207	Slope	Severe	Landslides	Erosion	Severe
510[2]	522	Complex Slope	Severe	None	None	Slight
999	0					

[1] Not applicable because landtype has only scattered stands of trees.
[2] Landtypes present within proposed harvest or fuel treatment units.

Of the 50 recognized landtypes on the KNF, 23 of these landtypes are found in the analysis area. Management activities on each landtype are designed to be comparable to the risk associated with the landtype.

SENSITIVE SOILS

Sensitive soils are identified based on one of three characteristics: 1) landtypes of concern, 2) riparian/ wetland areas; and 3) low productivity soils. Sensitive soils comprise 14,809 acres or 16% of the entire analysis area. Sensitive soils are best addressed through avoidance, BMPs, buffers, and/or through design criteria.

Landtypes of Concern

There are seven designated "landtypes of concern" on the KNF that should be given additional consideration prior to the introduction of management activities. These are landtypes 102, 112, 325, 351, 365, 370 and 520 (Kuennen 2007). Within the East Reservoir analysis area only four landtypes of concern are present and consist of 1,462 acres or less than 2% of the entire analysis area scale. These are landtypes 102 and 351 and 365. When viewed at the discrete unit-specific scale, only landtypes 102 and 351 are present which make up roughly 304 acres or approximately 3% of the soils analysis area. It should be noted that landtype 365 is only present in proposed Fuels and Wildlife (FW) units.

Riparian/Wetland Areas

There are scattered riparian corridors and small patches of wetland areas in the analysis area. Riparian and wetland soils are considered sensitive due to high moisture levels all or most of the year, and moist soils are more prone to compaction, displacement, rutting and puddling. Harvest and road construction activities would avoid wetland areas.

Low Productivity Soils

Soil productivity as defined by Brady and Weil (2002) is "the capacity of a soil for producing a specific plant or sequence of plants under a specified system of management." The most productive part of the soil occurs near the surface, at the contact between the forest litter and the mineral soil. Here the litter has been decomposed into an organic rich layer containing most of the soil nitrogen, potassium and mycorrhizae that must be present for a site to be productive. However, this is also the part of the soil that is easiest to disturb by management activities.

Soil productivity levels for each landtype on the KNF are classified as low, moderate or high in Kuennen and Gerhardt (1995). It is important to look at soil productivity to properly assess the effects of potential actions on a specific area. For instance, if timber harvest is proposed on a given area of land that was considered as having low soil productivity, additional actions may need to be taken to insure a fully stocked stand after harvest. Table 3.34 displays soil productivity by landtype in the analysis area.

Table 3-3 Soil Productivity in the Analysis Area (Kuennen and Gerhardt 1995)

LANDTYPE	ACRES	FOREST VEGETATIVE GROUP	RELATIVE PRODUCTIVITY
101[2]	452	Moist, Mixed Forest	High

LANDTYPE	ACRES	FOREST VEGETATIVE GROUP	RELATIVE PRODUCTIVITY
102[2]	524	Dry to Moist, Mixed Forest	High
103	212	Moist, Mixed Forest	High
105[2]	342	Non-Forested	N/A[1]
106[2]	848	Moist, Mixed Forest	High
108[2]	909	Moist, Mixed Forest	Moderate
110[2]	629	Moist, Mixed Forest	High
201[2]	2,721	Rocky Subalpine to Dry Mixed Forest	Low
251[2]	1,103	Open-grown forest	Moderate
252[2]	2,980	Moist, Mixed Forest	Moderate
301[2]	2,879	Dry, Mixed Forest	Moderate
302[2]	7,542	Dry, Mixed Forest	Moderate
303[2]	4,882	Open-grown forest	Low
324[2]	819	Dry, Mixed Forest	Moderate
329[2]	2,014	Dry, Mixed Forest	Moderate
351[2]	731	Moist, Mixed Forest	High
352[2]	28,538	Moist, Mixed Forest	High
353[2]	4,547	Rocky Subalpine to Moist, Mixed Forest	Low
355[2]	26,910	Moist, Mixed Forest	Moderate
357[2]	1,560	Moist, Mixed Forest	High
360[2]	675	Sub-alpine Forest	Low
365[2]	207	Sub-alpine Forest	Moderate
510[2]	522	Open-grown forest	Low
999	0	N/A	Null
TOTAL TREATED ACRES = 92,546			

[1] Not applicable due to landtype having only scattered stands of trees
[2] Landtypes present in the Soils Analysis Area

Of the 23 landtypes within the analysis area, 22 have proposed management activities under at least one of the action alternatives and are thus included as being in the soils analysis area. The majority of the analysis area has moderate to high soil productivity. However, landtypes 201, 303, 353, 360 and 510 are all rated as having low soil productivity from a Forestwide aspect. This equates to 13,347 acres or 14% of the entire analysis area. Management activities proposed on each landtype are designed to be compatible with the risks associated with that landtype. Application of appropriate management precautions (BMPs) such as avoiding timber harvest in wet seasons, maintaining buffer zones below open slopes, and skidding over snow or frozen ground can decrease negative impacts to soil productivity.

SITE CONDITIONS in the ACTIVITY AREAS

Site conditions are considered for each activity area in the effects analysis portion of this assessment. Past activities in the analysis area have resulted in impacts that persist today. Past activities affecting soils include, but are not limited to, road construction, timber harvest (including skid trails and landings), prescribed wildfires, cattle grazing, firewood gathering and off-highway use. Percent DSD is defined by agency directives for Soil Quality Monitoring found in FSM R-1 Supplement No. 2500-99-1. The following are the categories of detrimentally disturbed soils identified in FSM R-1 Supplement No. 2500-99-1: Compaction, Rutting, Displacement, Surface Erosion, Severely Burned Soil and Mass Movement (Landslides). All types of detrimental soil disturbance listed in FSM 2554.1.1 will be considered in the examination of the existing condition and the analysis of the environmental effects.

The four factors that have had the most impacts on soils in the analysis area are:

- Road Construction
- Timber Harvest
- Fire Impacts
- Livestock Grazing

Road Construction

Common impacts to soils from road construction are displacement, compaction, and erosion (road-related runoff). Road construction affects soils by displacing topsoil layers from the road prism and compacting the road surface and shoulders. The road surface will not support trees and other forest vegetation as long as the road is used and maintained. Trees and shrubs will grow along the road bank, but site productivity is less than in unaffected soils in similar productivity zones.

Roads also disrupt hydrologic processes that occur within the soil profile. The cut slope intercepts subsurface flow and the compacted road surface reduces precipitation infiltration. As long as roads remain on the landscape, the impacts to soils persist. When road use ceases, soils gradually begin to recover. Implementation of BMPs reduces erosion and the rerouting of water associated with roads. It should be noted that a number of the lower basin FS roads were constructed where early railway timber rail-lines previously existed.

Roads are categorized as "National Forest System Roads" (NFSR) (dedicated under the are transportation plan) or "Undetermined" which are non-dedicated roads that are not the road miles which fall into the category of being dedicated roads (FS, State, Private) are not calculated as contributing to soil disturbance as these are "permanent structures" and therefore have no relation to the 15% detrimental soil disturbance. This is due to the road system not being considered part of the suitable timber land base. However, the proposed temporary roads, excavated skid trails and landings do contribute towards the 15% standard. Implementation of BMPs reduces erosion associated with such roads.

There are approximately 439 miles of existing road in the analysis area. Of the total, 324 miles are NFSR 55.4 miles are Plum Creek Timber Company (PCTC) or other private ownership roads, 18 miles are State Highway, 9.8 miles are State lands, 11.6 miles combined Bonneville Power Administration (BPA) and Army Corps of Engineers (COE), and 20 miles of undetermined roads. Refer to the Transportation Section for further information.

Timber Harvest

Early harvest activities on FS lands included hand-fall and dozer skidding harvest activities in low relief land areas while later in time harvest activities was altered to skyline and rubber tire skidders and handcut/clipper cutting in land areas further up the drainage system. Two of the more important impacts to soils are detrimental soil disturbance (compaction, displacement, rutting, etc.) and removal of organic matter. Soil disturbance as a result of timber harvest and fuels reduction is usually associated with mechanized activity (Kuennen 2007a). Timber harvest activities can physically alter soils and reduce soil organic matter, which can lead to reduced site quality and soil productivity (Heninger et al. 2011). Detrimental soil disturbance is defined in FSM 2500-99-1 and typically is the result of compaction, displacement and rutting. Soil compaction results from the packing together of soil particles due to increased pressure on the soil surface. Compaction associated with equipment is often accompanied with formation of ruts, which collect and concentrate runoff, thus increasing erosion. The loss of surface organic matter through mechanical removal or burning can cause nutrient and carbon cycle deficits and negatively affect physical and biological soil conditions (Harrison et al. 2011).

Soil compaction impacts recover over time due to freeze/thaw activity, burrowing by animals, plant root growth and the action of soil microbes. Soil erosion and displacement are impacts that require a longer timeframe to recover since the rate of soil formation is very slow. Long-term soil processes are influenced by fire, mass wasting, wind-deposition and weathering of parent material at the rate of one inch of topsoil

formed every 300-1000 years (Thurow 1991). Timber harvest such as regeneration, intermediate and liberation has taken place on 47,067 acres of the analysis area.

Fire Impacts

Wildfire is a natural component in forest watersheds and has influenced forest soils for thousands of years. Records of historic wildfires enforce that the potential for future wildfire remains, especially if a fire ignites in untreated areas under dry weather conditions. Approximately 285 smaller "spot-fires" have been recorded in the analysis area since the early 1900s. Most of these fires are believed to have been caused by lightning but a significant portion which occurred between the 1900s until about 1930 are believed to have been human-related. These small spot fires are believed to have only impacted very small areas of land.

Approximately 22 large fires ranging in size from 50-1,000 acres have been recorded since 1872. Historically, the larger fires occurred on south, southeast and southwest slope aspects as related to drier vegetative stand compositions. The largest fire on record occurred during 1872 and burned a significant portion along the eastern boundary of the analysis area. Between 1910 and the 1920s, approximately 15 of the 22 large fires occurred. The next significant fire was the Dry Fork fire of 1988 which burned approximately 15,000 acres. The two more recent large fires were the 1994 South Fork Cripple Horse Fire (approximately 600 acres) and the 2000 Warland Fire (approximately 50 acres). Refer to Fire/Fuels Section for more detail.

Many fire effects on soil are not observable with the naked eye (Kuennen 2007b). Severe deteriorating effects that wildfires have on soils include loss of organics and nutrients and a reduction of water infiltration (Wells et al. 1979). Burns that create very high soil surface temperatures, particularly when soil moisture content is low, may result in an almost complete loss of soil microbial populations, woody debris and the protective duff and litter layer over mineral soil. Soil erosion increases following fire is often directly proportional to fire intensity (Megahan 1990), the removal of ash-capped surface soils as related to soil disturbance could reduce soil productivity. As a result, many of the nutrients present in surface organics and large woody debris can also be lost to the atmosphere through volatilization and removed from the site in fly-ash (DeBano 1991; Amaranthus et al. 1989).

Depending on fire severity and activity characteristics, many plants would survive and re-initiate growth soon after a fire. However, the ability of surviving plants to reestablish, thrive and reseed in subsequent years is greatly affected by the presence of invasive plants and weeds (Goodwin and Sheley 2001). Burned areas can contain high initial nutrient levels, exposed ground surfaces, and low shade with high light conditions which all directly favor colonization of invasive plant species. Invasive plant survival coupled with fire disturbance can cause rapid expansion of invasive plant growth. As a result, values such as wildlife habitat, watershed stability and water quality often deteriorate.

The scenario of a wildfire occurring on sites with accumulated fuels could result in areas of high burn severity and hydrophobicity (water repellant soils). This impact is greatly amplified by increased burn severity (Huffman et al. 2001). The heat of a fire vaporizes hydrophobic compounds in the organic matter and moves them into the soil layer where they condense and form a water repellant coating on the soil particles. Soil hydrophobicity usually returns to pre-burn conditions in no more than six years (DeBano 1981; Dyrness 1976) and other studies have documented a much more rapid recovery of one to three years (Huffman et al. 2001). However, before water infiltration rates improve, increased overland runoff and sediment movement may occur. The primary risks for erosion and mass failure during this timeframe is related to roads, especially near stream crossings. It should be noted that soils within the analysis area currently do not display hydrophobic concerns. Table 3.35 displays historic fire activity by decade on sensitive soils.

Table 3.35 - Burns by Decade on Sensitive Soils

ACTIVITY	LANDTYPE of CONCERN[1]	LOW PRODUCTIVITY SOILS[2]				GRAND TOTAL (acres)	% BURN on SENSITIVE SOILS
	351	201	303	353	360		

ACTIVITY	LANDTYPE of CONCERN[1]	LOW PRODUCTIVITY SOILS[2]				GRAND TOTAL	% BURN on SENSITIVE
Broadcast Burning Activity Fuels (human related, 1960s-1990s)	2	51	104	42	60	259	<1%
Jackpot Burning Activity Fuels (human related, 1980s-1990s)	0	0	75	0	0	75	<1%
Jackpot Burning Activity Fuels (non-human related, 1990s)	30	463	8	1	0	502	1%
Underburn Low Intensity (human related, 1970s-2000s)	18	55	8	54	29	164	<1%
Underburn Low Intensity (non-human related -1990s-2000s)	0	595	137	170	0	902	1%
NF Stand Modifications with Underburn Low Intensity (1990s-2000s)	0	1,415	319	404	72	2,210	2%
NF Wildfire Burn with Underburn Low Intensity (1970s-2000s)	12	1,336	1,898	506	145	3,897	4%
GRAND TOTAL	**62**	**3,915**	**2,549**	**1,177**	**306**	**8,009**	**9%**

[1]Landtype 102 is also considered to be a landtype of concern but has no recorded past burns recorded to match Soils Table 3-4 categories.
[2]Landtype 510 is also considered to be a low productivity soil but has no recorded past burns recorded to match Soils Table 3-4 categories.

Disturbance from fire suppression of small natural wildfires is usually limited to hand tools which result in only minor (insignificant) impacts to the soil resource. During fire suppression, closed roads may be reopened for access and incorporated as fire lines. As part of the post-fire work, the areas of disturbance are rehabilitated and the roads returned to the previous conditions in most cases.

Livestock Grazing

Livestock grazing impacts generally occur in localized areas where cattle tend to congregate season after season (areas offering good forage). Generally, these areas include riparian zones (water sources), harvest units, road corridors and meadows. Stream bank trampling/shearing occurs when cattle cross a stream and collapse the banks. This can lead to increase in bank scour during high flows. Compaction and stream bank trampling/shearing are among the most common soil disturbances resulting from grazing (Thurow 1991; Kaufman and Krueger 1984). Within the analysis area, historic grazing impacts tend to be discontinuous and localized. There is one active range allotment within the analysis area which is the Fivemile Creek Allotment. A maximum of 17 cow/calf pairs are allowed in the Fivemile Creek Allotment from June 1 to October 15. This allotment is dominantly restricted to privately owned lands and portions of the Fivemile Creek drainage system. Although the Warland Creek Grazing Allotment has been inactive for over 6 years it will be maintained as a vacant allotment with the potential for grazing in the foreseeable future.

Two other grazing allotments are present in the analysis area include the Cripple Horse and Canyon Creek allotments. Both of these grazing allotments have been closed through the administrative closure process due to declining transitory range, lack of demand and riparian area concerns. Grazing activities associated with the analysis area are not expected to have significant impacts on soils conditions and as a result this factor will not be carried forward in the Soils Report.

ENVIRONMENTAL CONSEQUENCES

Three alternatives were developed for the analysis area. These alternatives are discussed in this environmental consequences section. It should be noted that some of the key difference between

alternatives is related to different target acres for harvest and road construction agreements. The proposed alternatives are as follows:

- Alternative 1 – No Action
- Alternative 2 – Proposed Action
- Alternative 3 – Forest Plan Action

The Soils report will analyze in full content the impacts of the action alternatives (2 and 3) as compared to Alternative 1, the no-action Alternative. Both Alternatives 2 and 3 are the alternatives that were developed to respond to public comments. Alternative 3 was developed to meet KNFP requirements.

Measurement Indicators

No significant issues were identified for soil resources during the scoping process. Therefore, law regulation, and policy drive the effects analysis, specifically:

- Compliance with NFMA;
- Compliance with KNFP Standards.

Effects of the alternatives on soil resources will be analyzed in terms of:

- Activities on Sensitive Soils;
- Detrimental Soil Disturbance and the 15% Standard;
- Prescribed Fuels Treatments;
- Changes in Nutrient Cycling.

SENSITIVE SOILS

Recall that when viewed at the discrete unit-specific scale Landtypes (LT) 102, 351 and 365 are considered landtypes of concern and make up roughly 1,462 acres or slightly more than 1% of the soils analysis area. Table 3.36 displays the acres of management activities with potential heavy equipment on sensitive soils by alternative.

Soils Table 3.36 - Unit Acres on Sensitive Soils

SENSITIVE SOILS	ALT 1	ALT 2	ALT 3
Harvest Unit Acres on Sensitive Landtypes (102, 351, 365)	0	150	131
Commercial Thin Acres on Sensitive Landtypes (102, 351, 365)	0	0	0
Fuel Treatment on Sensitive Landtypes (102, 351, 365)	0	95	38
Acres PCT on Sensitive Landtypes (102, 351, 365)	0	71	71
Fuels and Wildlife Units on Sensitive Landtypes (102, 351, 365)	0	1	1
% Harvest Acres on Landtypes of Concern (102, 351, 365)	0	2	2
% of Proposed PCT on Landtypes of Concern (102, 351, 365)	0	1	1
% Fuels Acres on Landtypes of Concern (102, 351, 365)	0	5	3
% Fuels and Wildlife Acres on Landtypes of Concern (102, 351, 365)	0	<1	<1
Harvest Unit Acres on Low Productivity Soils (201, 303, 353, 360, 510)	0	322	365
CT Acres on Low Productivity Soils (201, 303, 353, 360, 510)	0	6	6
Acres PCT on Low Productivity Soils (201, 303, 353, 360, 510)	0	389	389
Acres FW Treatments on Low Productivity LT (201, 303, 353, 360, 510)	0	5,390	5,390
% of Harvest Acres on Low Productivity Soils (201, 303, 353, 360, 510)	0	5	6
% of CT Acres on Low Productivity LT (201, 303, 353, 360, 510)	0	<1	<1
% PCT on Low Productivity LT (201, 303, 353, 360, 510)	0	7	7
Fuel Treatments on Low Productivity LT (201, 303, 353, 360, 510)	300^	47	54
% Fuel Treatments on Low Productivity Landtypes (201, 303, 353, 360, 510)	0	3	4
% FW Treatments on Low Productivity LT (201, 303, 353, 360, 510)	6	53	53
Total Acres of Commercial Thin per Alternative	0	2,257	1,875
Total Acres Precommercial Thin per Alternative	0	5,687	5,687
Total Acres Fuel Treatment per Alternative*	0	1,378	1,309
Total Acres of Fuels and Wildlife Vegetative Management	765	10,049	10,049

SENSITIVE SOILS	ALT 1	ALT 2	ALT 3
Total Acres of Vegetative Management for timber productivity	0	6,596	5,817

*Includes Fuel treatments where mechanical fuel treatments may occur
^An estimated 300 acres of low productivity soils would be treated under Alternative 1 and would occur if the DEIS never gets signed.
PCT = Precommercial Thin CT = Commercial Thin FW = Fuel and Wildlife LT = Landtype

ALTERNATIVE 1 (No-Action)
Direct, Indirect and Cumulative Effects
Alternative 1 does not propose any new timber management, commercial thin, precommercial thin or fuel treatments activities on sensitive soils. Therefore, no direct, indirect or cumulative effects to sensitive soils would result from Alternative 1. However, if Alternative 1 is selected, there would still be approximately 765 acres of Forestwide Fuels treatment acres in Units FWF545, FWF536, FWF52403 and FWF589 (Chapter 3 DEIS, pg. 5). Such activities would not involve heavy equipment and thus is not expected to impact soils.

ALTERNATIVES 2 and 3
Direct and Indirect Effects
Landtypes 102, 351 and 365 are all considered as being landtypes of concern here on the KNF. Under Alternative 2, a total of 150 acres (2%) of proposed harvest and activity is located on these landtypes in proposed Units 4, 28, 51, 142, 147 and 148. Similarly, Alternative 3 proposes 131 acres harvest (2%) on landtypes 102 and 351 in Units 4, 28, 51, 142, 147, 148 and 158A. It should be noted that precommercial thin activities are anticipated to have no impacts as such activities do not involve equipment operations.

Alternative 2 proposes approximately 95 acres (5%) of Fuel Treatment acres which are located on landtypes 102 and 351 in Units F3, F4, F3OG, F14OG and COEF8. Alternative 3 proposes 38 acres (3%) of Mechanical Fuel Treatment activities in such landtypes in Units F3, F4 and COEF8. Note that landtype 365 is not present in this treatment activity. Under both Alternatives 2 and 3, only 1 acre of combined Fuels and Wildlife Treatments are proposed for landtypes 102, 351 and 365. Similarly, commercial thinning activities would not involve landtypes 102, 351 and 365 under Alternatives 2 or 3.

The landtypes considered as being low productivity soils within the East Reservoir analysis area include landtypes 201, 303, 353, 360 and 510; however, not all management activities include all five of these landtypes. Landtypes 201, 303, 353 and 510 are all present in proposed harvest activities where Alternative 2 proposes 322 acres (5%) harvest on such landtypes while Alternative 3 proposes 365 acres (6%) harvest activity on such landtypes. Under Alternative 2 such landtypes are located in Units 1, 2, 2B, 2D, 9, 10, 11, 16, 17, 18A, 42, 43, 150, 157, 158, 194T, 367, 367A and 368A, while Alternative 3 proposes harvest activities in such landtypes associated with Units 1, 2, 2B, 2D, 9, 10, 11, 16, 17, 18, 42, 43, 157, 158, 158A, 194T, 367 and 367A. Landtypes 303 and 353 are the most widely spread and make up 97% of the total acres of proposed harvest activities containing low productivity soils. For both Alternative 2 and 3 only minimal amount (<1%) of commercial thin activities are proposed to occur on low productivity soils. Alternatives 2 and 3 propose 389 acres or approximately 7% of precommercial thin on low productivity soils. Such activities are not expected to impact soils as this will be completed using hand cut procedures.

Of the proposed 1,378 acres of Fuels treatment units in Alternative 2, landtypes 201, 303, 353 and 510 are all present as a low productivity concerns in proposed Units F1, F15, F15OG, F18 and COEF8 making up a total of 47 acres (3%) of the Fuels treatment acres. Alternative 3 proposes 1,309 acres of Fuel treatments of which approximately 54 acres (4%) consist of low productivity landtypes. In Alternative 3 those Units consisting of low productivity soils include proposed Units F3, F15, F18, and COEF8. A number of the fuel treatment units are proposed to receive mechanical fuel treatment activities such as mastication.

Alternatives 2 and 3 propose nearly 53% of all Fuels and Wildlife Unit treatments occur on low productivity landtypes (201, 303, 353, 360). These activities involve portions of all such units except

proposed management units FW50601, FW502, FW5109, FW511, FW5111, FW5122, FW516, FW521 and FW589. Such activities are expected to leave a fully stocked stand and do not involve heavy equipment activities. This would allow for a continuous input of nutrients through needle-cast and coarse woody debris and would maintain soil productivity. Potential indirect effects of harvest on low productivity soils may include a slower vegetative return to harvested units.

No harvest activities are proposed in riparian areas or wetlands with Alternatives 2 and 3. Riparian and wetland areas are protected under INFS RHCAs (USDA Forest Service, 1995). RHCAs are based on direction laid out by INFS and include areas of specified widths that surround stream channels, riparian areas and wetlands. By definition, RHCAs are more extensive than the riparian and wetland features they protect (see Water Resource Section). RHCAs cannot be reduced to less than the SMZ boundary width required by law. As a result, one indirect effect to riparian areas and wetlands could be an increase in blow down trees or additional large woody debris from opening the stands in and around wet areas.

DETRIMENTAL SOIL DISTURBANCE (DSD)

Management activities including, but not limited to, road construction, off-highway vehicle use, timber harvest (trails and landings), mechanical fuel treatments, firewood gathering and grazing are considered to be potential sources of detrimental soil disturbance. Refer to the Soils Project File for spatial representation of past harvest activities.

Table 3.37 displays existing, proposed and cumulative detrimental soil disturbance for each activity area. Existing disturbance is based on field surveys. Predicting detrimental and foreseeable activity disturbance is based on information from Kuennen 2003; 2007c; 2007e; and Gier et al. 2012 which includes a summary of all KNF Soils Monitoring to date with recommendations for analysis based on field results. Please refer to the Soil Project File to review these documents. The cumulative percent is derived by adding the percentage of disturbance expected from proposed activities and reasonably foreseeable activities to the existing disturbance percentage. All harvest activities, prescribed burning, skid trails, landings, firelines, excavator piling and temporary roads are included in this analysis. Best Management Practices (BMPs) would be followed (Appendix C of the DEIS), and additional design criteria have been specified in order to minimize disturbance (refer to the Management Requirements in Chapter II of the EIS). Complete soils survey data can be found in the Soil Project File at the Canoe Gulch (Libby) Ranger District.

ALTERNATIVE 1 (No-Action)

Direct, Indirect and Cumulative Effects

Under Alternative 1, timber harvest and others proposed with this project would not occur. However, natural changes in climate and vegetation would continue to occur. Vegetation regeneration and stand growth activities would continue to slowly recover over time on existing harvest units resulting in lower compaction values due to tree root growth, freeze-thaw activities, and increased soil nutrients from the decomposition of forest litter and CWD. Therefore, no direct, indirect or cumulative DSD would result from Alternative 1.

Table 3.37 - Detrimental Soil Disturbance in Proposed Harvest Units of the East Reservoir Analysis Area

UNIT #	ACTIVITY AREA (acres) ALTS 2/3	PROPOSED VEGETATION TREATMENT ALT 2/3	PROPOSED FUELS TREATMENT ALT 2/3	PROPOSED LOGGING SYSTEM ALT 2/3	EXISTING DSD (%)[1]	ALTERNATIVES POTENTIAL DSD 1/2/3				
						PREDICTED TEMP ROAD DSD%[2]	PREDICTED HARVEST DSD%	CUMULATIVE DSD% POST-HARVEST	REDUCED DSD FROM REHAB[4] (%) ALTS 2/3	TOTAL POST ACTIVITY DSD (%)
1*	50/50	IMP/IMP	SGP/SGP	WT/WT	1	0/0/0	0/4/4	1/5/5	0/0	1/5/5
1A*	11/11	SW/SW	SGP/SGP	WT/WT	1	0/0/0	0/4/4	1/5/5	0/0	1/5/5
2^*	13/13	ST/ST	SUB/SUB	WT/WT	10	0/0/0	0/2/2	10/12/12	0/0	10/12/12
2B^*~	48/48	IMP/IMP	SGP/SUB	WT/WT	9	0/0/0	0/2/2	9/11/11	0/0	9/11/11
2C*~	9/9	IMP/IMP	SGP/SUB	WT/WT	7	0/0/0	0/4/4	7/11/11	0/0	7/11/11
2D*~	67/67	IMP/IMP	SGP/SUB	WT/WT	7	0/0/0	0/4/4	7/11/11	0/0	7/11/11
3*^	27/27	ST/ST	SUB/SUB	WT/WT	8	0/0/0	0/2/2	8/10/10	0/0	8/10/10
3A*	26/26	IMP/IMP	SGP/SUB	WT/WT	4	0/0/0	0/4/4	4/8/8	0/0	4/8/8
3B~	37/37	IMP/IMP	SGP/SUB	S/S	5	0/0/0	0/1/1	5/6/6	0/0	5/6/6
3C~	13/13	ST/ST	SGP/SUB	T/T	4	0/0/0	0/8/8	4/12/12	0/0	4/12/12
4	46/46	IMP/IMP	SGP/SGP	T/T	2	0/0/0	0/8/8	2/10/10	0/0	2/10/10
5	5/5	IMP/IMP	S/S	T/T	<1	0/0/0	0/8/8	0/8/8	0/0	0/8/8
6	11/11	ST/ST	SGP/SGP	T/T	0	0/0/0	0/8/8	0/8/8	0/0	0/8/8
7^*	19/19	ST/ST	SGP/SGP	WT/WT	9	0/0/0	0/2/2	9/11/11	0/0	9/11/11
8	13/13	ST/ST	SGP/SGP	T/T	3	0/0/0	0/8/8	3/11/11	0/0	3/11/11
9*	151/151	IMP-SW/IMP-SW	SUB/SUB	WT/WT	7	0/0/0	0/4/4	7/11/11	0/0	7/11/11
10*^	160/160	IMP-SW/IMP-SW	SUB/SUB	WT/WT	8	0/0/0	0/2/2	8/10/10	0/0	8/10/10
11*	102/102	IMP-SW/IMP-SW	SUB/SUB	WT/WT	4	0/0/0	0/4/4	4/8/8	0/0	4/8/8
12	119/119	IMP-SW/IMP-SW	SGP/SGP	T/T	7	0/0/0	0/8/8	7/15/15	0/0	7/15/15
13*^	22/22	ST/ST	SGP/SGP	WT/WT	9	0/0/0	0/2/2	9/11/11	0/0	9/11/11
14*^	40/40	ST/ST	SGP/SGP	WT/WT	13	0/0/0	0/2/2	13/15/15	0/0	13/15/15
14A	26/26	SW/SW	SGP/SGP	T/T	5	0/0/0	0/8/8	5/13/13	0/0	5/13/13
15*^	22/22	IMP/IMP	SGP/SGP	WT/WT	9	0/0/0	0/2/2	9/11/11	0/0	9/11/11
16	29/24	IRR-SW/IRR-SW	SGP/SGP	T/T	2	0/0/0	0/8/8	2/10/10	0/0	2/10/10
17*	68/68	IMP/IMP	GP/SUB	WT/WT	4	0/<1/<1	0/4/4	4/8/8	0/0	4/8/8
18	40/32	IRR-SW/IRR-SW	GP/GP	T/T	4	0/0/0	0/8/8	4/12/12	0/0	4/12/12
18A	20/0	IMP/NT	SGP/NT	T/NA	4	0/0/0	0/8/0	4/12/4	0/0	4/12/4
19	32/32	IMP-SW/IMP-SW	SGP/SGP	T/T	0	0/0/0	0/8/8	0/8/8	0/0	0/8/8
20	41/41	IMP-SW/IMP-SW	SGP/SGP	T/T	2	0/0/0	0/8/8	2/10/10	0/0	2/10/10
21	76/76	IMP-SW/IMP-SW	SGP/SGP	T/T	4	0/0/0	0/8/8	4/12/12	0/0	4/12/12
22	83/83	IMP/IMP	SGP/SGP	T/T	5	0/1/1	0/8/8	5/14/14	0/0	5/14/14
23	146/146	IMP/IMP	SGP/SGP	T/T	6	0/<1/<1	0/8/8	6/14/14	0/0	6/14/14
24*^	40/40	IMP/IMP	SGP/SGP	WT/WT	9	0/0/0	0/2/2	9/11/11	0/0	9/11/11
25	139/139	IMP/IMP	SUB/SUB	T/T	4	0/0/0	0/8/8	4/12/12	0/0	4/12/12
26*^	29/29	IMP/IMP	SGP/SGP	WT/WT	9	0/0/0	0/2/2	9/11/11	0/0	9/11/11
27	45/45	IMP/IMP	SGP/SGP	T/T	2	0/0/0	0/8/8	2/10/10	0/0	2/10/10
28*	31/31	IMP/IMP	SGP/SGP	WT/WT	4	0/0/0	0/4/4	4/8/8	0/0	4/8/8
29	54/54	IMP/IMP	SGP/SGP	T/T	4	0/0/0	0/8/8	4/12/12	0/0	4/12/12
30	62/62	IMP/IMP	SGP/SGP	T/T	6	0/0/0	0/8/8	6/14/14	0/0	6/14/14
31	698/698	IMP/IMP	SUB/SUB	T/T	4	0/<1/<1	0/8/8	4/12/12	0/0	4/12/12
32	75/75	IMP/IMP	SGP/SGP	T/T	2	0/0/0	0/8/8	2/10/10	0/0	2/10/10

UNIT #	ACTIVITY AREA (acres) ALTS 2/3	PROPOSED VEGETATION TREATMENT ALT 2/3	PROPOSED FUELS TREATMENT ALT 2/3	PROPOSED LOGGING SYSTEM ALT 2/3	EXISTING DSD (%)[1]	ALTERNATIVES POTENTIAL DSD 1/2/3				
						PREDICTED TEMP ROAD DSD%[2]	PREDICTED HARVEST DSD%	CUMULATIVE DSD% POST-HARVEST	REDUCED DSD FROM REHAB[4] (%) ALTS 2/3	TOTAL POST ACTIVITY DSD (%)
33	85/85	SSLV/SSLV	GP/GP	T/T	<1	0/0/0	0/8/8	0/8/8	0/0	0/8/8
34	144/144	SSLV/SSLV	GP/GP	T/T	5	0/0/0	0/8/8	5/13/13	0/0	5/13/13
36	41/0	ST/NT	SGP/NT	T/NA	4	0/0/0	0/8/0	4/12/4	0/0	4/12/4
39	40/40	ST/ST	SGP/SUB	T/T	<1	0/0/0	0/8/8	0/8/8	0/0	0/8/8
40	156/40	ST/ST	SGP/SUB	T/T	0	0/0/0	0/8/8	0/8/8	0/0	0/8/8
41	40/40	CCR/CCR	SGP/SGP	T/T	0	0/0/0	0/8/8	0/8/8	0/0	0/8/8
42	31/31	IMP/IMP	SGP/SGP	T/T	<1	0/0/0	0/8/8	0/8/8	0/0	0/8/8
43	26/26	IMP/IMP	SGP/SGP	T/T	1	0/0/0	0/8/8	1/9/9	0/0	1/9/9
44	28/28	SW/SW	SGP/SGP	T/T	2	0/0/0	0/8/8	2/10/10	0/0	2/10/10
45A	105/105	IMP-SW/IMP-SW	SGP/SUB	T&S/T&S	0	0/0/0	0/8/8	0/8/8	0/0	0/8/8
45B~	39/39	ST/ST	SUB/SUB	T/T	0	0/0/0	0/8/8	0/8/8	0/0	0/8/8
46#	37/37	ST/ST	SGP/SGP	S/S	0	0/0/0	0/3/3	0/3/3	0/0	0/3/3
47	40/40	ST/ST	SGP/GP	T/T	1	0/0/0	0/8/8	1/9/9	0/0	1/9/9
49	64/64	IMP/IMP	SGP/SUB	T/T	6	0/1/1	0/8/8	6/15/15	0/0	6/15/15
51	7/7	ST/ST	SGP/GP	T/T	2	0/0/0	0/8/8	2/10/10	0/0	2/10/10
52A	24/24	ST/ST	SGP/SGP	T/T	<1	0/0/0	0/8/8	0/8/8	0/0	0/8/8
53	40/40	ST/ST	SGP/SUB	T/T	4	0/0/0	0/8/8	4/12/12	0/0	4/12/12
54	9/9	ST/ST	SGP/SUB	T/T	0	0/0/0	0/8/8	0/8/8	0/0	0/8/8
55	40/40	IMP/IMP	SUB/SUB	T/T	<1	0/0/0	0/8/8	0/8/8	0/0	0/8/8
56	207/207	IMP/IMP	SUB/SUB	T&S/T&S	7	0/0/0	0/8/8	7/15/15	0/0	7/15/15
59	39/39	ST/ST	SUB/SUB	T/T	3	0/0/0	0/8/8	3/11/11	0/0	3/11/11
61	19/19	CCR/CCR	SUB/SUB	T/T	<1	0/0/0	0/8/8	0/8/8	0/0	0/8/8
62	77/40	ST/ST	SUB/SUB	T/T	4	0/0/0	0/8/8	4/12/12	0/0	4/12/12
62A	11/0	SSLV/NT	GP/NT	T/NA	4	0/0/0	0/8/0	4/12/4	0/0	4/12/4
62B	20/0	SSLV/NT	GP/NT	T/NA	4	0/0/0	0/8/0	4/12/4	0/0	4/12/4
64	8/8	ST/ST	SUB/SUB	WT/WT	8	0/0/0	0/2/2	8/10/10	0/0	8/10/10
64A	28/28	ST/ST	SUB/SUB	T/T	0	0/0/0	0/8/8	0/8/8	0/0	0/8/8
64B~	10/10	ST/ST	SUB/SUB	T/T	0	0/0/0	0/8/8	0/8/8	0/0	0/8/8
68#	25/0	CCR/NT	SGP/NT	S/NA	0	0/0/0	0/3/0	0/3/0	0/0	0/3/0
69~	16/16	ST/ST	SUB/SUB	S/S	0	0/0/0	0/1/1	0/1/1	0/0	0/1/1
70	14/14	ST/ST	SUB/SUB	T/T	5	0/0/0	0/8/8	5/13/13	0/0	5/13/13
70T^	9/0	ST/NT	SGP/NT	WT/NA	12	0/0/0	0/2/0	12/14/12	0/0	12/14/12
71	18/18	ST/ST	SGP/SGP	T/T	4	0/0/0	0/8/8	4/12/12	0/0	4/12/12
72	12/12	ST/ST	SGP/SGP	T/T	5	0/0/0	0/8/8	5/13/13	0/0	5/13/13
73T*^	31/29	ST/ST	SGP/SGP	WT/WT	9	0/0/0	0/2/2	9/11/11	0/0	9/11/11
74T*^	0/40	NT/SW	NT/SUB	NA/WT	8	0/0/0	0/0/2	8/8/10	0/0	8/8/10
75#	36/0	SW/NT	SUB/NT	S/NA	0	0/0/0	0/3/0	0/3/0	0/0	0/3/0
80*^	110/40	ST-SW/ST-SW	SGP/SGP	WT/WT	10	0/0/0	0/2/2	10/12/12	0/0	10/12/12
81^	36/36	ST/ST	SGP/SGP	WT/WT	8	0/0/0	0/2/2	8/10/10	0/0	8/10/10
82	25/25	ST-SW/ST-SW	SGP/SGP	T/T	4	0/0/0	0/8/8	4/12/12	0/0	4/12/12
135	16/16	IMP/IMP	SUB/SUB	T/T	3	0/0/0	0/8/8	3/11/11	0/0	3/11/11
141#	24/0	SW/NT	SUB/NT	S/NA	3	0/0/0	0/3/0	3/6/3	0/0	3/6/3
142~	9/9	ST/ST	SUB/SUB	S/S	0	0/0/0	0/1/1	0/1/1	0/0	0/1/1
143A	18/9	SW/ST	SGP/SUB	T/T	2	0/0/0	0/8/8	2/10/10	0/0	2/10/10

UNIT #	ACTIVITY AREA (acres) ALTS 2/3	PROPOSED VEGETATION TREATMENT ALT 2/3	PROPOSED FUELS TREATMENT ALT 2/3	PROPOSED LOGGING SYSTEM ALT 2/3	EXISTING DSD (%)[1]	ALTERNATIVES POTENTIAL DSD 1/2/3				
						PREDICTED TEMP ROAD DSD%[2]	PREDICTED HARVEST DSD%	CUMULATIVE DSD% POST-HARVEST	REDUCED DSD FROM REHAB[4] (%) ALTS 2/3	TOTAL POST ACTIVITY DSD (%)
144S#	22/22	ST/ST	SUB/SUB	S/S	0	0/0/0	0/3/3	0/3/3	0/0	0/3/3
144T	18/18	ST/ST	SUB/SUB	T/T	0	0/0/0	0/8/8	0/8/8	0/0	0/8/8
147~	93/40	ST/ST	SUB/SUB	T&S/T&S	4	0/0/0	0/8/8	4/12/12	0/0	4/12/12
148~	77/40	ST/ST	SUB/SUB	S/S	4	0/1/2	0/1/1	4/5/5	0/0	4/5/5
149~	65/40	ST/ST	SUB/SUB	T&S/T&S	0	0/0/0	0/8/8	0/8/8	0/0	0/8/8
150~	103/40	ST/ST	SUB/SUB	T&S/T	6	0/<1/1	0/8/8	6/14/15	0/0	6/14/15
151	40/40	ST/ST	SGP/SGP	T/T	4	0/0/0	0/8/8	4/12/12	0/0	4/12/12
157*	54/54	IMP/IMP	SUB/SUB	WT/WT	6	0/0/0	0/4/4	6/10/10	0/0	6/10/10
158*	143/143	IMP-SW/IMP-SW	SGP/SGP	WT/WT	2	0/0/0	0/4/4	2/6/6	0/0	2/6/6
158A*	0/33	NT/IMP-SW	NT/GP	NA/WT	2	0/0/0	0/0/4	2/2/6	0/0	2/2/6
159A*^	18/18	ST/ST	SGP/SUB	WT/WT	11	0/0/0	0/2/2	11/13/13	0/0	11/13/13
170#	97/40	SW/ST	SUB/SUB	S/T	0	0/0/0	0/3/8	0/3/8	0/0	0/3/8
173~	18/18	IMP/IMP	SUB/SUB	S/S	4	0/0/0	0/1/1	4/5/5	0/0	4/5/5
174~	29/29	IMP/IMP	SUB/SUB	S/S	<1	0/0/0	0/1/1	0/1/1	0/0	0/1/1
176#	15/15	IMP/IMP	SUB/SUB	S/S	2	0/0/0	0/3/3	2/5/5	0/0	2/5/5
179	76/0	IMP/NT	SGP/NT	T/NA	5	0/1/0	0/8/0	5/14/5	0/0	5/14/5
182	50/0	IMP/NT	SUB/NT	T/NA	0	0/0/0	0/8/0	0/8/0	0/0	0/8/0
183*^	68/68	IMP/IMP	SGP/SGP	WT/WT	9	0/0/0	0/2/2	9/11/11	0/0	9/11/11
185	27/27	ST/ST	SGP/SGP	T/T	4	0/0/0	0/8/8	4/12/12	0/0	4/12/12
185N	22/22	ST/ST	SGP/SGP	T/T	4	0/0/0	0/8/8	4/12/12	0/0	4/12/12
188#	40/0	ST/NT	SUB/NT	S/NA	2	0/0/0	0/3/0	2/5/2	0/0	2/5/2
188S#	0/10	NT/ST	NT/SUB	NA/S	2	0/0/0	0/0/3	2/2/5	0/0	2/2/5
190*^	43/43	IMP/IMP	SGP/SGP	WT/WT	10	0/0/0	0/2/2	10/12/12	0/0	10/14/12
190A*^	44/44	SSLV/SSLV	SGP/PCT-GP	WT/WT	10	0/0/0	0/2/2	10/12/12	0/0	10/10/12
192~	40/40	IMP/IMP	SUB/SUB	S/S	1	0/0/0	0/1/1	1/2/2	0/0	1/2/2
193	17/17	SW/SW	GP/GP	T/T	2	0/0/0	0/8/8	2/10/10	0/0	2/10/10
194S^#	36/36	IMP/IMP	SUB/SUB	S/S	14	0/0/0	0/3/3	14/17/17	2/2	14/15/15
194T*^	31/31	IMP/IMP	SGP/SUB	WT/WT	14	0/0/0	0/2/2	14/16/16	1/1	14/15/15
195	28/28	SSLV/SSLV	SGP/SGP	T/T	2	0/0/0	0/8/8	2/10/10	0/0	2/10/10
196*^	14/14	IMP/IMP	SGP/SGP	WT/WT	12	0/0/0	0/2/2	12/14/14	0/0	12/14/14
197	24/24	IMP/IMP	SGP/SGP	T/T	2	0/1/1	0/8/8	2/11/11	0/0	2/11/11
203	59/59	IMP/IMP	SGP/SUB	T/T	5	0/0/0	0/8/8	5/13/13	0/0	5/13/13
205	34/34	IMP/IMP	SGP/SUB	T/T	1	0/0/0	0/8/8	1/9/9	0/0	1/9/9
207	40/40	SW/SW	SGP/SUB	T/T	2	0/0/0	0/8/8	2/10/10	0/0	2/10/10
208	40/40	ST/ST	SGP/SUB	T/T	2	0/0/0	0/8/8	2/10/10	0/0	2/10/10
209	24/24	IMP/IMP	SGP/SGP	T/T	2	0/0/0	0/8/8	2/10/10	0/0	2/10/10
214	6/6	ST/ST	SGP/SGP	T/T	1	0/0/0	0/8/8	1/9/9	0/0	1/9/9
219	38/38	ST/ST	SGP/SGP	T/T	5	0/0/0	0/8/8	5/13/13	0/0	5/13/13
220	0/35	NT/CCR	NT/UB	NA/T	4	0/0/0	0/0/8	4/4/12	0/0	4/4/12
362	192/0	CCR/NT	SGP/NT	T/NA	2	0/<1/0	0/8/0	2/10/2	0/0	2/10/2
362A	0/40	NT/CCR	NT/GP	NA/T	2	0/0/0	0/0/8	2/2/10	0/0	2/2/10
362B	0/40	NT/CCR	NT/UB	NA/T	2	0/0/1	0/0/8	2/2/11	0/0	2/2/11
362C	0/39	NT/CCR	NT/UB	NA/T	2	0/0/2	0/0/8	2/2/12	0/0	2/2/12
363	40/40	CCR/CCR	SGP/UB	T/T	4	0/0/0	0/8/8	4/12/12	0/0	4/12/12

UNIT #	ACTIVITY AREA (acres) ALTS 2/3	PROPOSED VEGETATION TREATMENT ALT 2/3	PROPOSED FUELS TREATMENT ALT 2/3	PROPOSED LOGGING SYSTEM ALT 2/3	EXISTING DSD (%)[1]	ALTERNATIVES POTENTIAL DSD 1/2/3				
						PREDICTED TEMP ROAD DSD%[2]	PREDICTED HARVEST DSD%	CUMULATIVE DSD% POST-HARVEST	REDUCED DSD FROM REHAB[4] (%) ALTS 2/3	TOTAL POST ACTIVITY DSD (%)
364	33/33	CCR/CCR	SUB/UB	T/T	0	0/0/0	0/8/8	0/8/8	0/0	0/8/8
365	25/25	CCR/CCR	SUB/UB	T/T	0	0/0/0	0/8/8	0/8/8	0/0	0/8/8
366	6/6	CCR/CCR	SUB/UB	T/T	0	0/0/0	0/8/8	0/8/8	0/0	0/8/8
367	38/38	CCR/CCR	SUB/UB	T/T	0	0/0/0	0/8/8	0/8/8	0/0	0/8/8
367A	40/40	CCR/CCR	SUB/UB	T/T	0	0/0/0	0/8/8	0/8/8	0/0	0/8/8
368	0/40	NT/CCR	NT/UB	NA/T	0	0/0/0	0/0/8	0/0/8	0/0	0/0/8
368A	10/0	CCR/NT	SGP/NT	T/NA	0	0/0/0	0/8/0	0/8/0	0/0	0/8/0
368B	6/0	CCR/NT	SGP/NT	T/NA	0	0/0/0	0/8/0	0/8/0	0/0	0/8/0
368C	7/0	CCR/NT	SGP/NT	T/NA	0	0/0/0	0/8/0	0/8/0	0/0	0/8/0
369	40/40	CCR/CCR	SGP/GP	T/T	0	0/0/0	0/8/8	0/8/8	0/0	0/8/8
TOTAL ACRES by ALTERNATIVE: Alt 2 = 6,589 Alt 3 = 5,817										
COMMERCIAL THINNING HARVEST OPERATIONS *Higher rehab acres										
219A	26/32	CT/CT	WTY/WTY	T/T	5	0/0/0	0/8/8	5/13/13	0/0	5/13/13
305*^	43/43	CT/CT	WTY/WTY	WT/WT	11	0/0/0	0/2/2	11/13/13	0/0	11/13/13
306	57/57	CT/CT	WTY/WTY	WT/WT	4	0/0/0	0/4/4	4/8/8	0/0	4/8/8
307*^	305/304	CT/CT	WTY/WTY	WT/WT	8	0/0/0	0/2/2	8/10/10	0/0	8/10/10
311*^	9/0	CT/NT	WTY/NT	WT/NA	11	0/0/0	0/2/0	11/13/11	0/0	11/13/11
317	63/63	CT/CT	WTY/WTY	T/T	3	0/0/0	0/8/8	3/11/11	0/0	3/11/11
318*^	131/131	CT/CT	WTY/WTY	WT/WT	13	0/<1/0	0/2/2	13/15/15	0/0	13/15/15
319*^	17/17	CT/CT	WTY/WTY	WT/WT	12	0/0/0	0/2/2	12/14/14	0/0	12/14/14
327*^	46/46	CT/CT	WTY/WTY	WT/WT	12	0/0/0	0/2/2	12/14/14	0/0	12/14/14
328*^	31/31	CT/CT	WTY/WTY	WT/WT	10	0/0/0	0/2/2	10/12/12	0/0	10/12/12
330*^	9/9	CT/CT	WTY/WTY	WT/WT	14	0/0/0	0/2/2	14/16/16	1/1	14/15/15
331*^	16/16	CT/CT	WTY/WTY	WT/WT	14	0/0/0	0/2/2	14/16/16	1/1	14/15/15
332	10/10	CT/CT	WTY/WTY	T/T	4	0/0/0	0/8/8	4/12/12	0/0	4/12/12
333	14/14	CT/CT	WTY/WTY	T/T	3	0/0/0	0/8/8	3/11/11	0/0	3/11/11
334*^	22/22	CT/CT	WTY/WTY	WT/WT	9	0/0/0	0/2/2	9/11/11	0/0	9/11/11
335*^	20/20	CT/CT	WTY/WTY	WT/WT	8	0/0/0	0/2/2	8/10/10	0/0	8/10/10
337	272/0	CT/NT	WTY/NT	T/NA	7	0/0/0	0/8/0	7/15/7	0/0	7/15/7
339*^	89/89	CT/NT	WTY/WTY	WT/WT	10	0/0/0	0/2/2	10/12/12	0/0	10/12/12
340*^	266/266	CT/CT	WTY/WTY	WT/WT	12	0/<1/<1	0/2/2	12/14/14	0/0	12/14/14
343	100/93	CT/CT	WTY/WTY	T/T	7	0/<1/<1	0/8/8	7/15/15	0/0	7/15/15
344*^	73/64	CT/CT	WTY/WTY	WT/WT	11	0/1/1	0/2/2	11/14/14	0/0	11/14/14
345*^	45/45	CT/CT	WTY/WTY	WT/WT	8	0/2/2	0/2/2	8/12/12	0/0	8/12/12
346*^	11/11	CT/CT	WTY/WTY	WT/WT	8	0/0/0	0/2/2	8/10/10	0/0	8/10/10
347*^	520/520	CT/CT	WTY/WTY	WT/WT	11	0/0/0	0/2/2	11/13/13	0/0	11/13/13
348	14/14	CT/CT	WTY/WTY	T/T	4	0/0/0	0/8/8	4/12/12	0/0	4/12/12
349*^	21/21	CT/CT	WTY/WTY	WT/WT	10	0/0/0	0/2/2	10/12/12	0/0	10/12/12
350*^	26/26	CT/CT	WTY/WTY	WT/WT	8	0/0/0	0/2/2	8/10/10	0/0	8/10/10
TOTAL CT ACRES BY ALTERNATIVE: ALT 2 = 2,256 ALT 3 = 1,965										
WHITE PINE DAYLIGHT THIN UNITS										
237	21/0	WPDT/NT	CSH/NT	NEq/NA	DNA	0/0/0	0/0/0	0/0/0	0/0	0/0/0
238	8/0	WPDT/NT	CSH/NT	NEq/NA	DNA	0/0/0	0/0/0	0/0/0	0/0	0/0/0

UNIT #	ACTIVITY AREA (acres) ALTS 2/3	PROPOSED VEGETATION TREATMENT ALT 2/3	PROPOSED FUELS TREATMENT ALT 2/3	PROPOSED LOGGING SYSTEM ALT 2/3	EXISTING DSD (%)[1]	ALTERNATIVES POTENTIAL DSD 1/2/3				
						PREDICTED TEMP ROAD DSD%[2]	PREDICTED HARVEST DSD%	CUMULATIVE DSD% POST-HARVEST	REDUCED DSD FROM REHAB[4] (%) ALTS 2/3	TOTAL POST ACTIVITY DSD (%)
239	5/0	WPDT/NT	CSH/NT	NEq/NA	DNA	0/0/0	0/0/0	0/0/0	0/0	0/0/0
240	15/0	WPDT/NT	CSH/NT	NEq/NA	DNA	0/0/0	0/0/0	0/0/0	0/0	0/0/0
241	22/0	WPDT/NT	CSH/NT	NEq/NA	DNA	0/0/0	0/0/0	0/0/0	0/0	0/0/0
242	44/0	WPDT/NT	CSH/NT	NEq/NA	DNA	0/0/0	0/0/0	0/0/0	0/0	0/0/0
243	2/0	WPDT/NT	CSH/NT	NEq/NA	DNA	0/0/0	0/0/0	0/0/0	0/0	0/0/0
244	18/0	WPDT/NT	CSH/NT	NEq/NA	DNA	0/0/0	0/0/0	0/0/0	0/0	0/0/0
245	14/0	WPDT/NT	CSH/NT	NEq/NA	DNA	0/0/0	0/0/0	0/0/0	0/0	0/0/0
246	23/0	WPDT/NT	CSH/NT	NEq/NA	DNA	0/0/0	0/0/0	0/0/0	0/0	0/0/0
247	17/0	WPDT/NT	CSH/NT	NEq/NA	DNA	0/0/0	0/0/0	0/0/0	0/0	0/0/0
248	41/0	WPDT/NT	CSH/NT	NEq/NA	DNA	0/0/0	0/0/0	0/0/0	0/0	0/0/0
249	211/0	WPDT/NT	CSH/NT	NEq/NA	DNA	0/0/0	0/0/0	0/0/0	0/0	0/0/0
250	56/0	WPDT/NT	CSH/NT	NEq/NA	DNA	0/0/0	0/0/0	0/0/0	0/0	0/0/0
251	41/0	WPDT/NT	CSH/NT	NEq/NA	DNA	0/0/0	0/0/0	0/0/0	0/0	0/0/0
252	8/0	WPDT/NT	CSH/NT	NEq/NA	DNA	0/0/0	0/0/0	0/0/0	0/0	0/0/0
253	20/0	WPDT/NT	CSH/NT	NEq/NA	DNA	0/0/0	0/0/0	0/0/0	0/0	0/0/0
254	31/0	WPDT/NT	CSH/NT	NEq/NA	DNA	0/0/0	0/0/0	0/0/0	0/0	0/0/0
255	34/0	WPDT/NT	CSH/NT	NEq/NA	DNA	0/0/0	0/0/0	0/0/0	0/0	0/0/0
256	11/0	WPDT/NT	CSH/NT	NEq/NA	DNA	0/0/0	0/0/0	0/0/0	0/0	0/0/0
257	28/0	WPDT/NT	CSH/NT	NEq/NA	DNA	0/0/0	0/0/0	0/0/0	0/0	0/0/0
258	17/0	WPDT/NT	CSH/NT	NEq/NA	DNA	0/0/0	0/0/0	0/0/0	0/0	0/0/0
259	24/0	WPDT/NT	CSH/NT	NEq/NA	DNA	0/0/0	0/0/0	0/0/0	0/0	0/0/0
260	20/0	WPDT/NT	CSH/NT	NEq/NA	DNA	0/0/0	0/0/0	0/0/0	0/0	0/0/0
261	39/0	WPDT/NT	CSH/NT	NEq/NA	DNA	0/0/0	0/0/0	0/0/0	0/0	0/0/0
262	14/0	WPDT/NT	CSH/NT	NEq/NA	DNA	0/0/0	0/0/0	0/0/0	0/0	0/0/0
263	27/0	WPDT/NT	CSH/NT	NEq/NA	DNA	0/0/0	0/0/0	0/0/0	0/0	0/0/0
264	33/0	WPDT/NT	CSH/NT	NEq/NA	DNA	0/0/0	0/0/0	0/0/0	0/0	0/0/0
265	29/0	WPDT/NT	CSH/NT	NEq/NA	DNA	0/0/0	0/0/0	0/0/0	0/0	0/0/0
266	27/0	WPDT/NT	CSH/NT	NEq/NA	DNA	0/0/0	0/0/0	0/0/0	0/0	0/0/0
267	16/0	WPDT/NT	CSH/NT	NEq/NA	DNA	0/0/0	0/0/0	0/0/0	0/0	0/0/0
268	60/0	WPDT/NT	CSH/NT	NEq/NA	DNA	0/0/0	0/0/0	0/0/0	0/0	0/0/0
269	24/0	WPDT/NT	CSH/NT	NEq/NA	DNA	0/0/0	0/0/0	0/0/0	0/0	0/0/0
270	16/0	WPDT/NT	CSH/NT	NEq/NA	DNA	0/0/0	0/0/0	0/0/0	0/0	0/0/0
271	36/0	WPDT/NT	CSH/NT	NEq/NA	DNA	0/0/0	0/0/0	0/0/0	0/0	0/0/0
272	3/0	WPDT/NT	CSH/NT	NEq/NA	DNA	0/0/0	0/0/0	0/0/0	0/0	0/0/0
273	3/0	WPDT/NT	CSH/NT	NEq/NA	DNA	0/0/0	0/0/0	0/0/0	0/0	0/0/0
TOTAL WHITE PINE DAYLIGHT THIN ACRES BY ALTERNATIVE: ALT 2 = 1,060 ALT 3 = 0										
PRECOMMERCIAL THIN UNITS										
1	30/30	PCT/PCT	CSH/CSH	NEq/NEq	DNA	0/0/0	0/0/0	0/0/0	0/0	0/0/0
2	15/15	PCT/PCT	CSH/CSH	NEq/NEq	DNA	0/0/0	0/0/0	0/0/0	0/0	0/0/0
3	31/31	PCT/PCT	CSH/CSH	NEq/NEq	DNA	0/0/0	0/0/0	0/0/0	0/0	0/0/0
4	2/2	PCT/PCT	CSH/CSH	NEq/NEq	DNA	0/0/0	0/0/0	0/0/0	0/0	0/0/0
5	3/3	PCT/PCT	CSH/CSH	NEq/NEq	DNA	0/0/0	0/0/0	0/0/0	0/0	0/0/0
6	20/20	PCT/PCT	CSH/CSH	NEq/NEq	DNA	0/0/0	0/0/0	0/0/0	0/0	0/0/0
7	29/29	PCT/PCT	CSH/CSH	NEq/NEq	DNA	0/0/0	0/0/0	0/0/0	0/0	0/0/0

UNIT #	ACTIVITY AREA (acres) ALTS 2/3	PROPOSED VEGETATION TREATMENT ALT 2/3	PROPOSED FUELS TREATMENT ALT 2/3	PROPOSED LOGGING SYSTEM ALT 2/3	EXISTING DSD (%)[1]	ALTERNATIVES POTENTIAL DSD 1/2/3				
						PREDICTED TEMP ROAD DSD%[2]	PREDICTED HARVEST DSD%	CUMULATIVE DSD% POST-HARVEST	REDUCED DSD FROM REHAB[4] (%) ALTS 2/3	TOTAL POST ACTIVITY DSD (%)
8	21/21	PCT/PCT	CSH/CSH	NEq/NEq	DNA	0/0/0	0/0/0	0/0/0	0/0	0/0/0
9	19/19	PCT/PCT	CSH/CSH	NEq/NEq	DNA	0/0/0	0/0/0	0/0/0	0/0	0/0/0
10	21/21	PCT/PCT	CSH/CSH	NEq/NEq	DNA	0/0/0	0/0/0	0/0/0	0/0	0/0/0
11	29/29	PCT/PCT	CSH/CSH	NEq/NEq	DNA	0/0/0	0/0/0	0/0/0	0/0	0/0/0
12	11/11	PCT/PCT	CSH/CSH	NEq/NEq	DNA	0/0/0	0/0/0	0/0/0	0/0	0/0/0
13	24/24	PCT/PCT	CSH/CSH	NEq/NEq	DNA	0/0/0	0/0/0	0/0/0	0/0	0/0/0
14	15/15	PCT/PCT	CSH/CSH	NEq/NEq	DNA	0/0/0	0/0/0	0/0/0	0/0	0/0/0
15	14/14	PCT/PCT	CSH/CSH	NEq/NEq	DNA	0/0/0	0/0/0	0/0/0	0/0	0/0/0
16	15/15	PCT/PCT	CSH/CSH	NEq/NEq	DNA	0/0/0	0/0/0	0/0/0	0/0	0/0/0
17	22/22	PCT/PCT	CSH/CSH	NEq/NEq	DNA	0/0/0	0/0/0	0/0/0	0/0	0/0/0
18	11/11	PCT/PCT	CSH/CSH	NEq/NEq	DNA	0/0/0	0/0/0	0/0/0	0/0	0/0/0
19	19/19	PCT/PCT	CSH/CSH	NEq/NEq	DNA	0/0/0	0/0/0	0/0/0	0/0	0/0/0
20	6/6	PCT/PCT	CSH/CSH	NEq/NEq	DNA	0/0/0	0/0/0	0/0/0	0/0	0/0/0
21	7/7	PCT/PCT	CSH/CSH	NEq/NEq	DNA	0/0/0	0/0/0	0/0/0	0/0	0/0/0
22	7/7	PCT/PCT	CSH/CSH	NEq/NEq	DNA	0/0/0	0/0/0	0/0/0	0/0	0/0/0
23	2/2	PCT/PCT	CSH/CSH	NEq/NEq	DNA	0/0/0	0/0/0	0/0/0	0/0	0/0/0
24	2/2	PCT/PCT	CSH/CSH	NEq/NEq	DNA	0/0/0	0/0/0	0/0/0	0/0	0/0/0
25	38/38	PCT/PCT	CSH/CSH	NEq/NEq	DNA	0/0/0	0/0/0	0/0/0	0/0	0/0/0
26	51/51	PCT/PCT	CSH/CSH	NEq/NEq	DNA	0/0/0	0/0/0	0/0/0	0/0	0/0/0
27	25/25	PCT/PCT	CSH/CSH	NEq/NEq	DNA	0/0/0	0/0/0	0/0/0	0/0	0/0/0
28	11/11	PCT/PCT	CSH/CSH	NEq/NEq	DNA	0/0/0	0/0/0	0/0/0	0/0	0/0/0
29	26/26	PCT/PCT	CSH/CSH	NEq/NEq	DNA	0/0/0	0/0/0	0/0/0	0/0	0/0/0
30	42/42	PCT/PCT	CSH/CSH	NEq/NEq	DNA	0/0/0	0/0/0	0/0/0	0/0	0/0/0
31	25/25	PCT/PCT	CSH/CSH	NEq/NEq	DNA	0/0/0	0/0/0	0/0/0	0/0	0/0/0
32	48/48	PCT/PCT	CSH/CSH	NEq/NEq	DNA	0/0/0	0/0/0	0/0/0	0/0	0/0/0
33	6/6	PCT/PCT	CSH/CSH	NEq/NEq	DNA	0/0/0	0/0/0	0/0/0	0/0	0/0/0
36	12/12	PCT/PCT	CSH/CSH	NEq/NEq	DNA	0/0/0	0/0/0	0/0/0	0/0	0/0/0
37	7/7	PCT/PCT	CSH/CSH	NEq/NEq	DNA	0/0/0	0/0/0	0/0/0	0/0	0/0/0
38	6/6	PCT/PCT	CSH/CSH	NEq/NEq	DNA	0/0/0	0/0/0	0/0/0	0/0	0/0/0
39	11/11	PCT/PCT	CSH/CSH	NEq/NEq	DNA	0/0/0	0/0/0	0/0/0	0/0	0/0/0
40	12/12	PCT/PCT	CSH/CSH	NEq/NEq	DNA	0/0/0	0/0/0	0/0/0	0/0	0/0/0
41	14/14	PCT/PCT	CSH/CSH	NEq/NEq	DNA	0/0/0	0/0/0	0/0/0	0/0	0/0/0
42	28/28	PCT/PCT	CSH/CSH	NEq/NEq	DNA	0/0/0	0/0/0	0/0/0	0/0	0/0/0
43	6/6	PCT/PCT	CSH/CSH	NEq/NEq	DNA	0/0/0	0/0/0	0/0/0	0/0	0/0/0
44	57/57	PCT/PCT	CSH/CSH	NEq/NEq	DNA	0/0/0	0/0/0	0/0/0	0/0	0/0/0
45	13/13	PCT/PCT	CSH/CSH	NEq/NEq	DNA	0/0/0	0/0/0	0/0/0	0/0	0/0/0
46	7/7	PCT/PCT	CSH/CSH	NEq/NEq	DNA	0/0/0	0/0/0	0/0/0	0/0	0/0/0
47	20/20	PCT/PCT	CSH/CSH	NEq/NEq	DNA	0/0/0	0/0/0	0/0/0	0/0	0/0/0
48	42/42	PCT/PCT	CSH/CSH	NEq/NEq	DNA	0/0/0	0/0/0	0/0/0	0/0	0/0/0
49	44/44	PCT/PCT	CSH/CSH	NEq/NEq	DNA	0/0/0	0/0/0	0/0/0	0/0	0/0/0
50	55/55	PCT/PCT	CSH/CSH	NEq/NEq	DNA	0/0/0	0/0/0	0/0/0	0/0	0/0/0
51	11/11	PCT/PCT	CSH/CSH	NEq/NEq	DNA	0/0/0	0/0/0	0/0/0	0/0	0/0/0
52	18/18	PCT/PCT	CSH/CSH	NEq/NEq	DNA	0/0/0	0/0/0	0/0/0	0/0	0/0/0
53	16/16	PCT/PCT	CSH/CSH	NEq/NEq	DNA	0/0/0	0/0/0	0/0/0	0/0	0/0/0

UNIT #	ACTIVITY AREA (acres) ALTS 2/3	PROPOSED VEGETATION TREATMENT ALT 2/3	PROPOSED FUELS TREATMENT ALT 2/3	PROPOSED LOGGING SYSTEM ALT 2/3	EXISTING DSD (%)[1]	ALTERNATIVES POTENTIAL DSD 1/2/3				
						PREDICTED TEMP ROAD DSD%[2]	PREDICTED HARVEST DSD%	CUMULATIVE DSD% POST-HARVEST	REDUCED DSD FROM REHAB[4] (%) ALTS 2/3	TOTAL POST ACTIVITY DSD (%)
54	11/11	PCT/PCT	CSH/CSH	NEq/NEq	DNA	0/0/0	0/0/0	0/0/0	0/0	0/0/0
55	5/5	PCT/PCT	CSH/CSH	NEq/NEq	DNA	0/0/0	0/0/0	0/0/0	0/0	0/0/0
56	32/32	PCT/PCT	CSH/CSH	NEq/NEq	DNA	0/0/0	0/0/0	0/0/0	0/0	0/0/0
57	73/73	PCT/PCT	CSH/CSH	NEq/NEq	DNA	0/0/0	0/0/0	0/0/0	0/0	0/0/0
58	27/27	PCT/PCT	CSH/CSH	NEq/NEq	DNA	0/0/0	0/0/0	0/0/0	0/0	0/0/0
59	63/63	PCT/PCT	CSH/CSH	NEq/NEq	DNA	0/0/0	0/0/0	0/0/0	0/0	0/0/0
60	74/74	PCT/PCT	CSH/CSH	NEq/NEq	DNA	0/0/0	0/0/0	0/0/0	0/0	0/0/0
61	7/7	PCT/PCT	CSH/CSH	NEq/NEq	DNA	0/0/0	0/0/0	0/0/0	0/0	0/0/0
62	3/3	PCT/PCT	CSH/CSH	NEq/NEq	DNA	0/0/0	0/0/0	0/0/0	0/0	0/0/0
63	3/3	PCT/PCT	CSH/CSH	NEq/NEq	DNA	0/0/0	0/0/0	0/0/0	0/0	0/0/0
64	12/12	PCT/PCT	CSH/CSH	NEq/NEq	DNA	0/0/0	0/0/0	0/0/0	0/0	0/0/0
65	9/9	PCT/PCT	CSH/CSH	NEq/NEq	DNA	0/0/0	0/0/0	0/0/0	0/0	0/0/0
66	8/8	PCT/PCT	CSH/CSH	NEq/NEq	DNA	0/0/0	0/0/0	0/0/0	0/0	0/0/0
67	37/37	PCT/PCT	CSH/CSH	NEq/NEq	DNA	0/0/0	0/0/0	0/0/0	0/0	0/0/0
68	7/7	PCT/PCT	CSH/CSH	NEq/NEq	DNA	0/0/0	0/0/0	0/0/0	0/0	0/0/0
69	13/13	PCT/PCT	CSH/CSH	NEq/NEq	DNA	0/0/0	0/0/0	0/0/0	0/0	0/0/0
70	43/43	PCT/PCT	CSH/CSH	NEq/NEq	DNA	0/0/0	0/0/0	0/0/0	0/0	0/0/0
71	2/2	PCT/PCT	CSH/CSH	NEq/NEq	DNA	0/0/0	0/0/0	0/0/0	0/0	0/0/0
72	28/28	PCT/PCT	CSH/CSH	NEq/NEq	DNA	0/0/0	0/0/0	0/0/0	0/0	0/0/0
73	85/85	PCT/PCT	CSH/CSH	NEq/NEq	DNA	0/0/0	0/0/0	0/0/0	0/0	0/0/0
74	15/15	PCT/PCT	CSH/CSH	NEq/NEq	DNA	0/0/0	0/0/0	0/0/0	0/0	0/0/0
75	3/3	PCT/PCT	CSH/CSH	NEq/NEq	DNA	0/0/0	0/0/0	0/0/0	0/0	0/0/0
76	63/63	PCT/PCT	CSH/CSH	NEq/NEq	DNA	0/0/0	0/0/0	0/0/0	0/0	0/0/0
77	53/53	PCT/PCT	CSH/CSH	NEq/NEq	DNA	0/0/0	0/0/0	0/0/0	0/0	0/0/0
78	34/34	PCT/PCT	CSH/CSH	NEq/NEq	DNA	0/0/0	0/0/0	0/0/0	0/0	0/0/0
79	24/24	PCT/PCT	CSH/CSH	NEq/NEq	DNA	0/0/0	0/0/0	0/0/0	0/0	0/0/0
81	26/26	PCT/PCT	CSH/CSH	NEq/NEq	DNA	0/0/0	0/0/0	0/0/0	0/0	0/0/0
82	11/11	PCT/PCT	CSH/CSH	NEq/NEq	DNA	0/0/0	0/0/0	0/0/0	0/0	0/0/0
83	31/31	PCT/PCT	CSH/CSH	NEq/NEq	DNA	0/0/0	0/0/0	0/0/0	0/0	0/0/0
84	35/35	PCT/PCT	CSH/CSH	NEq/NEq	DNA	0/0/0	0/0/0	0/0/0	0/0	0/0/0
85	40/40	PCT/PCT	CSH/CSH	NEq/NEq	DNA	0/0/0	0/0/0	0/0/0	0/0	0/0/0
86	49/49	PCT/PCT	CSH/CSH	NEq/NEq	DNA	0/0/0	0/0/0	0/0/0	0/0	0/0/0
87	35/35	PCT/PCT	CSH/CSH	NEq/NEq	DNA	0/0/0	0/0/0	0/0/0	0/0	0/0/0
88	39/39	PCT/PCT	CSH/CSH	NEq/NEq	DNA	0/0/0	0/0/0	0/0/0	0/0	0/0/0
89	11/11	PCT/PCT	CSH/CSH	NEq/NEq	DNA	0/0/0	0/0/0	0/0/0	0/0	0/0/0
90	3/3	PCT/PCT	CSH/CSH	NEq/NEq	DNA	0/0/0	0/0/0	0/0/0	0/0	0/0/0
91	16/16	PCT/PCT	CSH/CSH	NEq/NEq	DNA	0/0/0	0/0/0	0/0/0	0/0	0/0/0
92	19/19	PCT/PCT	CSH/CSH	NEq/NEq	DNA	0/0/0	0/0/0	0/0/0	0/0	0/0/0
93	6/6	PCT/PCT	CSH/CSH	NEq/NEq	DNA	0/0/0	0/0/0	0/0/0	0/0	0/0/0
94	10/10	PCT/PCT	CSH/CSH	NEq/NEq	DNA	0/0/0	0/0/0	0/0/0	0/0	0/0/0
95	3/3	PCT/PCT	CSH/CSH	NEq/NEq	DNA	0/0/0	0/0/0	0/0/0	0/0	0/0/0
96	8/8	PCT/PCT	CSH/CSH	NEq/NEq	DNA	0/0/0	0/0/0	0/0/0	0/0	0/0/0
97	2/2	PCT/PCT	CSH/CSH	NEq/NEq	DNA	0/0/0	0/0/0	0/0/0	0/0	0/0/0
98	48/48	PCT/PCT	CSH/CSH	NEq/NEq	DNA	0/0/0	0/0/0	0/0/0	0/0	0/0/0

UNIT #	ACTIVITY AREA (acres) ALTS 2/3	PROPOSED VEGETATION TREATMENT ALT 2/3	PROPOSED FUELS TREATMENT ALT 2/3	PROPOSED LOGGING SYSTEM ALT 2/3	EXISTING DSD (%)[1]	ALTERNATIVES POTENTIAL DSD 1/2/3				
						PREDICTED TEMP ROAD DSD%[2]	PREDICTED HARVEST DSD%	CUMULATIVE DSD% POST-HARVEST	REDUCED DSD FROM REHAB[4] (%) ALTS 2/3	TOTAL POST ACTIVITY DSD (%)
99	30/30	PCT/PCT	CSH/CSH	NEq/NEq	DNA	0/0/0	0/0/0	0/0/0	0/0	0/0/0
100	24/24	PCT/PCT	CSH/CSH	NEq/NEq	DNA	0/0/0	0/0/0	0/0/0	0/0	0/0/0
101	46/46	PCT/PCT	CSH/CSH	NEq/NEq	DNA	0/0/0	0/0/0	0/0/0	0/0	0/0/0
102	4/4	PCT/PCT	CSH/CSH	NEq/NEq	DNA	0/0/0	0/0/0	0/0/0	0/0	0/0/0
103	19/19	PCT/PCT	CSH/CSH	NEq/NEq	DNA	0/0/0	0/0/0	0/0/0	0/0	0/0/0
104	31/31	PCT/PCT	CSH/CSH	NEq/NEq	DNA	0/0/0	0/0/0	0/0/0	0/0	0/0/0
105	11/11	PCT/PCT	CSH/CSH	NEq/NEq	DNA	0/0/0	0/0/0	0/0/0	0/0	0/0/0
106	9/9	PCT/PCT	CSH/CSH	NEq/NEq	DNA	0/0/0	0/0/0	0/0/0	0/0	0/0/0
108	15/15	PCT/PCT	CSH/CSH	NEq/NEq	DNA	0/0/0	0/0/0	0/0/0	0/0	0/0/0
109	18/18	PCT/PCT	CSH/CSH	NEq/NEq	DNA	0/0/0	0/0/0	0/0/0	0/0	0/0/0
110	12/12	PCT/PCT	CSH/CSH	NEq/NEq	DNA	0/0/0	0/0/0	0/0/0	0/0	0/0/0
111	30/30	PCT/PCT	CSH/CSH	NEq/NEq	DNA	0/0/0	0/0/0	0/0/0	0/0	0/0/0
112	24/24	PCT/PCT	CSH/CSH	NEq/NEq	DNA	0/0/0	0/0/0	0/0/0	0/0	0/0/0
113	4/4	PCT/PCT	CSH/CSH	NEq/NEq	DNA	0/0/0	0/0/0	0/0/0	0/0	0/0/0
114	45/45	PCT/PCT	CSH/CSH	NEq/NEq	DNA	0/0/0	0/0/0	0/0/0	0/0	0/0/0
115	14/14	PCT/PCT	CSH/CSH	NEq/NEq	DNA	0/0/0	0/0/0	0/0/0	0/0	0/0/0
116	9/9	PCT/PCT	CSH/CSH	NEq/NEq	DNA	0/0/0	0/0/0	0/0/0	0/0	0/0/0
117	16/16	PCT/PCT	CSH/CSH	NEq/NEq	DNA	0/0/0	0/0/0	0/0/0	0/0	0/0/0
118	39/39	PCT/PCT	CSH/CSH	NEq/NEq	DNA	0/0/0	0/0/0	0/0/0	0/0	0/0/0
119	27/27	PCT/PCT	CSH/CSH	NEq/NEq	DNA	0/0/0	0/0/0	0/0/0	0/0	0/0/0
120	22/22	PCT/PCT	CSH/CSH	NEq/NEq	DNA	0/0/0	0/0/0	0/0/0	0/0	0/0/0
121	16/16	PCT/PCT	CSH/CSH	NEq/NEq	DNA	0/0/0	0/0/0	0/0/0	0/0	0/0/0
122	32/32	PCT/PCT	CSH/CSH	NEq/NEq	DNA	0/0/0	0/0/0	0/0/0	0/0	0/0/0
123	4/4	PCT/PCT	CSH/CSH	NEq/NEq	DNA	0/0/0	0/0/0	0/0/0	0/0	0/0/0
124	47/47	PCT/PCT	CSH/CSH	NEq/NEq	DNA	0/0/0	0/0/0	0/0/0	0/0	0/0/0
125	9/9	PCT/PCT	CSH/CSH	NEq/NEq	DNA	0/0/0	0/0/0	0/0/0	0/0	0/0/0
126	4/4	PCT/PCT	CSH/CSH	NEq/NEq	DNA	0/0/0	0/0/0	0/0/0	0/0	0/0/0
127	12/12	PCT/PCT	CSH/CSH	NEq/NEq	DNA	0/0/0	0/0/0	0/0/0	0/0	0/0/0
128	7/7	PCT/PCT	CSH/CSH	NEq/NEq	DNA	0/0/0	0/0/0	0/0/0	0/0	0/0/0
129	25/25	PCT/PCT	CSH/CSH	NEq/NEq	DNA	0/0/0	0/0/0	0/0/0	0/0	0/0/0
130	19/19	PCT/PCT	CSH/CSH	NEq/NEq	DNA	0/0/0	0/0/0	0/0/0	0/0	0/0/0
131	16/16	PCT/PCT	CSH/CSH	NEq/NEq	DNA	0/0/0	0/0/0	0/0/0	0/0	0/0/0
132	23/23	PCT/PCT	CSH/CSH	NEq/NEq	DNA	0/0/0	0/0/0	0/0/0	0/0	0/0/0
133	27/27	PCT/PCT	CSH/CSH	NEq/NEq	DNA	0/0/0	0/0/0	0/0/0	0/0	0/0/0
134	14/14	PCT/PCT	CSH/CSH	NEq/NEq	DNA	0/0/0	0/0/0	0/0/0	0/0	0/0/0
135	12/12	PCT/PCT	CSH/CSH	NEq/NEq	DNA	0/0/0	0/0/0	0/0/0	0/0	0/0/0
136	14/14	PCT/PCT	CSH/CSH	NEq/NEq	DNA	0/0/0	0/0/0	0/0/0	0/0	0/0/0
137	6/6	PCT/PCT	CSH/CSH	NEq/NEq	DNA	0/0/0	0/0/0	0/0/0	0/0	0/0/0
138	6/6	PCT/PCT	CSH/CSH	NEq/NEq	DNA	0/0/0	0/0/0	0/0/0	0/0	0/0/0
139	15/15	PCT/PCT	CSH/CSH	NEq/NEq	DNA	0/0/0	0/0/0	0/0/0	0/0	0/0/0
140	4/4	PCT/PCT	CSH/CSH	NEq/NEq	DNA	0/0/0	0/0/0	0/0/0	0/0	0/0/0
141	20/20	PCT/PCT	CSH/CSH	NEq/NEq	DNA	0/0/0	0/0/0	0/0/0	0/0	0/0/0
142	23/23	PCT/PCT	CSH/CSH	NEq/NEq	DNA	0/0/0	0/0/0	0/0/0	0/0	0/0/0
143	28/28	PCT/PCT	CSH/CSH	NEq/NEq	DNA	0/0/0	0/0/0	0/0/0	0/0	0/0/0

UNIT #	ACTIVITY AREA (acres) ALTS 2/3	PROPOSED VEGETATION TREATMENT ALT 2/3	PROPOSED FUELS TREATMENT ALT 2/3	PROPOSED LOGGING SYSTEM ALT 2/3	EXISTING DSD (%)[1]	ALTERNATIVES POTENTIAL DSD 1/2/3				
						PREDICTED TEMP ROAD DSD%[2]	PREDICTED HARVEST DSD%	CUMULATIVE DSD% POST-HARVEST	REDUCED DSD FROM REHAB[4] (%) ALTS 2/3	TOTAL POST ACTIVITY DSD (%)
144	5/5	PCT/PCT	CSH/CSH	NEq/NEq	DNA	0/0/0	0/0/0	0/0/0	0/0	0/0/0
145	4/4	PCT/PCT	CSH/CSH	NEq/NEq	DNA	0/0/0	0/0/0	0/0/0	0/0	0/0/0
146	1/1	PCT/PCT	CSH/CSH	NEq/NEq	DNA	0/0/0	0/0/0	0/0/0	0/0	0/0/0
147	43/43	PCT/PCT	CSH/CSH	NEq/NEq	DNA	0/0/0	0/0/0	0/0/0	0/0	0/0/0
148	27/27	PCT/PCT	CSH/CSH	NEq/NEq	DNA	0/0/0	0/0/0	0/0/0	0/0	0/0/0
149	5/5	PCT/PCT	CSH/CSH	NEq/NEq	DNA	0/0/0	0/0/0	0/0/0	0/0	0/0/0
150	8/8	PCT/PCT	CSH/CSH	NEq/NEq	DNA	0/0/0	0/0/0	0/0/0	0/0	0/0/0
151	39/39	PCT/PCT	CSH/CSH	NEq/NEq	DNA	0/0/0	0/0/0	0/0/0	0/0	0/0/0
152	24/24	PCT/PCT	CSH/CSH	NEq/NEq	DNA	0/0/0	0/0/0	0/0/0	0/0	0/0/0
153	30/30	PCT/PCT	CSH/CSH	NEq/NEq	DNA	0/0/0	0/0/0	0/0/0	0/0	0/0/0
154	14/14	PCT/PCT	CSH/CSH	NEq/NEq	DNA	0/0/0	0/0/0	0/0/0	0/0	0/0/0
155	18/18	PCT/PCT	CSH/CSH	NEq/NEq	DNA	0/0/0	0/0/0	0/0/0	0/0	0/0/0
156	7/7	PCT/PCT	CSH/CSH	NEq/NEq	DNA	0/0/0	0/0/0	0/0/0	0/0	0/0/0
157	62/62	PCT/PCT	CSH/CSH	NEq/NEq	DNA	0/0/0	0/0/0	0/0/0	0/0	0/0/0
158	13/13	PCT/PCT	CSH/CSH	NEq/NEq	DNA	0/0/0	0/0/0	0/0/0	0/0	0/0/0
159	81/81	PCT/PCT	CSH/CSH	NEq/NEq	DNA	0/0/0	0/0/0	0/0/0	0/0	0/0/0
160	1/1	PCT/PCT	CSH/CSH	NEq/NEq	DNA	0/0/0	0/0/0	0/0/0	0/0	0/0/0
161	15/15	PCT/PCT	CSH/CSH	NEq/NEq	DNA	0/0/0	0/0/0	0/0/0	0/0	0/0/0
162	6/6	PCT/PCT	CSH/CSH	NEq/NEq	DNA	0/0/0	0/0/0	0/0/0	0/0	0/0/0
163	4/4	PCT/PCT	CSH/CSH	NEq/NEq	DNA	0/0/0	0/0/0	0/0/0	0/0	0/0/0
164	6/6	PCT/PCT	CSH/CSH	NEq/NEq	DNA	0/0/0	0/0/0	0/0/0	0/0	0/0/0
165	7/7	PCT/PCT	CSH/CSH	NEq/NEq	DNA	0/0/0	0/0/0	0/0/0	0/0	0/0/0
166	5/5	PCT/PCT	CSH/CSH	NEq/NEq	DNA	0/0/0	0/0/0	0/0/0	0/0	0/0/0
167	5/5	PCT/PCT	CSH/CSH	NEq/NEq	DNA	0/0/0	0/0/0	0/0/0	0/0	0/0/0
168	29/29	PCT/PCT	CSH/CSH	NEq/NEq	DNA	0/0/0	0/0/0	0/0/0	0/0	0/0/0
169	12/12	PCT/PCT	CSH/CSH	NEq/NEq	DNA	0/0/0	0/0/0	0/0/0	0/0	0/0/0
170	32/32	PCT/PCT	CSH/CSH	NEq/NEq	DNA	0/0/0	0/0/0	0/0/0	0/0	0/0/0
171	24/24	PCT/PCT	CSH/CSH	NEq/NEq	DNA	0/0/0	0/0/0	0/0/0	0/0	0/0/0
172	24/24	PCT/PCT	CSH/CSH	NEq/NEq	DNA	0/0/0	0/0/0	0/0/0	0/0	0/0/0
173	27/27	PCT/PCT	CSH/CSH	NEq/NEq	DNA	0/0/0	0/0/0	0/0/0	0/0	0/0/0
174	16/16	PCT/PCT	CSH/CSH	NEq/NEq	DNA	0/0/0	0/0/0	0/0/0	0/0	0/0/0
175	16/16	PCT/PCT	CSH/CSH	NEq/NEq	DNA	0/0/0	0/0/0	0/0/0	0/0	0/0/0
176	5/5	PCT/PCT	CSH/CSH	NEq/NEq	DNA	0/0/0	0/0/0	0/0/0	0/0	0/0/0
177	13/13	PCT/PCT	CSH/CSH	NEq/NEq	DNA	0/0/0	0/0/0	0/0/0	0/0	0/0/0
178	29/29	PCT/PCT	CSH/CSH	NEq/NEq	DNA	0/0/0	0/0/0	0/0/0	0/0	0/0/0
179	13/13	PCT/PCT	CSH/CSH	NEq/NEq	DNA	0/0/0	0/0/0	0/0/0	0/0	0/0/0
180	19/19	PCT/PCT	CSH/CSH	NEq/NEq	DNA	0/0/0	0/0/0	0/0/0	0/0	0/0/0
181	12/12	PCT/PCT	CSH/CSH	NEq/NEq	DNA	0/0/0	0/0/0	0/0/0	0/0	0/0/0
182	27/27	PCT/PCT	CSH/CSH	NEq/NEq	DNA	0/0/0	0/0/0	0/0/0	0/0	0/0/0
183	23/23	PCT/PCT	CSH/CSH	NEq/NEq	DNA	0/0/0	0/0/0	0/0/0	0/0	0/0/0
184	38/38	PCT/PCT	CSH/CSH	NEq/NEq	DNA	0/0/0	0/0/0	0/0/0	0/0	0/0/0
185	38/38	PCT/PCT	CSH/CSH	NEq/NEq	DNA	0/0/0	0/0/0	0/0/0	0/0	0/0/0
186	24/24	PCT/PCT	CSH/CSH	NEq/NEq	DNA	0/0/0	0/0/0	0/0/0	0/0	0/0/0
187	46/46	PCT/PCT	CSH/CSH	NEq/NEq	DNA	0/0/0	0/0/0	0/0/0	0/0	0/0/0

UNIT #	ACTIVITY AREA (acres) ALTS 2/3	PROPOSED VEGETATION TREATMENT ALT 2/3	PROPOSED FUELS TREATMENT ALT 2/3	PROPOSED LOGGING SYSTEM ALT 2/3	EXISTING DSD (%)[1]	ALTERNATIVES POTENTIAL DSD 1/2/3				
						PREDICTED TEMP ROAD DSD%[2]	PREDICTED HARVEST DSD%	CUMULATIVE DSD% POST-HARVEST	REDUCED DSD FROM REHAB[4] (%) ALTS 2/3	TOTAL POST ACTIVITY DSD (%)
188	47/47	PCT/PCT	CSH/CSH	NEq/NEq	DNA	0/0/0	0/0/0	0/0/0	0/0	0/0/0
189	37/37	PCT/PCT	CSH/CSH	NEq/NEq	DNA	0/0/0	0/0/0	0/0/0	0/0	0/0/0
190	24/24	PCT/PCT	CSH/CSH	NEq/NEq	DNA	0/0/0	0/0/0	0/0/0	0/0	0/0/0
191	39/39	PCT/PCT	CSH/CSH	NEq/NEq	DNA	0/0/0	0/0/0	0/0/0	0/0	0/0/0
192	19/19	PCT/PCT	CSH/CSH	NEq/NEq	DNA	0/0/0	0/0/0	0/0/0	0/0	0/0/0
193	31/31	PCT/PCT	CSH/CSH	NEq/NEq	DNA	0/0/0	0/0/0	0/0/0	0/0	0/0/0
194	23/23	PCT/PCT	CSH/CSH	NEq/NEq	DNA	0/0/0	0/0/0	0/0/0	0/0	0/0/0
195	44/44	PCT/PCT	CSH/CSH	NEq/NEq	DNA	0/0/0	0/0/0	0/0/0	0/0	0/0/0
196	38/38	PCT/PCT	CSH/CSH	NEq/NEq	DNA	0/0/0	0/0/0	0/0/0	0/0	0/0/0
197	49/49	PCT/PCT	CSH/CSH	NEq/NEq	DNA	0/0/0	0/0/0	0/0/0	0/0	0/0/0
198	19/19	PCT/PCT	CSH/CSH	NEq/NEq	DNA	0/0/0	0/0/0	0/0/0	0/0	0/0/0
199	21/21	PCT/PCT	CSH/CSH	NEq/NEq	DNA	0/0/0	0/0/0	0/0/0	0/0	0/0/0
200	9/9	PCT/PCT	CSH/CSH	NEq/NEq	DNA	0/0/0	0/0/0	0/0/0	0/0	0/0/0
201	51/51	PCT/PCT	CSH/CSH	NEq/NEq	DNA	0/0/0	0/0/0	0/0/0	0/0	0/0/0
202	63/63	PCT/PCT	CSH/CSH	NEq/NEq	DNA	0/0/0	0/0/0	0/0/0	0/0	0/0/0
203	47/47	PCT/PCT	CSH/CSH	NEq/NEq	DNA	0/0/0	0/0/0	0/0/0	0/0	0/0/0
204	26/26	PCT/PCT	CSH/CSH	NEq/NEq	DNA	0/0/0	0/0/0	0/0/0	0/0	0/0/0
205	41/41	PCT/PCT	CSH/CSH	NEq/NEq	DNA	0/0/0	0/0/0	0/0/0	0/0	0/0/0
206	32/32	PCT/PCT	CSH/CSH	NEq/NEq	DNA	0/0/0	0/0/0	0/0/0	0/0	0/0/0
207	22/22	PCT/PCT	CSH/CSH	NEq/NEq	DNA	0/0/0	0/0/0	0/0/0	0/0	0/0/0
208	12/12	PCT/PCT	CSH/CSH	NEq/NEq	DNA	0/0/0	0/0/0	0/0/0	0/0	0/0/0
209	109/109	PCT/PCT	CSH/CSH	NEq/NEq	DNA	0/0/0	0/0/0	0/0/0	0/0	0/0/0
210	37/37	PCT/PCT	CSH/CSH	NEq/NEq	DNA	0/0/0	0/0/0	0/0/0	0/0	0/0/0
211	20/20	PCT/PCT	CSH/CSH	NEq/NEq	DNA	0/0/0	0/0/0	0/0/0	0/0	0/0/0
212	28/28	PCT/PCT	CSH/CSH	NEq/NEq	DNA	0/0/0	0/0/0	0/0/0	0/0	0/0/0
213	20/20	PCT/PCT	CSH/CSH	NEq/NEq	DNA	0/0/0	0/0/0	0/0/0	0/0	0/0/0
214	40/40	PCT/PCT	CSH/CSH	NEq/NEq	DNA	0/0/0	0/0/0	0/0/0	0/0	0/0/0
215	15/15	PCT/PCT	CSH/CSH	NEq/NEq	DNA	0/0/0	0/0/0	0/0/0	0/0	0/0/0
216	32/32	PCT/PCT	CSH/CSH	NEq/NEq	DNA	0/0/0	0/0/0	0/0/0	0/0	0/0/0
217	29/29	PCT/PCT	CSH/CSH	NEq/NEq	DNA	0/0/0	0/0/0	0/0/0	0/0	0/0/0
218	48/48	PCT/PCT	CSH/CSH	NEq/NEq	DNA	0/0/0	0/0/0	0/0/0	0/0	0/0/0
219	40/40	PCT/PCT	CSH/CSH	NEq/NEq	DNA	0/0/0	0/0/0	0/0/0	0/0	0/0/0
220	50/50	PCT/PCT	CSH/CSH	NEq/NEq	DNA	0/0/0	0/0/0	0/0/0	0/0	0/0/0
221	17/17	PCT/PCT	CSH/CSH	NEq/NEq	DNA	0/0/0	0/0/0	0/0/0	0/0	0/0/0
222	46/46	PCT/PCT	CSH/CSH	NEq/NEq	DNA	0/0/0	0/0/0	0/0/0	0/0	0/0/0
223	25/25	PCT/PCT	CSH/CSH	NEq/NEq	DNA	0/0/0	0/0/0	0/0/0	0/0	0/0/0
224	12/12	PCT/PCT	CSH/CSH	NEq/NEq	DNA	0/0/0	0/0/0	0/0/0	0/0	0/0/0
225	57/57	PCT/PCT	CSH/CSH	NEq/NEq	DNA	0/0/0	0/0/0	0/0/0	0/0	0/0/0
226	18/18	PCT/PCT	CSH/CSH	NEq/NEq	DNA	0/0/0	0/0/0	0/0/0	0/0	0/0/0
227	7/7	PCT/PCT	CSH/CSH	NEq/NEq	DNA	0/0/0	0/0/0	0/0/0	0/0	0/0/0
228	53/53	PCT/PCT	CSH/CSH	NEq/NEq	DNA	0/0/0	0/0/0	0/0/0	0/0	0/0/0
229	19/19	PCT/PCT	CSH/CSH	NEq/NEq	DNA	0/0/0	0/0/0	0/0/0	0/0	0/0/0
230	43/43	PCT/PCT	CSH/CSH	NEq/NEq	DNA	0/0/0	0/0/0	0/0/0	0/0	0/0/0
231	17/17	PCT/PCT	CSH/CSH	NEq/NEq	DNA	0/0/0	0/0/0	0/0/0	0/0	0/0/0

UNIT #	ACTIVITY AREA (acres) ALTS 2/3	PROPOSED VEGETATION TREATMENT ALT 2/3	PROPOSED FUELS TREATMENT ALT 2/3	PROPOSED LOGGING SYSTEM ALT 2/3	EXISTING DSD (%)[1]	ALTERNATIVES POTENTIAL DSD 1/2/3				
						PREDICTED TEMP ROAD DSD%[2]	PREDICTED HARVEST DSD%	CUMULATIVE DSD% POST-HARVEST	REDUCED DSD FROM REHAB[4] (%) ALTS 2/3	TOTAL POST ACTIVITY DSD (%)
232	11/11	PCT/PCT	CSH/CSH	NEq/NEq	DNA	0/0/0	0/0/0	0/0/0	0/0	0/0/0
233	14/14	PCT/PCT	CSH/CSH	NEq/NEq	DNA	0/0/0	0/0/0	0/0/0	0/0	0/0/0
234	69/69	PCT/PCT	CSH/CSH	NEq/NEq	DNA	0/0/0	0/0/0	0/0/0	0/0	0/0/0
235	35/35	PCT/PCT	CSH/CSH	NEq/NEq	DNA	0/0/0	0/0/0	0/0/0	0/0	0/0/0
236	54/54	PCT/PCT	CSH/CSH	NEq/NEq	DNA	0/0/0	0/0/0	0/0/0	0/0	0/0/0
274	21/21	PCT/PCT	CSH/CSH	NEq/NEq	DNA	0/0/0	0/0/0	0/0/0	0/0	0/0/0
275	3/3	PCT/PCT	CSH/CSH	NEq/NEq	DNA	0/0/0	0/0/0	0/0/0	0/0	0/0/0
TOTAL PRECOMMERCIAL THIN ACRES BY ALTERNATIVE: ALT 2 = 5,563 ALT 3 = 5,563										
US ARMY CORPS OF ENGINEERING										
COE 1*	41/41	IMP/IMP	UB/UB	T/T	7	0/0/0	0/8/8	7/15/15	0/0	7/15/15
COE 3*	181/181	IMP/IMP	UB/UB	T/T	4	0/0/0	0/8/8	4/12/12	0/0	4/12/12
COE 4	22/22	IMP/IMP	UB/UB	WT/WT	0	0/0/0	0/4/4	0/4/4	0/0	0/4/4
COEF5	47/47	S/S	B/B	NEq/NEq	DNA	0/0/0	0/0/0	0/0/0	0/0	0/0/0
COE5T	6/6	IMP/IMP	UB/UB	WT/WT	Est 4%	0/0/0	0/4/4	4/8/8	0/0	4/8/8
COE 6^	11/11	IMP/IMP	UB/UB	WT/WT	11	0/0/0	0/2/2	11/13/13	0/0	11/13/13
COEF7	37/37	S/S	B/B	NEq/NEq	DNA	0/0/0	0/0/0	0/0/0	0/0	0/0/0
COEF8	25/25	S/S	B/B	NEq/NEq	DNA	0/0/0	0/0/0	0/0/0	0/0	0/0/0
COEF9	23/23	S/S	GP/GP	NEq/NEq	App. 4	0/0/0	0/2/2	0/6/6	0/0	0/6/6
COEF10	12/12	S/S	B/B	NEq/NEq	DNA	0/0/0	0/0/0	0/0/0	0/0	0/0/0
COEF11	8/8	S/S	B/B	NEq/NEq	DNA	0/0/0	0/0/0	0/0/0	0/0	0/0/0
COEF12	8/8	S/S	B/B	NEq/NEq	DNA	0/0/0	0/0/0	0/0/0	0/0	0/0/0
TOTAL US ARMY CORPS OF ENGINEERING ACRES BY ALTERNATIVE: ALT 2 = 421 ALT 3 = 421										
FUELS TREATMENT UNITS										
F1	174/174	MFT/MFT	B/B	MAeq/MAeq	6	0/0/0	0/2/2	6/8/8	0/0	6/8/8
F1A	17/17	S/S	B/B	NEq/NEq	DNA	0/0/0	0/0/0	0/0/0	0/0	0/0/0
F1OG^	38/0	MFT/NT	B/NT	MAeq/NEq	8	0/0/0	0/2/0	8/10/8	0/0	8/10/8
F2	116/112	MFT/MFT	B/B	MAeq/MAeq	6	0/0/0	0/2/2	6/8/8	0/0	6/8/8
F3	17/17	MFT/MFT	B/B	MAeq/MAeq	5	0/0/0	0/2/2	5/7/7	0/0	5/7/7
F3OG	20/0	MFT/NT	B/NT	MAeq/NA	5	0/0/0	0/2/2	5/7/7	0/0	5/7/7
F4	17/17	S/S	B/B	NEq/NEq	DNA	0/0/0	0/0/0	0/0/0	0/0	0/0/0
F8	52/52	MFT/MFT	B/B	MAeq/MAeq	6	0/0/0	0/2/2	6/8/8	0/0	6/8/8
F11OG	54/0	S/NT	B/NT	NEq/NA	4	0/0/0	0/0/0	4/4/4	0/0	4/4/4
F12	11/11	MFT/MFT	B/B	MAeq/MAeq	1	0/0/0	0/2/2	1/3/3	0/0	1/3/3
F13	24/24	S/S	B/B	NEq/NEq	DNA	0/0/0	0/0/0	0/0/0	0/0	0/0/0
F13OG	5/0	MFT/NT	B/NT	MAeq/NA	App. 4	0/0/0	0/2/0	4/6/4	0/0	4/6/4
F14OG	43/0	MFT/NT	B/NT	MAeq/NA	App. 4	0/0/0	0/2/0	4/6/4	0/0	4/6/4
F15	9/9	MFT/MFT	B/B	MAeq/MAeq	App. 4	0/0/0	0/2/2	4/6/4	0/0	4/6/4
F15OG	13/0	MFT/NT	B/NT	MAeq/NA	App. 4	0/0/0	0/2/0	0/2/0	0/0	0/2/0
F16	73/73	S/S	B/B	NEq/NEq	DNA	0/0/0	0/0/0	0/0/0	0/0	0/0/0
F18	568/568	S/S	B/B	NEq/NEq	DNA	0/0/0	0/0/0	0/0/0	0/0	0/0/0
F19	0/110	NT/S	NT/B	NA/NEq	DNA	0/0/0	0/0/0	0/0/0	0/0	0/0/0
F45	125/125	S/S	B/B	NEq/NEq	0	0/0/0	0/0/0	0/0/0	0/0	0/0/0
TOTAL FUELS ACRES BY ALTERNATIVE: ALT 2 = 1,378 ALT 3 = 1,309										

UNIT #	ACTIVITY AREA (acres) ALTS 2/3	PROPOSED VEGETATION TREATMENT ALT 2/3	PROPOSED FUELS TREATMENT ALT 2/3	PROPOSED LOGGING SYSTEM ALT 2/3	EXISTING DSD (%)[1]	ALTERNATIVES POTENTIAL DSD 1/2/3				
						PREDICTED TEMP ROAD DSD%[2]	PREDICTED HARVEST DSD%	CUMULATIVE DSD% POST-HARVEST	REDUCED DSD FROM REHAB[4] (%) ALTS 2/3	TOTAL POST ACTIVITY DSD (%)
FUELS AND WILDLIFE UNITS										
FW501	281/281	S/S	UB/UB	NEq/NEq	DNA	0/0/0	0/0/0	0/0/0	0/0	0/0/0
FW502	159/159	S/S	UB/UB	NEq/NEq	3	0/0/0	0/0/0	3/3/3	0/0	3/3/3
FW503	215/215	S/S	UB/UB	NEq/NEq	DNA	0/0/0	0/0/0	0/0/0	0/0	0/0/0
FW509	32/32	S/S	UB/UB	NEq/NEq	DNA	0/0/0	0/0/0	0/0/0	0/0	0/0/0
FW511	34/34	S/S	UB/UB	NEq/NEq	DNA	0/0/0	0/0/0	0/0/0	0/0	0/0/0
FW512	51/51	S/S	UB/UB	NEq/NEq	DNA	0/0/0	0/0/0	0/0/0	0/0	0/0/0
FW516	39/39	S/S	UB/UB	NEq/NEq	DNA	0/0/0	0/0/0	0/0/0	0/0	0/0/0
FW521	41/41	S/S	UB/UB	NEq/NEq	DNA	0/0/0	0/0/0	0/0/0	0/0	0/0/0
FW522	642/642	S/S	UB/UB	NEq/NEq	7	0/0/0	0/0/0	7/7/7	0/0	7/7/7
FW524	484/484	S/S	UB/UB	NEq/NEq	App. 4	0/0/0	0/0/0	4/4/4	0/0	4/4/4
FW525	84/84	S/S	UB/UB	NEq/NEq	DNA	0/0/0	0/0/0	0/0/0	0/0	0/0/0
FW533	214/214	S/S	UB/UB	NEq/NEq	4	0/0/0	0/0/0	4/4/4	0/0	4/4/4
FW535	142/142	S/S	UB/UB	NEq/NEq	App. 4	0/0/0	0/0/0	4/4/4	0/0	4/4/4
FW536	307/307	NT/NT	UB/UB	NEq/NEq	DNA	0/0/0	0/0/0	0/0/0	0/0	0/0/0
FW539	121/121	S/S	UB/UB	NEq/NEq	DNA	0/0/0	0/0/0	0/0/0	0/0	0/0/0
FW540	538/538	S/S	UB/UB	NEq/NEq	DNA	0/0/0	0/0/0	0/0/0	0/0	0/0/0
FW543	215/215	S/S	UB/UB	NEq/NEq	DNA	0/0/0	0/0/0	0/0/0	0/0	0/0/0
FW544	576/576	S/S	UB/UB	NEq/NEq	App. 4	0/0/0	0/0/0	4/4/4	0/0	4/4/4
FW545	429/429	NT/NT	UB/UB	NEq/NEq	App. 4	0/0/0	0/0/0	4/4/4	0/0	4/4/4
FW577	147/147	S/S	UB/UB	NEq/NEq	DNA	0/0/0	0/0/0	0/0/0	0/0	0/0/0
FW589	335/335	NT/NT	UB/UB	NEq/NEq	4	0/0/0	0/0/0	4/4/4	0/0	4/4/4
FW5109	170/170	S/S	UB/UB	NEq/NEq	DNA	0/0/0	0/0/0	0/0/0	0/0	0/0/0
FW5111	46/46	S/S	UB/UB	NEq/NEq	DNA	0/0/0	0/0/0	0/0/0	0/0	0/0/0
FW5122^	112/112	NT/NT	UB/UB	NEq/NEq	9	0/0/0	0/0/0	9/9/9	0/0	9/9/9
FW5125	14/14	S/S	UB/UB	NEq/NEq	DNA	0/0/0	0/0/0	0/0/0	0/0	0/0/0
FW50601	294/294	S/S	UB/UB	NEq/NEq	1	0/0/0	0/0/0	1/1/1	0/0	1/1/1
FW50602	913/913	S/S	UB/UB	NEq/NEq	9	0/0/0	0/0/0	9/9/9	0/0	9/9/9
FW51101	575/575	S/S	UB/UB	NEq/NEq	DNA	0/0/0	0/0/0	0/0/0	0/0	0/0/0
FW51102	272/272	S/S	UB/UB	NEq/NEq	DNA	0/0/0	0/0/0	0/0/0	0/0	0/0/0
FW51103	743/743	S/S	UB/UB	NEq/NEq	DNA	0/0/0	0/0/0	0/0/0	0/0	0/0/0
FW53401	596/596	S/S	UB/UB	NEq/NEq	DNA	0/0/0	0/0/0	0/0/0	0/0	0/0/0
FW53402	581/581	S/S	UB/UB	NEq/NEq	DNA	0/0/0	0/0/0	0/0/0	0/0	0/0/0
FW53403	646/646	NT/NT	UB/UB	NEq/NEq	DNA	0/0/0	0/0/0	0/0/0	0/0	0/0/0
TOTAL FUELS & WILDLIFE ACRES BY ALTERNATIVE: ALT 2 = 10,049 ALT 3 = 10,049										

CCR - Clearcut with Reserves (Regen.)	GP – Grapple Pile	T – Tractor
SW – Shelterwood with Reserves (Regen.)	SGP – Slash with Grapple Pile	WT – Winter Tractor
ST – Seed Tree with Reserves (Regen.)	UB – Underburn	S – Skyline
ST-SW – Seedtree with Shelterwood (Regen.)	MFT – Mechanical Fuel Treatment	T&S – Combined Tractor & Skyline Harvest Operations
IMP-SW – Stand Improvement with Shelterwood (Regen.)	PPR – Potential Product Removal	HSS – Hot Saw Cut with Skyline
IRR-SW – Irregular Shelterwood (Regen.)	B – Burn	CSH – Chainsaw Hand
IMP – Stand Improvement (Intermediate)	S – Slash	NEq – No Equipment Operations
SSLV – Sanitation Salvage (Intermediate)	SB – Slash and Burn	MAeq – Mastication Equivalent
CT – Commercial Thin (Intermediate)	SUB – Slash with Underburn	

UNIT #	ACTIVITY AREA (acres) ALTS 2/3	PROPOSED VEGETATION TREATMENT ALT 2/3	PROPOSED FUELS TREATMENT ALT 2/3	PROPOSED LOGGING SYSTEM ALT 2/3	EXISTING DSD (%)[1]	ALTERNATIVES POTENTIAL DSD 1/2/3				
						PREDICTED TEMP ROAD DSD%[2]	PREDICTED HARVEST DSD%	CUMULATIVE DSD% POST-HARVEST	REDUCED DSD FROM REHAB[4] (%) ALTS 2/3	TOTAL POST ACTIVITY DSD (%)
PCT – Precommercial Thin (Intermediate) PCT-GP – Precommercial Thin with Grapple Piles (Intermediate) OG – Old Growth WPDT – Western White Pine Precommercial Thin FUEL – Fuel Treatments FW FUELS – Fuels and Wildlife Treatments NT – No Treatment under this Alternative				WTY – Whole Tree Yarding				NA – No Activities DNA – Does Not Apply Null – Does not apply with this Alternative		

Note: An existing condition of 0% DSD can mean either: 1) No disturbance is present or 2) there is some disturbance present but does not amount to 1%

[1]The East Reservoir soil survey was conducted using the new Region 1 Soil Sampling Protocol which meets the R1 definition of detrimental soil disturbance, and therefore the pre-East Reservoir activity conditions meet the R1 definitions. Field forms are present in the East Reservoir Soil files.

[2]For determining temporary road soil disturbance an average width of 12' has been applied for calculating area of DSD. Following harvest all temp roads and landings used for harvest activities will be scarified at least 6-12" based on the depth. An average of 50% DSD has been used to calculate potential soil DSD values for existing tractor-dozer skid trails which currently exist but are not on the roads database layer.

[3]Predicted DSD has been calculated based on historical soil monitoring data collected in the field in post-harvest timber sale units. (Kuennen, 2007a). In units with combined tractor/skyline harvest activity the anticipated DSD was calculated as related to the overall acreage of potential disturbance by harvest activity.

^In units where existing DSD is 8% or greater expect 50% less skidding disturbance as a result of using existing skid trails and landings. This reduction of anticipated DSD values only applies to proposed ground-based harvest activities.

~Units most likely to be handsawed as compared to clipper cut in skyline Units.

#Units most likely to be hot-saw cut with skyline timber removal. If skyline Units are expected to be clipper cut an additional 2% DSD was added.

[4]Reduction in percent DSD is expected to occur in 3 years following harvest activities within a given unit. This number varies based on the severity of restoration requirements and mitigations in a given harvest unit. Such activities apply to Units 194S, 194T, 330, and 331 which exceeded 15% DSD following proposed harvest activities.

[5]Units determined to have an additional 1% DSD due to fireline construction following harvest activity. Such impacts only apply to those areas where heavy equipment is suspected to be used for such activities.

*Units 2, 2B, 3, 7, 10, 13, 14, 15, 24, 26, 64, 70T, 73T, 74T, 80, 81, 159A, 183, 190, 190A, 194T, 196, 305, 307, 311, 318, 319, 327, 328, 330, 331, 334, 335, 339, 340, 344, 345, 346, 347, 349, and 350 require harvest Winter Tractor operations in winter based on soil concerns. Similarly, Winter Tractor operations are recommended in Units COE1 and COE6 to avoid exceeding 15% DSD following harvest activities. Units 1 and 1A also require WT operations based on Archeology concerns for all proposed Action Alternatives while Units 2C, 2D, 3A, 9, 11, 17, 28, 157, 158, and 306 all have weed concerns and thus require winter harvest operations under Alternatives 2 and 3.

WT Units with GP requirements may require provision C64.

ALTERNATIVES 2 and 3

Direct and Indirect Effects

The percent detrimental soil disturbance (DSD) is the measurement indicator of soil compaction for this analysis. Direct impacts on soils from management activities could include compaction, rutting and displacement. Typically, these impacts take place as a result of vehicles/equipment traversing areas within proposed units such as skid trails, landings and temporary roads. Soil compaction is most common where heavy equipment makes repeated passes over the same ground, particularly during times of high soil moisture (Kuennen 2003). Soil compaction can change slope hydrology and lead to overland flow of water during precipitation or snowmelt events. Compacted soils can also reduce soil productivity. These are some general direct effects that can occur with all timber harvest activities. For this analysis, all units expected to receive heavy equipment activities were reviewed to determine the currently existing soil conditions. Table 3.37 identifies the extent of these impacts for each unit for both Alternatives 2 and 3.

Note that harvest procedures can result in very minimal impacts to soils where proposed units are likely to be cut using handsaw activities on steeper hill slopes and removed using skyline activities.

Regeneration harvest activities would require one entry to reach the desired silvicultural objective. Related post-harvest unit entry over time would be for thinning and scheduled to occur several decades later. This being said, units proposed for intermediate silvicultural objectives such as commercial thinning or stand improvement operations are more subjective to higher detrimental soil disturbance than that of a regeneration prescription based on the needs for multiple entries over a similar time period.

The construction of a fireline directly impacts soils by removing (displacing) the organic layer down to mineral soil for 2-3 feet wide around the perimeter of the units. Some compaction along the fireline could occur from foot, all-terrain vehicle and/or heavy equipment traffic. The effects of soil compaction associated with fireline construction only apply to those units where machinery may be involved in such lines. The bulk of units would have firelines constructed by hand.

Fuels treatments may also include mastication equivalent activities using machinery that may impact soils. The effects of mastication are included in the figures identified in Table 3.37. The direct effects of mastication with heavy equipment operations are discussed in the fuels section. Because mastication equivalent activities are reducing the amount of woody material within a unit, it can also affect nutrient cycling. Nutrient cycling is discussed in depth later in this section. In proposed units where existing soil compactions were found to be higher, recommendations to limit machinery activities outside of skid trails used for harvest practices is suggested. In Alternatives 2 and 3, grapple piling on COE lands is only proposed in Unit COEF9 for fuel concerns. All other fuel treatments involve either underburns or hand-slash-burn prescriptions. Where grapple piling is proposed, a 2% DSD has been applied to the existing field data to estimate the cumulative DSD values.

Indirect impacts from management activities could include erosion from surface water runoff channeled into ruts, fire lines, and/or along temporary roads within units. With less vegetation a conversion from a drier soil environment to a slightly moister site would occur. Less vegetation would mean a thinner canopy and more soil interception from rainfall above. These impacts are anticipated to be minimized by implementing BMPs (Appendix C of the DEIS) and the following specific management requirements and design criteria.

Recommendations to Minimize DSD from Ground-Based Activities

Under Alternative 2, elevated levels of legacy soil compaction (8% or greater) in proposed ground based harvest regeneration or intermediate harvest units are present in Units 2, 2B, 2C, 2D, 3, 3A, 7, 10, 12, 13, 14, 15, 24, 26, 70T, 73T, 80, 81, 159A, 183, 190, 190A, 194T, 196 and COE6. In Alternative 3, the legacy soil compaction (8% or greater) for ground based units is present in Units 2, 2B, 2C, 2D, 3, 3A, 7, 10, 12, 13, 14, 15, 24, 26, 73T, 74T, 80, 81, 159A, 183, 190, 190A, 194T, 196 and COE6.

Similar concerns are also present in a number of commercial thin units. In Alternative 2, those units containing legacy soil compaction (8% or greater) is present in Units 305, 307, 311, 318, 319, 327, 328, 330, 331, 334, 335, 339, 340, 344, 345, 346, 347, 349 and 350. In Alternative 3, the proposed commercial thin units currently exceeding 8% are units 305, 307, 318, 319, 327, 328, 330, 331, 334, 335, 339, 340, 344, 345, 346, 347, 349 and 350. Higher values in these units are believed to be the result of much more recent harvest operations when compared to both regeneration and intermediate operations which tended to have been harvested between early 1960s and 1980s. Such conditions in the commercial thinning units have allowed far less time for soil recovery to occur. Soil recovery studies on the KNF (2012) display much higher percent recovery when comparing harvest activities which occurred more recently as compared to earlier D6 equivalent activities.

Those units exceeding 8% DSD are also present in proposed Fuel and Fuels and Wildlife Units F1OG, FW5122 and FW50602 in Alternative 2; and units FW5122 and FW50602 in Alternative 3. It should be noted that no equipment activities are planned to occur within Units FW5122 and FW50602 while Unit F1OG only proposes to be a mastication-equivalent operation which results in only a 2% DSD value. Unit F1OG is only proposed for Alternative 2 (Table 3.37).

No additional impacts to the existing conditions are expected to occur in white pine daylight thin units and precommercial thins as such activities do not involve heavy equipment activities.

Cumulative Effects

Units found to cumulatively exceed the 15% DSD value on one or more of the proposed alternatives include intermediate harvest Units 194S, 194T and commercial thin units 330 and 331 (Table 3.37). Following harvest operations there are plans to reduce the overall DSD values in these units as determined by the Forest Soil Scientist in coordination with the timber sale contracting officer. In such units, winter operations are proposed in order to minimize additional soil disturbance values. However, new skid trails may be required in areas where the existing skid trail network does not fit the current operations. Effects on temporary roads and skid trails on vegetative regrowth are expected to be temporary due to planned ripping and seeding following harvest operations where these areas are used for harvest operations. Post-harvest rehabilitation activities would include ripping skid trails and temporary roads and seeding as necessary. Such activities would help to offset the harvest activities to soil productivity by allowing previously disturbed soils to re-establish as a productive area capable of producing future natural vegetative cover which in turn may one day be harvested again. Harvest operations may also include placing downed woody material on skid trails to reduce impacts to soils. In proposed ground based harvest units currently exceeding 8% DSD this analysis assumes that 50% of historic skid trails would be reused during harvest operations.

The soil rehabilitation effects may not be immediately apparent, as it would take several years for diverse native vegetation to establish in areas that previously had limited root capacity. Disturbed soil organic layers, which play an important role in soil nutrient cycling and microbial population/function, would also take time to rebuild after rehabilitation treatments. The importance of the rehabilitation cannot be overlooked because it does not immediately restore soils to pre-disturbance conditions. The rehabilitation provides the critical bridge that allows these natural processes to improve conditions over time. Based on this analysis, while some increase in DSD is expected with proposed management activities, following soil mitigation and rehabilitation activities all activity areas would be below the 15% allowable DSD. Even with the proposed mitigations/ rehabilitation activities, there is a potential that intermediate harvest Units 194S, 194T, and commercial thin Units 330 and 331 may still exceed the15% DSD value. For these units, the goal is to return the soils following harvest operations to DSD values which are either equivalent or lower than the currently existing conditions within a 3 year timeframe. Accomplishing this would be completed by requiring the contractor to actively rehabilitate all skid-trails and landings used by the operators during the harvest activity. Plans are to monitor these units within 2-3 years following

harvest operations to determine the recovery ratio of the soils to compare pre-existing to post-existing conditions.

PERMANENT ROADS
ALTERNATIVE 1 (No-Action)
Direct, Indirect and Cumulative Effects
Regarding soil disturbance it should be noted that Authorized Forest Roads as defined in 36 CFR 212.1 are not considered part of the productive land base. As a result, these features do not count toward the 15% soil quality standard (FSM 2500-2009-1).

In Alterative 1, no additional permanent roads road construction or temporary road reconstruction is proposed; no Intermittent Stored Service or road decommissioning would take place. Therefore, road management would have no cumulative effect on soils in the analysis areas because soil productivity effects are spatially static and productivity in one location does not affect productivity in another location. Similarly, in Alternative 1, 0 miles of road are to be placed in intermittent stored service or decommissioned, and no motorized trails would be converted to non-motorized trails.

ALTERNATIVES 2 and 3
Direct and Indirect Effects
Currently, approximately 34.4 miles of road exist as stored road miles within the East Reservoir analysis area. Alternatives 2 would involve placing approximately 16.0 miles of road into Intermittent Stored Service and Alternative 3 would involve placing approximately 17.6 miles of road into Intermittent Stored Service. Intermittent road storage activities may include removing culverts on live, intermittent and ephemeral streams, restoring natural stream drainage patterns, out-sloping the road surface, removing unstable materials such as seeps and slumps, water-bar or cross-drain installation, and seeding disturbed sites. Under such activities the road prism remains on the landscape for long-term future resource management. The benefit of such activities includes decreased soil erosion from water channeling down the road surface. It should be noted that although such activities would not achieve 100% soil recovery, it is anticipated that with time such linear segments would improve hydrologically and begin to vegetatively recover (Table 3.38).

Under Alternative 2, approximately 9.3 miles of new permanent road miles would be constructed while Alternative 3 would involve constructing approximately 8.1 miles of new permanent road. Physical activities suspected to occur include, but are not limited to, vegetative removal, placement of culverts, road prism excavation, hauling, leveling, surfacing and compacting in order to provide a functional road drainage system. It should be noted that construction of new permanent road miles are not analyzed as being a concern as system roads fall out of the productive land base.

Both Alternatives 2 and 3 propose decommissioning approximately 5.9 miles of existing roads. Such activities would involve removal of culverts where stream channels exist, road closure barriers, out-sloping the road surface, removing unstable materials such as seeps and slumps, water-bar or cross-drain installation and seeding disturbed sites. Under such activities, the past road prism would return to a productive land area for long-term future resource management.

Alternatives 2 and 3 propose placing approximately 13.5 miles of undetermined roads to NFS roads. Alternative 2 proposes converting approximately 6.2 miles of undetermined roads to be decommissioned while Alternative 3 proposes converting approximately 6.5 miles of undetermined roads to be decommissioned.

Alternative 2 proposes making approximately 1.8 miles of seasonally restricted road miles open yearlong while Alternative 3 is scheduled to open approximately 8.1 miles of seasonally restricted road miles.

Similarly, Alternative 2 proposes to reconstruct approximately 7.1 miles of stored roads to use and store after harvest activities have occurred while Alternative 3 proposes reconstruction of approximately 5.5 miles of stored roads which would be stored following harvest activities. Proposed road reconstruction and maintenance under both Alternatives 2 and 3 may increase short-term sediment movement from road surface runoff but should be minimal, especially at road locations higher on the slope that are relatively low gradient and provide for sufficient buffer zones. Road reconstruction includes new culvert installation, blading, and brushing, and typically improves drainages and decreases erosion from water channeling down the road surface in the long-run (Table 3.38). Alternatives 2 and 3 both would involve approximately 30.3 miles of cost-share road use during harvest activities.

Alternative 2 proposes converting approximately 36.6 miles of motorized trails to non-motorized access only while Alternative 3 proposes 26.9 miles of such activities. The conversion of motorized trails to non-motorized trails involves those trails found to be no longer necessary for motorized access. Under Alternatives 2 and 3, it is expected that such activities would not include any direct physical impacts to soils but more directly deal with constructing barriers and placing signs at the beginning of current roads to prohibit vehicular traffic. In the long-term, soil infiltration rates and ground drainage capabilities would begin to improve as soils freeze and thaw, and plant root growth improves soil porosity.

Table 3.38 - Road Treatments by Alternative with regards to Soils 4Disturbance

ROAD MANAGEMENT ACTIVITIES	ALT 1	ALT 2	ALT 3
Existing Stored Road	0	34.4	34.4
Road Placed in Intermittent Storage	0	16.0	17.6
New Permanent Road Construction	0	9.3	8.1
New Temporary Road Construction	0	4.3	4.1
Existing Road Proposed for Decommissioning	0	5.9	5.9
Undetermined Roads to NFS Roads	0	13.5	13.5
Undetermined Roads to be Decommissioned	0	6.2	6.5
Stored Roads to Use and Store After	0	7.1	5.5
Motorized Trails Converted to Non-Motorized Trails	0	36.6	26.9
Seasonally Restricted Roads Made Available to Motorized Vehicles	0	1.8	8.1
Miles of Cost Share Roads	0	29.72	29.72
Total Miles	**0**	**App. 176.5**	**App. 168.3**

TEMPORARY ROADS
ALTERNATIVE 1 (NO-Action)
Direct and Indirect and Cumulative Effects
Alternative 1 has no temporary road construction and closure occurring. Therefore, temporary road management would have no cumulative effect on soils in the analysis areas because soil productivity effects are spatially static and productivity in one location does not affect productivity in another location.

ALTERNATIVES 2 and 3
Direct and Indirect Effects
All new landings and temporary roads are considered 100% detrimentally disturbed through removal of organic matter and compaction. Related mitigation activity following timber harvest includes restoring temporary roads and landings needed to facilitate timber harvest after use. Indirect effects from the action alternatives include the temporary soil erosion related to the exposure of more mineral soil. Without a protective mat of vegetation and stable soil profile, these areas are more susceptible to the erosive forces of wind, water and the dynamic temperature changes (frost heaves) sometimes seen in and around the East Reservoir analysis area. These localized effects are typically short-term (5-10 years) due to the warmer wet climate found on the KNF. Should Alternative 2 be selected approximately 4.3 miles or roughly 8.6 acre equivalent of temporary road would be constructed while Alternative 3 involves approximately 4.1 miles of temporary road (8.2 acre equivalent) disturbance (an average 2 ac/mi has been

used to calculate DSD values). Tables 3.38 and 3.39 display information regarding which units would have temporary roads constructed in Alternatives 2 and 3. These potential soil disturbance values are also represented on a unit by unit basis in Table 3.37.

Table 3.39 - Calculated DSD Related to Temp Road Construction

TEMP RD #	TEMP RD LENGTH (miles)	UNIT ID*	UNIT ACRES by ALT 2/3	ROAD DSD by UNIT (ac) ALT 2/3	% DSD RELATED to TEMP ROAD by UNIT ALT 2/3
T5	0.2	17	68/68	0.4/0.4	<1/<1
T6	0.4	22	83/83	0.8/0.8	1/1
T14	0.1	318	131/0	0.2/0	<1/0
T25	0.5	31	698/698	1.0/1.0	<1/<1
T25	0.1	197	24/24	0.2/0.2	1/1
T28	0.4	345	45/45	0.8/0.8	2/2
T37	0.1	340	266/266	0.2/0.2	<1/<1
T42	0.2	362	192/0	0.4/0	<1/0
T43	0.3	362	192/0	0.6/0	<1/0
T42	0.2	362B	0/40	0/0.4	0/1
T43	0.3	362C	0/39	0/0.6	0/2
T44	0.2	150	103/40	0.4/0.4	<1/1
T45	0.3	49	64/64	0.6/0.6	1/1
T53	0.4	148	77/40	0.8/0.8	1/2
T54	0.2	344	73/64	0.4/0.4	1/1
T55	0.3	343	100/93	0.6/0.6	<1/<1
T57	0.3	23	146/146	0.6/0.6	<1/<1
T58	0.2	179	76/0	0.4/0	1/0
Sub-total (Alt 2)	**4.3**			**8.6**	
Sub-total (Alt 3)	**4.1**			**8.2**	

^Road length rounded to the nearest tenth of a mile.
*Only those Units where new temporary road construction would be required are listed above.

All temporary roads and landings constructed for the sale would be agreed upon by the FS and purchaser. These areas would be constructed and used in adherence to BMPs and RHCAs to minimize their impacts to soils. After use, these areas would receive the following rehabilitation treatments: the road or landing surface would be ripped to remedy compaction, the berm would be pulled back (on roads), woody debris would be spread to stabilize soil from movement and to provide organic material, and all disturbed areas would be seeded. Such activities would help to offset the harvest activities to soil productivity by allowing previously disturbed soils to re-establish as a productive area capable of producing future natural vegetative cover which in turn may one day be harvested again.

FUELS TREATMENTS

Due to the suppression of wildfires over the last century, fuels have accumulated in many areas throughout the analysis area. The intent of fuels treatments is to reduce fuel levels and meet vegetation management objectives. Table 3.40 displays the fuels treatment proposed with this project.

Soils Table 3.40 - Types and Amount of Fuels Treatments by Alternative

ACTIVITY	ALT 1	ALT 2	ALT 3
Timber Harvest/Grapple Pile	0	3,952	2,457
Timber Harvest/Prescribed Fire	0	2,771	3,390
Fuel Reduction/Prescribed Fire	0	1,378	1,309
Mechanical Fuel Treatments	0	498	375
Commercial Thin/Whole Tree Yarding	0	2,256	1,965
Fuels and Wildlife Prescribed Fire	765	10,049	10,049

ACTIVITY	ALT 1	ALT 2	ALT 3
Precommercial Thin/Lop and Scatter	0	5,775	5,563
Timber Harvest/Prescribed Fire on COE Lands	0	261	261
Fuel Reduction/Prescribed Fire on COE Lands	0	137	137
Fuel Reduction/Grapple Pile on COE Lands	0	23	23

ALTERNATIVE 1 (No-Action)
Direct, Indirect and Cumulative Effects
Currently, as of the spring of 2013, approximately 170 acres of Unit FWF545 have already been burnt as part of the Forestwide Fuels EIS. Similarly, an additional 765 acres of Forestwide Fuels acres are planned to be burnt in proposed Units FWF545, FWF536, FWF52403 and FWF589 (Chapter 3, page 5). These acres would to be burnt even if Alternative 1 is the selected alternative. This activity would result in both a cumulative and indirect effect to soils. The potential direct effects include alteration of soil structure, impacts to soil invertebrates, reduced nitrogen and loss of soluble nutrients (Kuennen 2000). However, past experience with wildfires on KNF indicate that there is a very low risk of these effects even with high intensity fire. Alternative 1 does not propose any additional fuels treatments. The indirect effects would be an increased risk of damage to soils caused by high intensity wildfire resulting in a higher soil heating (Keane et al. 2002).

ALTERNATIVES 2 and 3
Direct and Indirect Effects
Alternatives 2 and 3 include approximately 3,952 and 2,457 acres proposed grapple pile fuel abatement activities following both regeneration and intermediate harvest activities. Excavator (grapple pile) activities would only occur in areas which are feasibly reached by machinery along skid trails and/or clipper cut trails used during harvest activities in order to reduce impacts to soils. In Alternatives 2 and 3, approximately 2,771 and 3,390 acres of timber harvest activities would occur with prescribed fire treatments such as underburning, broadcast burning and jackpot burning activities with timber removal. Alternatives 2 and 3 propose a total of 1,378 and 1,309 acres of proposed fuel treatment units where no harvest activities will occur. Some of these units involve proposed mechanical fuel treatment activities such as mastication. Of the fuel treatment units, Alternative 2 proposes 498 acres of potential mastication while Alternative 3 proposes only 375 acres of such activities. Alternatives 2 and 3 propose 2,256 and 1,965 acres of commercial thinning operations/whole tree yarding in order to remove potential fuel material overloading and improve the existing timber stand conditions. Such activities would involve heavy equipment activities along dominantly pre-existing skid trails. Activities such as grapple piling, mechanical fuel treatments and commercial thin are all expected to impact soils based on equipment activities in those units (Table 3.40).

Approximately 10,049 acres of Fuels and Wildlife acres are proposed for treatment under both Alternatives 2 and 3. Such activities are anticipated to remove understory vegetative concerns and enhance wildlife habitat along with reducing the potential for a large natural fire to occur which may remove standing vigorous healthy tree stands. In both Alternatives 2 and 3, approximately 5,563 acres of precommercial thinning are proposed. Such activities would be completed by hand saw with slash hand pile, and/or lop and scatter thus would not involve heavy equipment. Both Alternatives 2 and 3 propose 261 acres of proposed timber harvest along with prescribed fire on COE lands while Alternatives 2 and 3 both recommend a fuel reduction by prescribed fires on COE lands that does not involve timber harvest activities. Finally, Alternatives 2 and 3 both propose grapple piling on COE lands to deal with fuel concerns. No harvest activities are to occur in these areas (Table 3.40).

The burning prescriptions under Alternatives 2 and 3 were designed to provide only the fire intensity needed to achieve the vegetative management objectives. Direct effects resulting from underburning can result in soil heating and associated soil impacts such as loss of organic matter, impacts to soil organisms and creation of water repellency. The potential for these impacts are minimized because the burning

prescriptions for this project were designed for low to moderate fire intensity and would be implemented when soil moisture levels are high. Typically, burning is scheduled when the moisture in the lower duff layers is high enough so that the fire does not consume those layers, which insulate the soil from surface heating (DeBano 2000). Burn intensity would not reach the levels associated with nutrient loss through volatilization. Nutrients would be released from burned materials and made available for new vegetation. If temperatures are hot enough during prescribed burns Nitrogen (N) may be lost into the atmosphere (KNF 2001). If the soil is moist when burning occurs, much of the volatilized nitrogen would be retained in the soil. When soils have adequate moisture conditions to retain their biological, chemical and physical integrity, effects from the loss of forest floor can be minimized (Barnett 1989; Frandsen and Ryan 1985; Hungerford et al. 1991; McNabb and Cromack 1990). Prescribed pile burning could potentially remove woody debris that would otherwise provide nutrient to the soil as the decay process occurs (Page-Dumroese et al. 2006). Hence, burning when soil moisture content is high helps to maintain both coarse woody debris requirements.

Although a small portion of the nutrients would be lost through leaching, most of the nutrients would remain attached to or between the soil particles on-site. The re-introduction of fire in the analysis area is consistent with the ecological understanding of these forest types (Arno 1996). Positive impacts may result in a short-term (1 to 2 years) increase in plant-available nutrients (Choromanska and Deluca 2001; Hart et al. 2005; Certini 2005). Additionally, MacKenzie et al. (2006) found that light to moderate fire effects may maintain higher nutrient availability in the long-term with the positive influences from charcoal. Therefore, implementation of an action alternative containing post-harvest burns is not expected to adversely impact nutrient cycling in the analysis area. This is supported by Forest Soil Productivity Monitoring (refer to the Soil and Water Project File).

NUTRIENT CYCLING

Forest ecosystems have evolved with a continual flux of coarse woody debris (CWD). Coarse woody debris is defined as woody material greater than 3.0 inches in diameter, and is derived from tree limbs, boles and roots in various stages of decay (Graham et al. 1994; Brown et al. 2003). CWD performs many physical, chemical and biological functions in the forest ecosystems. Physically, it protects the forest floor and mineral soil from erosion and mechanical disturbances. CWD disrupts airflow and provides shade, which insulates and protects new forest growth. In moist forest types, it can be a seedbed and nursery area for new conifer seedlings. CWD also has significant water holding capacity, making it an important source of moisture for vegetation during dry periods. This decaying woody debris provides nutrients, especially sulfur, phosphorus and nitrogen, necessary for new plant growth. CWD also hosts ectomycorrhize, micro-organisms that play an important role in the uptake of nutrients and water by woody plants (Graham et al. 1994).

The importance of soil organic matter (duff layer) is indispensable to productivity and the ecological function of soils (Brady and Weil 2002). The organic component contains large reserve of nutrients and carbon, and typically contains the majority of microbial activity within the soil column. Forest soil organic matter influences many critical ecosystem processes such as formation of soil structure, which in turn influences soil water infiltration rates and soil water holding capacity. Soil organic matter is also the primary location of nutrient recycling and humus formation, which enhances soil cation exchange and overall soil fertility.

Nitrogen (N) is the most limiting nutrient in forest ecosystems and is almost totally dependent on microbial action by way of both symbiotic and nonsymbiotic N fixation. Except where nitrogen fixing plants are abundantly present such as alder, most N acquisition in forests comes from non-symbiotic fixation that depends on organic matter (Harvey et al. 1989). Another group of microorganisms that depends on soil organic matter and is important to a conifer’s ability to acquire nutrients such as nitrogen is the ectomycorrhizae fungi associated with roots. Using ectomycorrhizae fungi as a bioindicator of

healthy productive forest soils, Graham et al. (1994) developed conservative recommendations for leaving CWD after timber harvesting to ensure organic matter will be left to maintain long-term soil productivity.

ALTERNATIVE 1 (No-Action)
Direct, Indirect and Cumulative Effects
Alternative 1 does not propose any new management activities. Therefore, no direct, indirect or cumulative effects to nutrient cycling could result from Alternative 1. Nutrient cycling would continue at present rates until a natural disturbance occurs.

ALTERNATIVES 2 and 3
Direct and Indirect Effects
A direct impact from management activities in Alternatives 2 and 3 would be the removal of woody material from proposed timber harvest units. The removal of all or most of the organic material (both duff layers and CWD) from a site can cause temporary nutrient deficits that may affect physical and biological soil conditions (Brady and Weil 2002; Graham et al. 1994; Brown et al. 2003). To avoid this, it is important to maintain both fine and CWD on managed sites, especially regeneration harvest units where most of the organic matter is removed (Graham et al. 1994; Brown et al. 2003). Allowing the accumulation and decomposition of a range of sizes of woody debris maintains both short-term and long-term soil productivity. The different decomposition rates provide for the slow, continual release of nutrients.

This project was designed to provide for a continuous supply of woody material based on recommendations from Graham et al. (1994) and Brown et al. (2003). In harvest stands where more of the overstory is being removed, each activity area has been assigned a habitat-specific retention level for CWD (Table 3.41). In both regeneration and stand improvement units with underburn, broadcast burn, or jackpot pile activities, post-harvest stands would remain fully stocked, which would provide for yearly nutrient inputs through litter fall (Brady and Weil 2002) and long-term CWD as a result of future blow-down and decadence. Therefore, these units would meet the CWD requirements left on the ground following harvest activity. It should be noted that currently under the KNFP, the required CWD tons per acre to be retained only applies to regeneration harvest activities. In stand improvement units such as commercial thins future CWD is expected to result from natural events such as blow-over, root rot and beetle kill.

Table 3.41 Recommended Levels of CWD (> 3' diameter) for Timber Treatments Units

FOREST TYPE	VRU(S)	TONS ACRE^	UNIT(S)*
Warm Dry	1-3	5 to 20	1A, 2, 3, 3C, 9, 10, 11, 16, 18, 19, 20, 21, 33, 34, 44, 45A, 45B, 46, 54, 73T, 80, 81, 82, 141, 142, 143A, 158, 158A, 188S, 193, 195, 214, 219, 220, 367, 367A, 368, 368A, 368B, 368C, and 368
Warm Moist / Cool Moist	4-11	10 to 30	6, 7, 8, 12, 13, 14, 14A, 36, 39, 40, 41, 47, 51, 52A, 53, 59, 61, 62, 62A, 62B, 64, 64A, 64B, 68, 69, 70, 70T, 71, 72, 74T, 75, 144S, 144T, 147, 148, 149, 150, 151, 159A, 170, 185, 185N, 188, 190A, 207, 208, 362, 362A, 362B, 362C, 363, 364, 365, 366, and 369

*Some units may be listed under more than one Forest Type based on multiple habitat types being present in the unit.
^It should be noted that the biophysical setting CWD values should be looked at as a local estimation and are dependent on local precipitation levels and vary across the KNF from north to south.

Coarse wood provides micro-sites for microbial activity, retains carbon on-site, and moderates soil moisture (Graham et al. 1994; Brown et al. 2003). Alternatives 2 and 3 propose the removal of vegetation through timber harvest and burning. Soil productivity would be maintained through retention of CWD at levels recommended in Graham et al. (1994) and Brown et al. (2003). Maintaining CWD at the levels identified in these guidelines would ensure that both short-term and long-term soil productivity is

maintained. Therefore, implementation of either of the action alternatives is not expected to adversely impact nutrient cycling in the analysis area.

Cumulative Effects

Cumulative effects are the result of all the impacts that past, current and reasonably foreseeable activities have on a resource. A summary of activities are listed in Chapter 3 of the DEIS. The results of past activities have resulted in the "Existing Condition" described previously. The anticipated effects from proposed activities were then added to the existing condition and described in the section titled Analysis Methods, Detrimental Soil Disturbance. The sum of the existing condition (including past actions) and the direct and indirect effects of proposed actions combined with current and reasonably foreseeable actions result in the cumulative effects described in this section.

The geographic bounds of analysis area for consideration of cumulative effects consist of the same activity areas analyzed used in existing condition, direct and indirect effects. This is appropriate because soil productivity is spatially static and productivity in one location does not affect productivity in another location. The activity areas are delineated as directed by FSM R-1 Supplement No. 2500-99-1.

The temporal scale is dependent on the issue being addressed with no one scale being appropriate for all issues. The analysis may need to evaluate the effects of proposed management over all seasons for several days, years and even decades with regards to soils. This is complicated by data constraints that require constant monitoring to detect change – though data is often insufficient to identify even trends or trajectories of change until the impact is large enough or has been occurring for some time. Furthermore, there is often a lag between some actions and the observed effect. This is particularly true for soils. This analysis strives toward an integrated approach to soil processes and function to project future trends in response to proposed management options to the best abilities.

CURRENT VERSUS HISTORIC MANAGEMENT PRACTICES

There are marked differences between past and current land management practices and policies. The evolution of land management practices is the result of science, technology, ongoing monitoring actions, and changing public values. The earliest harvest activities within the analysis area were completed by horse logging, railway, logging chutes, Shay locomotives and Holt tractors. Such activities involved harvesting the biggest, most valuable trees and leaving the other trees on-site. Logging systems were selected primarily by the least expensive method to transport trees from the forest to the mill. Tractor skidding was typically used and trails and landings were not minimized. Harvest on steeper slopes, at times, involved stair-step excavated trails (i.e. jammer roads). In addition to harvest activities, fuel reduction and site preparation for natural regeneration or planting many times consisted of dozer piling. Many of these practices led to excess soil disturbance and increased the risk of erosion.

Over the last 20 years, impacts to soil and water resources from logging activities have been significantly reduced because of BMPs, the Inland Native Fish Strategy (INFS), and changes in science, technology, etc. Based on research studies, current BMPs and INFS riparian habitat conservation areas (RHCAs) can reduce sediment delivery to streams compared with historical practices (Lee et al. 1997; USDA Forest Service 1995). Harvest methods and removal of timber products from the National Forest changed substantially over time. Modern timber harvest prescriptions and design emphasize desired conditions of the forest after timber harvest. This often results in the retention of various amounts of trees in a post-harvest stand to address objectives that may include seed production, shelter for the site, watershed objectives, soil productivity, wildlife, and others. Elements of modern harvest prescriptions that address specific resource concerns include retention of snags and down wood for soil nutrition, minimizing the number of skid trails, and maintaining sediment filtering vegetation in riparian areas near lakes and streams. Jammer roads and dozer piling rarely occur.

Forest BMPs currently incorporated into timber harvest activities include some of the following:

- Reduce impacts to sensitive soils based on season of operations or equipment use.
- Use excavator for mechanized slash piling and fire line construction.
- Operate equipment over a slash mat where feasible.
- Limit logging to dry conditions (less than 18% soil moisture) or during winter when the ground is frozen.
- Use existing skid trails and landings where feasible.
- Avoid skidding on unstable slopes and slopes that exceed 40% unless not causing excessive erosion (State of Montana BMPS Section IV.B).
- Units 2, 2B, 3, 7, 10, 13, 14, 15, 24, 26, 64, 70T, 73T, 74T, 80, 81, 159A, 183, 190, 190A, 194T, 196, 305, 307, 311, 318, 319, 327, 328, 330, 331, 334, 335, 339, 340, 344, 345, 346, 347, 349, and 350 require harvest operations in winter based on soil concerns. Similarly, winter tractor (WT) operations are recommended in Unit COE6 to avoid exceeding 15% DSD following harvest activities.
- Provision C64 is recommended in those units where WT operations based on soil related issues are in place.
- Rehabilitate, scarify, reseed and waterbar project areas deemed necessary upon completion.
- Space skid trails 75 to 125 feet apart.
- Ensure that enough coarse woody debris is left to sustain long term soil productivity while still meeting fuel reduction objectives.
- Removal of slash to landing using whole tree yarding.
- Using excavators instead of dozers for slash piling.
- Reduce erosion and sedimentation through timber harvest unit design.
- Excluding RHCAs from harvest and equipment entry.
- Limit operations during high moisture conditions.
- Determining the proper log retrieval system for the timber harvest unit slope to protect from degradation of water quality or soil productivity.
- Light intensity burns following harvest operations.

In 1995, the KNFP was amended to include INFS management direction (USDA Forest Service 1995). The implementation of INFS gave greater protection to soil and water resources in riparian areas adjacent to streams, lakes and wetlands. INFS gives riparian dependent resources priority over other resources in RHCAs. RHCAs are no “lock out” zones, activities that occur in them either benefit the riparian area and associated aquatic features or, at a minimum, do not slow the rate of recovery within the riparian area.

ONGOING and REASONABLY FORESEEABLE ACTIONS

In the following discussion, the effects of past, current and/or reasonably foreseeable activities are considered cumulatively with activities proposed with this project. The effects were either described as not contributing effects, contributing indiscernible effects, or having measureable effects on water resources.

Vegetation Management and Fuels Reduction Activities

There is an estimated 910 acres of Forestwide Fuel units which have been slashed in preparation for underburning between 2013 and 2015. These three units (FWF545; FWF536 and FWF52403) have all been hand-slashed and would not involve heavy equipment activities. Additionally, there is an expected 765 acres of proposed Forestwide Fuel acres which is likely to be treated should the no action (Alternative 1) be selected. These units include: FWF545; FWF536; FWF53404; and FWF589. Associated light, short-duration burning that does not consume the entire duff layer does not strongly affect soils. Duff acts as an insulator, protecting the soil from excessive heating. As a result no impacts to soil conditions are expected to occur.

It is expected that personal firewood collection would occur throughout the analysis area. Such activities would not create additional ground disturbance or remove enough vegetation to affect soil productivity

and therefore would not contribute additional effects to soil resources.

State of Montana Department of Natural Resources and Conservation (DNRC) Harvest Activities
The DNRC plans on completing approximately 198 acres of regeneration harvest operations over the next 10 years of time. Such activities are planned to be mostly tractor operations. Some of the related soil disturbance activities expected to occur on DNRC lands would include soil compaction along skid trails, roads and firelines. Activities on state, Plum Creek Timber Company and DNRC lands would have no effect on soils in the analysis area because soil productivity effects are spatially static and productivity in one location does not affect productivity in another location.

Blowdown Salvage
It is expected that there would be salvage of blown-down trees within the analysis area. Treatment acres are not expected to exceed 20 acres per year over the next 10 years. If blowdown were to occur, proper analysis would be conducted for any potential harvest activities. As a result, related soil disturbance would be limited to existing trails, roads and firelines. Therefore, no additional detrimental soil disturbance is expected within the activity areas. Some of the salvage is likely to occur outside of the units treated under the selected alternative; therefore, any such impacts would not be additive activity areas analyzed in this decision.

Precommercial Thinning
An estimated 760 acres of precommercial thinning is anticipated to occur within the analysis area within the Cripple Horse and Canyon Creek drainages over the next five years. Ongoing and reasonably foreseeable precommercial thinning activities within the analysis area would contribute indiscernible effects to soils at the analysis area scale. This is because precommercial thinning is done by hand and there is no additional ground disturbance. In addition, trees removed during thinning projects are left on-site which is beneficial to soils by reducing soil erosion and returning nutrients to the system over time.

Christmas Tree Boughs
Christmas trees/boughs can be harvested for individual use or commercially on NFS land. Each of these activities requires a permit. These activities are both current and reasonably foreseeable within the analysis area over the next ten years (approximately 200 acres). This activity does not create additional ground disturbance or remove enough vegetation to affect soil productivity and therefore would not contribute additional effects to soil resources.

Noxious Weed Treatments
The control of noxious weeds on NFS land is an ongoing activity that normally occurs within the summer months. The KNF Invasive Plant Management ROD (USDA 2007) provides direction for noxious weed control on the District. Noxious weed control is expected to continue over the next ten years. Most herbicide treatments are conducted along existing roads with very few treatments occurring in timber harvest units.

Effects of noxious weed control were incorporated into the cumulative effects analysis through consideration of the effects disclosed in the Herbicide Weed Control EA, a review of the project database, and professional judgment and personal knowledge of noxious weed control. Approximately 183 acres of weeds were sprayed in the Cripple Planning Unit (Weeds Project File) in 2010. The findings of this assessment conclude that ongoing and reasonably foreseeable noxious weed control within the analysis area would cumulatively contribute indiscernible effects to the soils resource. The level of noxious weed control within the analysis area is not expected to increase much over the next ten years. All activities would follow approved application methods as analyzed in the KNF Invasive Plant Management ROD (2007); therefore no adverse cumulative effects would occur.

Fire Suppression
Fire suppression activities would occur as needed. Effects from wildfire suppression would vary with location and size of the fire; however suppression activities are expected to follow KNFP direction. Such

activities may include construction of firelines, safety zones and helispots by hand and equipment. Suppression of wildfires could have measurable effects to soils within the analysis area. These effects could include soil compaction, displacement and erosion. Due to the unpredictable nature of wildfires, cumulative effects from future wildfire suppression activities could not be meaningfully quantified in this document.

Road Management

Routine road maintenance is likely to occur as funds become available and would follow BMPs and INFS guidelines in order to minimize effects on soil resources. Existing BMPs would be maintained but not all needed BMPs would be accomplished (i.e. it would be unlikely that existing undersized culverts would be replaced due to funding concerns, and thus would remain at risk of future failure). Water and sediment delivery would continue to occur at problem locations and no road storage would take place under the No Action Alternative. When viewed from a cumulative effects input to soils such activities would result in such activities as contributing further cumulative effects to soil conditions when viewed at the individual timber harvest unit.

Under Alternatives 2 and 3, an estimated 9.3 and 8.1 miles of permanent road are proposed to be constructed on NFS lands. Permanent road management is outside of the activity areas identified for soils analysis because the permanent road system and administrative sites do not count toward the 15% soil quality standard. Road management would have no cumulative effects on soils in the analysis areas because soil productivity effects are spatially static and productivity in one location does not affect productivity in another location.

Recreation Maintenance

Routine maintenance would occur on non-motorized trails in the analysis area as funds become available to do such work. Maintenance may include brushing; removing blowdown, debris and hazard trees; repairing or adding waterbars; repairing treads; repairing or replacing signs; and improving vistas. All such activities involve hand-work and would not include heavy equipment. As a result, routine trail maintenance would have no effect on soils in the activity areas identified. Administrative sites do not count toward the 15% standard. In addition, the trails are individually small, scattered across many watersheds, and not all work would occur in the same year.

Outfitter and Guide Activities

There is one outfitter permit in the analysis area. This activity would have no effect on soils within the analysis area. This conclusion is based on the limited amount of activity in the past. If camps are proposed and approved, the outfitter is allowed only two motorized trips per camper year behind gates, one each season to move in and set up compass and the other to move out. Activities moving in and out of such camps are restricted to horses and trails. Therefore, disturbance is not expected to cumulatively affect soil conditions.

Other special use permits include road access to private property, water lines and gravel pit. Such activities would not add detrimental disturbance to the amounts listed in Table 3.37. The level of special uses within the analysis area is not expected to change much over the next ten years.

Utility Lines

No additional utility lines are proposed for construction. Therefore, disturbance associated with utility lines would not count towards the 15% standard individually or within proposed timber harvest units.

Mineral Activities

There are ten gravel pits within the East Reservoir analysis area. Only three of the ten pits are currently active and still contain materials. Activities on such land areas are not considered a part of the soils resource to analyze for disturbance values and no additional gravel pits are proposed for construction. Therefore, disturbance associated with gravel pits would not count towards the 15% standard individually or within proposed timber harvest units.

Public Uses
Recreational use of the analysis area includes hiking, camping, fishing, hunting, photography, small forest product gathering (berries, mushrooms, cones, and boughs), Christmas tree cutting, firewood gathering, driving for pleasure, mountain biking, sightseeing, wildlife viewing, cross-country skiing, snowshoeing, trapping and snowmobiling. These activities are expected to continue over the next ten years. Because of increasing numbers of people moving into the local communities, it is expected that some of these activity levels would increase. Recreational activities would contribute indiscernible effects to soils. This is based on the fact that these activities are individually small and scattered across many watersheds.

Special Use Permits
There are ten special use authorizations within the East Reservoir analysis area. Such authorizations consist of authorized roads right-of-ways, water developments and utility corridors. Most road use permits are short segment roads that were built to access private land/residences from major NFS roads. Water developments normally consist of spring developments and water transmission lines crossing NFS lands in need of domestic potable and non-potable waters. Electric and telephone utility corridors are usually buried in road right-of-ways adjacent to NFS roads. As a result, all such activities would not be counted towards the 15% DSD and have no impacts on cumulative effects.

Marina
Marina authorization includes access to the Kootenai Lake water body and NFS lands and is also associated with lodging, guiding, sales, etc. The Koocanusa Marina plans to expand its camping sites during 2012-2013. This expansion includes 33 new seasonal RV camping sites, a new septic system and new well. Such activities may also relate to chip sealing approximately 0.9 miles of the access road. There would be selective tree and vegetative removal which is already associated with proposed Unit 183. Should this occur, there would be potential soil impacts associated with equipment operations in that area. It is expected that such operations would be very site-specific and benefit timber stands by removal of future potential fire and beetle concerns in the East Reservoir Planning Area.

OHV Use
Off-highway vehicle (OHV) use was left off the list of reasonably, foreseeable future activities as determined under USDA 2001 because it is currently limited only to existing trails and open roads (OHV Record of Decision and Plan Amendment for Montana, North Dakota, and Portions of South Dakota, 2001). Therefore, no additional disturbance is expected from OHV use because soil productivity effects are spatially static and productivity in one location does not affect productivity in another location.

Private Property
Activities on private lands would continue especially within the lower Warland Creek drainage basin. Such activities would include commercial timber harvest, land clearing, home construction, road construction, septic field installation, water well drilling, livestock grazing and stabilization of migrating stream banks. Activities on private lands would have no effect on soils in the analysis area because soil productivity effects are spatially static and productivity in one location does not affect productivity in another location.

Grazing
There are four grazing allotments in the project area. They are Fivemile, Warland, Cripple Horse and Canyon Creek. The Cripple Horse and Canyon Creek have been closed through the administrative closure process due to declining transitory range, lack of demand and riparian area concerns. Both Cripple Horse and Canyon Creek have been inactive for ten years. Fivemile is an active allotment that supports 17 cow/calf pair with a grazing season of June 1 to October 15. Much of the grazing is on private lands owned by the permit holder along Fivemile Creek and upland areas adjacent to Blue Sky Road #6271. The Warland Creek Allotment has been inactive for 6 years. It would be maintained as a potential grazing in the foreseeable future.
Only livestock grazing was determined to contribute cumulative effects. Livestock grazing and associated

activities are expected to continue in the analysis area through the operating period of 10 years. Cattle tend to use existing skid trails and are not expected to increase soil compaction in activity areas by more than two percent (Kuennen 2003). Those units located within the Fivemile allotment that are more likely to be impacted by grazing include the following, F1, F1OG, F2, 143A, 144S, 144T, 147, 148, 149, 150 and 311. Those units located within the Warland Creek Allotment that are more likely to be impacted by grazing include the following, 9, 10, 11, 9, 10, 11, 12, 13, 14, 14A, 49, 51, 52A, 53, 54, 158, 159A, 306, 307, 348 and 350. Of these units, none are expected to cumulatively exceed the 15% DSD value. As a result, grazing in combination with the effects of prior management and the proposed activities is not expected to exceed the threshold of 15% for detrimental soil disturbance in the activity area (Table 3.37).

CONSISTENCY with REGULATORY FRAMEWORK

State and Federal Laws and Regulations

The National Forest Management Act (NFMA) requires that all lands be managed to ensure maintenance of long-term soil productivity, hydrologic function and ecosystem health. All activities proposed are consistent with this direction. Having a fully stocked stand left on-site to contribute needle-cast and/or trending toward the CWD guidelines contained in Graham et al. (1994) and Brown et al. (2003) would assure long-term soil productivity. All activity areas would remain below 15% detrimentally disturbed soils, RHCAs would be delineated where appropriate, design criteria would be followed, and all applicable BMPs would be implemented.

FOREST PLAN DIRECTION

The KNFP states that project plans for activities requiring the use of ground-based equipment will establish standards for the area allocated to skid trails, landings, temporary roads, or similar areas of concentrated equipment use (USDA Forest Service 1987a). FSM 2500-99-1 establishes guidelines that limit detrimental soil disturbance to no more than 15% of an activity area. KNFP soil productivity monitoring results were reviewed throughout this project (Kuennen 2007b; Kuennen 2003; USDA Forest Service 2003; and USDA Forest Service 1998). The five-year results from 1992–1997 found less than one percent of the acres surveyed were above the 15% threshold, with 77% of surveyed areas having less than 10% detrimental disturbance. Between 1998–2005, none of the areas surveyed were above the threshold.

Kuennen (2003; 2007c; Kuennen 2007e) compiled all monitoring data to date, which was used as the basis for soils analysis and specifying design criteria for this project. All management activities would follow the BMPs outlined in Soil and Water Project Files and would be consistent with KNFP Standards. The 2011 KNF Monitoring Summary (USDA Forest Service 2011b) states that monitoring between 1991 and 2011 shows that 95 percent of the BMPs implemented during that time were effective. In 2012 the KNF remonitored 57 timber sales which involved 118 timber sale units and 3,338 timber harvest acres. Data was collected along 222 transects and 47,042 data points in harvest areas which had been previously monitored for soil disturbance (1992-2006). All units were resampled at a 95% confidence level (Gier et al. 2013).

The proposed project is consistent with the goals, objectives, and standards for soil and water resources set forth in the KNFP because project design criteria and BMPs have been included to protect soil and water resources. The BMPs include Soil and Water Conservation Practices at a minimum to control non-point source pollution and protect soil and water resources from permanent damage. All proposed treatment units where harvest equipment may disturb soil conditions were field reviewed.

FISHERIES and AQUATIC SPECIES RESOURCES INTRODUCTION

INTRODUCTION

This analysis section discloses the potential effects to fish, amphibians, and mollusks and their habitats from implementing the action alternatives. This discussion includes the no-action alternative for comparison with the action alternatives.

REGULATORY FRAMEWORK

Clean Water Act

Cripple Horse Creek is a Water Quality Limited Segment (WQLS) (see Water Resources section). Probable causes include sedimentation and siltation. The water quality limited listing includes all upstream tributaries to the listed segment. Therefore, the entire Cripple Horse Creek drainage is considered part of the WQLS.

Endangered Species Act

The Endangered Species Act (ESA) of 1973 declares that *"...all Federal departments and agencies shall seek to conserve endangered species and threatened species and shall utilize their authorities in furtherance of the purposes of this Act.*" Under the Act, Federal agencies must consult with the Secretary of the Interior whenever an action authorized by such agency is likely to affect a species listed as threatened or endangered. Bull trout and white sturgeon are currently the only two listed fish species on the Kootenai National Forest (KNF) as threatened and endangered, respectively, under the ESA.

Executive Order

Executive Order 12962 mandates disclosure of effects to recreational fishing.

Kootenai National Forest Plan

The Inland Native Fish Strategy (INFS) amended the 1987 Kootenai National Forest Plan (KNFP) in 1995 (USDA Forest Service 1995). INFS establishes stream, wetland and landslide-prone area protection zones called Riparian Habitat Conservation Areas (RHCAs) setting standards and guidelines for managing activities that potentially affect conditions within the RHCAs. Widths of RHCA buffers are based on current scientific literature that documents them to be adequate to protect streams from non-channelized sediment inputs and provide for other riparian functions. These riparian functions include delivery of organic matter, large woody debris (LWD) recruitment and stream shading. INFS also established riparian management objectives (RMOs) that provide guidance with respect to key habitat variables (Table 3.42). RMOs as established by INFS as standards for forested systems include pool frequency, LWD, temperature, and width/depth ratio (W/D). Actions that retard attainment of these RMOs, whether existing conditions are better or worse than objective values, are inconsistent with INFS.

Table 3.42 - INFS RHCA Buffer Widths

RHCA DEFAULT BUFFER WIDTHS			
FLOW REGIME	DESCRIPTION	INFS	INFS RHCA WIDTH
Perennial	Perennial Fish Bearing Stream	1	300 feet on each side unless extended by ERV or slope
Perennial	Perennial Non-Fish Bearing Stream	2	150 feet on each side unless extended by ERV or slope
Wetlands	Lakes, Ponds, and Wetlands > 1 acre	3	150 feet on each side unless extended by ERV or slope
Intermittent/Ephemeral & Wetlands	Intermittent/Ephemeral Non-Fish Bearing Stream & Wetlands < 1 acre	4	50 or 100* feet on each side unless extended by ERV or slope

The RHCA buffer represented in the chart is for single side of the stream channel. The total length of the buffer would be 2X the listed value.
ERV = Edge of Riparian Vegetation Priority watersheds have a 100 feet RHCA for Class 4

ANALYSIS AREA

Potentially affected watersheds in the analysis area include Lake Koocanusa and the Kootenai River, Dunn Creek, Canyon Creek, Cripple Horse Creek, Warland Creek, Five Mile Creek and tributary streams to these drainages. The project area can be viewed on Map 1 in Chapter 2 at a watershed scale.

ANALYSIS METHODS

Existing conditions were determined through field surveys and review of data sources to develop effects analysis for fisheries resources in project area watersheds. Effects to fish populations were assessed based on effects to habitat. This analysis was done to the nearest point of effect for all threatened, endangered and sensitive species.

AFFECTED ENVIRONMENT

Sensitive species are managed under the authority of the National Forest Management Act (NFMA) and are administratively designated by the Regional Forester (FSM 2670.5, Tidwell 2008). Threatened and Endangered species (TES) are under the jurisdiction of the United States Fish and Wildlife Service (FWS) under the authority of Section 7 of the Endangered Species Act. The Forest Service (FS) is directed to maintain viable populations of native species and to avoid actions that may trend towards a species becoming threatened or endangered. Threatened, endangered, and sensitive fish species identified to exist on the KNF are displayed in Table 3.43. The table includes presence and/or absence of species in the analysis area.

Table 3.43 – TES Fish Presence in the Analysis Area

STATUS	SPECIES	PRESENCE in ANALYSIS AREA or DOWNSTREAM RECEIVING WATERS
Threatened	Bull Trout (*Salvelinus confluentus*)	Known from Lake Koocanusa
Endangered	White Sturgeon (*Acipenser transmontanus*)	Found only below Kootenai Falls
Sensitive	Westslope Cutthroat Trout (*Oncorhynchus clarki lewisi)*	Known
Sensitive	Western Pearlshell Mussel (*Margaritifera* Falcata)	Known

Data Sources, Methods and Assumption

Libby Ranger District records and the Montana Fisheries Information System (MFISH) were reviewed to determine current known fish and amphibian distribution in the analysis area. Fisheries surveys conducted in the past found trout distributed in Dunn Creek, throughout Cripple Horse Creek, and lower Fivemile. Warland Creek and upper Fivemile Creek have limited fisheries due to their intermittent nature. The results of genetic analysis in streams above Libby Dam showed that fish where highly hybridized with non-native rainbows. A genetic sample from Dunn Creek was completed in 2010. The results of this sample showed that cutthroat were 98% pure westslope and were hybridized with rainbow trout. The sample site was located in upper Dunn Creek above a known natural fish barrier in the drainage. Due to this genetic testing, westslope cutthroat from this segment of Dunn Creek will be considered pure strain for this document. Brook trout also populate the streams making up most the fish within Fivemile Creek and Cripple Horse Creek above the falls. Non-native rainbows are known from project area streams as well.

There are three known natural barriers on the mainstems of Canyon Creek (Photo1), Dunn Creek and Cripple Horse Creek (Photo2). The barriers on Cripple Horse Creek and Canyon Creek are large waterfalls with roughly 10 and 20 foot drops respectively. There are no fish above the falls in Canyon Creek and only brook trout are known above the falls in Cripple Horse Creek. The barrier on Dunn Creek is a steep intermittent segment of stream channel. There are three known culvert barriers in the project area. Dunn Creek (Photo 3) and Canyon Creek (Photo 4) both have large barrier culverts where US HWY 37 crosses. These large structures are barriers to fisheries migration into the drainages. A third structure is known from Warland Creek where NFS road 566 crosses the stream (Photo 5).

Photo 1 - Canyon Creek Falls

Photo 2 - Cripple Horse Creek Falls

Photo 3 - Fish Barrier on Dunn Creek HWY 37

Photo 4 - Fish Barrier on Canyon Creek HWY 37

Photo 5 – Fish Barrier on Warland Creek 566

FISH POPULATION STATUS

A detailed map of the analysis area can be found in Chapter 2.

Project area streams presently have small populations of westslope cutthroat, coastal rainbow and brook trout. Genetic surveying found mixed westslope cutthroat and coastal rainbows hybrids, and pure strain westslope cutthroat in the analysis area. MFISH was queried for species presence within the analysis area. The MFISH database showed the presence of other native fish from past surveys. Dunn Creek showed the presence of both longnose dace and sculpin, Cripple Horse Creek had both large scale sucker and longnose dace; and Fivemile Creek had longnose dace, mountain whitefish and sculpin.

Historical data on fisheries abundance and distribution is limited and dates back to the late 1800s. The earliest stocking records for streams around Libby are from 1913. There were some 185,000 brook trout and some unknown number of Yellowstone cutthroat trout released into local waters. The next earliest recorded planting was 1914 when more Yellowstone cutthroat trout were released. It is important to note that the next detailed stocking report was from 1936. In the 22 years between stocking records, millions of brook trout, Yellowstone cutthroat and coastal rainbow trout were brought into the Libby area.

The construction of Libby Dam created numerous problems to native fish. The river above the dam was wild and had high populations of native fish including westslope cutthroat, bull trout and burbot. The reservoir created challenges for these fish and as part of the mitigation for the dam, westslope cutthroat were enhanced and propagated to colonize the reservoir and its tributaries. The mitigation plan from 1968 included chemical treatment (retenone) of streams entering the reservoir by Montana Fish, Wildlife and Parks (MFWP). The plan called for the removal of "rough" fish to increase the amount of available habitat for westslope cutthroat. This project was carried out in 1969 and 1970 when streams were rotenoned along the reservoir corridor. Most of the native fish were removed from reservoir tributaries. Fish from the reservoir have recolonized analysis area streams but no longer contain the pure strain westslope genetics. Recent electrofishing surveys show that brook trout were more successful at colonizing these streams then westslopes. Most of the perennial segments of stream channel above the Reservoir contain higher concentrations of brook trout then westslope and rainbows combined. MTFWP no longer stocks westslope cutthroat trout in Lake Koocanusa. The appearance (and food web take over) by kokanee salmon (landlocked sockeye salmon) made the cutthroat trout fishery infeasible. The State now stocks triploid rainbows from Canada to create a trophy rainbow trout fishery. The stocked rainbows are sterile and do not contribute their genetics to fish within the Reservoir and its tributaries. Bull trout have thrived in past years due in part to the large population of kokanee. The number of bull trout is high enough in the reservoir that a tag system was in place for the taking of bull trout. However, in recent years, redd counts in the Elk River have dropped and the taking of bull trout is no longer legal in the Reservoir.

MFWP continues to plant non-native fish in lakes throughout Lincoln County many of which are headwaters streams. These fish can migrate downstream which brings them into contact with native species.

THREATENED, ENDANGERED and PROPOSED FISH SPECIES

White Sturgeon (*Acipenser transmontanus*)

Description of Population and Habitat Status

The white sturgeon is restricted to 168 miles of the Kootenai River between Cora Linn Dam in Canada and Kootenai Falls in Montana. They migrate freely throughout the area, but are uncommon upstream of Bonners Ferry, Idaho (Apperson and Anders 1991; Graham 1981). Above Bonners Ferry there are very few fish, estimated at only 1 to 5 individuals (Graham 1981).

Operation of Libby Dam is considered the primary cause for the white sturgeon decline (Holton 1980; Apperson and Anders 1991). Overt or inadvertent harvest of the species by anglers is thought to be virtually non-existent, and a no-kill harvest regulation is in effect throughout the range of this population.

No activities are proposed that would directly affect potentially inhabited white sturgeon habitat. The proposed activities are situated over 20 stream miles from Kootenai Falls. No riparian or upland activities immediately adjacent to sturgeon habitat are proposed and as such the proposed activities would have no effect on white sturgeon or their habitat.

Bull Trout (*Salvelinus confluentus*)

Description of General Population and Habitat Status
Bull trout are native to the upper Columbia River basin in northwest Montana. They require clean, cold, complex and connected habitat (MTBSG 1998). They have declined by perhaps more than 50% because of land management practices, expansion of introduced fish, non-sustainable recreational harvest and loss of habitat connectivity (MTBSG 1998). Forest management, mining and dam operations have adversely affected spawning and rearing habitat conditions for bull trout in the Kootenai River Section 7 Consultation population. (The middle Kootenai River is that segment of river from Libby Dam down to Kootenai Falls). Current bull trout habitat is also inhabited by non-native brook trout and lake trout that threaten the persistence of bull trout by hybridization and interspecific competition. Bull trout, brook trout and lake trout are (genetically) similar species (falling in the genus *Salvelinus*). These fish were historically separated geographically; bull trout in the western side of the continental divide, and brook trout in the east along the Appalachian Mountains, and lake trout occurring in the Midwest and Canada. The species are fall spawners and will hybridize with other species in the *Salvelinus* genus. This hybridization in bull trout threatens the species throughout its range.

Description of the Population within the Analysis Area
Bull Trout are known from Lake Koocanusa. The fish in the reservoir are migratory and move into streams for spawning and rearing primarily in the Elk River, Canada. Fivemile Creek in the analysis area has mention of bull trout use which is anecdotal and from past professional judgment and personnel communications. However, during numerous electrofishing surveys by Libby Ranger District personnel and FWS, only large numbers of brook trout (and a few rainbows) were found in the perennial segment of the stream. Any use of the drainage for spawning by bull trout would result in hybrid fish and the lack of actual evidence of bull trout in the drainage leads to the conclusion that bull trout do not use the drainage for spawning and rearing. An occasional fish may migrate into the system but conditions for bull trout in the drainage do not contain suitable habitat. Therefore, for this document, bull trout will not be considered present in tributary streams and not affected by the proposed project.

SENSITIVE FISH SPECIES
Westslope Cutthroat Trout *(Oncorhynchus clarki lewisi)*

Description of General Population and Habitat Status
The distribution and abundance of westslope cutthroat trout has declined from historic levels across its range, which includes western Montana's Kootenai River drainage. Westslope cutthroat trout persist in only 27% of their historic range in Montana. Due to hybridization, genetically pure populations are present in only 2.5% of that range (May et al. 2003). Hybridization causes loss of genetic purity of the population through introgression (Backcrossing of hybrids populations to introduce new genes into a wild population.). Some of the remaining genetically pure populations of westslope cutthroat trout are found above fish passage barriers that protect them from hybridization, but isolate them from other populations. Westslope cutthroat trout are common on the KNF and many genetically pure populations still persist although hybridization and displacement is still a major concern.

Westslope cutthroat trout exhibit both migratory and resident life histories on the KNF. These fish are capable of traveling over 100 miles on spawning migrations. Migratory fish typically rear in their natal streams until their third year, and a length of 7-9 inches, when they migrate to either a larger stream or

lake to rear to maturity. Resident fish are significantly smaller than their migratory counterparts. Sexual maturity is attained at either age 4 or 5, length of 4-16 inches at which time they migrate back to their natal streams to spawn. Westslopes can reach lengths in excess of 20 inches and weigh in excess of three pounds. Common lifespan for this species is seven years. Westslope cutthroat trout feed primarily on aquatic insects in streams and larger zooplankton in lakes.

Habitat fragmentation and the subsequent isolation of populations is a concern for westslope cutthroat trout due to the increased risk of local and general extinctions. The probability that one population in any locality will persist depends on habitat quality and proximity to other populations (Rieman and McIntyre 1993).

Description of the Population within the Analysis Area

Historically, pure strain westslope cutthroat trout were likely distributed throughout the mainstems and headwaters of project area streams. Genetic testing on Dunn Creek occurred in 2010 on a likely pure population of westslopes. The data found 98% pure westslope cutthroat trout hybridized with rainbow trout. The population of westslopes in upper Dunn Creek will be considered pure strain for this document due to the fact that this population of fish is isolated from upstream migrants and its small size. Genetic exchange is not occurring from downstream waters. A catastrophic event could remove fish from the basin. There are no other pure populations of westslope cutthroat in the analysis area.

No additional population data exists for streams in the analysis area. Based on electrofishing data, as well as results of previous genetic analysis completed on analysis area streams, westslope cutthroat are only known to be present in Dunn Creek. Streams in the analysis area above Libby Dam have been chemically treated by MFWP and recolonized by non-native fish and westslope hybrids.

There is insufficient data to determine growth and survival rates of fish in the analysis area. Genetic analysis has proved the existence of pure westslope cutthroat in Dunn Creek and hybrid westslope cutthroat x redband rainbow trout throughout the remainder of the analysis area streams. Since growth rates have not been determined in the analysis area, this factor is largely rated based on the survival aspect. Removal of barriers to fish passage facilitates genetic exchange with other westslopes but also facilitates movement by introduced salmonids, which can permit hybridization and interspecific competition. The remaining culvert barriers in the analysis area seem not to be negatively affecting westslope cutthroat.

DESIRABLE NATIVE AND NON-NATIVE FISH SPECIES

Brook Trout (*Salvelinus fontinalis*)

Description of General Population and Habitat Status

The brook trout is widespread across the KNF. This species is endemic to the Eastern United States and is an invasive in western streams. They directly compete with native fish for food and habitat, and in some instances completely replace native fish. This is especially true with westslope cutthroat in lower gradient warmer water streams. This does not seem to be the case on the KNF where brook trout and westslopes seem to come to some sort of equilibrium. The brook trout is closely related to native bull trout and can interbreed with them. Hybrid brook/bull trout are usually sterile and do not contribute to the genetics of either bull trout or brook trout. Historic stocking of brook trout started around the turn of the century on the KNF. This fish was widely planted in streams and lakes and still maintains viable populations on the Forest in many watersheds.

Brook trout are fall spawners with spawning normally occurring between September and November. Fry emerge in the spring after high flows and live up to five years (Scott and Crossman 1973). Sexual maturity comes at age three; however in some cases individual fish may become mature as early as two. Spawning occurs mostly in headwater streams but can also occur in lower gradient streams and lakes with sandy substrate with spring upwelling (Scott and Crossman 1973).

Brook trout exhibit a large number of migratory patterns. Most fish live in a particular area for the

majority of their lives. However, some exhibit both fluvial and adfluvial migrations both for spawning and for finding new home ranges. It is not uncommon for these fish to colonize an entire drainage in a short time period if no barriers to upstream migration are present.
Brook trout are considered to be a desirable non-native species from the perspective of sport fishing. From the perspective of native fish species diversity, brook trout are considered a threat due to hybridization and competition for food and habitat.

Rainbow Trout (Coastal strain) (*Oncorhynchus mykiss*)

Description of General Population and Habitat Status
The rainbow trout is a widely distributed western North America native salmonid that is closely related to the interior redband rainbow. Rainbows can be divided into two forms - the adfluvial rainbow that annually migrates between a lake and tributary river in order to complete its lifecycle, and the fluvial rainbow that remains in a river system throughout its life. The potential for both exists in the project area.

The historic range of the rainbow trout included freshwaters west of the Rocky Mountains, extending from northern California to northern British Columbia, Canada. Presently there are a large number of populations of rainbows in the Upper Kootenai Subbasin, they occur in numerous drainages and lakes on the Libby Ranger District.

Rainbows are spring spawners, March-June, (Scott and Crossman 1973). Fry emerge from the stream-bottom approximately two months after spawning and begin a stream residence that may last one year to a lifetime (Scott and Crossman 1973). Adfluvial and migratory fluvial rainbow juveniles will typically move downstream to their ancestral lake or river after one to three years of residence in the headwaters. Sexual maturity typically occurs at three to five years except in cold or hot climates where life expectancy is shortened.

Rainbow trout have been found in watersheds as small as three square miles, but the subspecies is generally known from far more productive waters where piscivory supports fish up to 35 pounds (Scott and Crossman 1973).

The widespread culture and stocking of coastal rainbows (as described above) or hybrid rainbow, steelhead and rainbow, throughout the range of other native trout species has lead to substantial losses of the native genotypes (Behnke 1992).

Description of the Population within the Analysis Area
Historically, it is assumed that only native redband rainbows were present and distributed throughout the Kootenai River system on Libby Ranger District. The current population of costal rainbows is probably composed of a resident component that rears and spawns in the Kootenai River and Lake Koocanusa and lower segments of other streams (where migration is not blocked) in the project area.

Sculpin (*Cottus spp.*)
The sculpin is a wide-ranging species found across the Western North America. Generally, this small fish is found in riffle areas among rocks of cold, clear streams, but it can be found along gravel beaches of lakes. They spawn in the spring with females lay eggs under rocks and eggs guarded by males. They feed on a variety of aquatic invertebrates. They may attain lengths of four inches or slightly more, but most adults are two to three inches in length. Sculpin are a prey species for other fish including salmonids.

District electrofishing confirmed the presence of sculpin in the analysis area. These fish are desirable in the fact that they are a natural component of healthy streams in the analysis area.
Mountain Whitefish *(Prosopium williamsoni)*

Description of General Population and Habitat Status
The mountain whitefish is widespread across the KNF. Their numbers however are only high in the Kootenai Rivers system. They are a native fish that seeks cold, clean water and is almost entirely an

insectivore. These fish normally become sexually mature between the ages of three and four. Spawning occurs in the late fall or early winter. Life span of the mountain whitefish can be upwards of fifteen years (Scott and Crossman 1973).

The mountain whitefish has both fluvial and adfluvial life histories. Fish in lakes will seek out streams for spawning. Numerous fish leave the Kootenai River and spawn in the tributary drainages.

Past electrofishing surveys found whitefish in streams above and below the Libby Dam in the Project area.

OTHER NATIVE FISH SPECIES

Largescale Sucker (*Catostomus macrocheilus*)
The large-scale sucker is native to the Pacific Northwest, occurring from British Columbia south to Oregon. It is widespread in the Columbia River system. It occurs in the slower-moving portions of rivers and streams, and in lakes. Largescale suckers spawn in the spring in shallow water over sandy areas of streams or the sandy or small gravel shoals of lakes. Females may produce up to 20,000 adhesive eggs. The young feed upon small zooplankton until they become bottom dwellers. Then they feed on benthic aquatic invertebrates, diatoms, and other plant material. This species reaches a length of up to 24 inches and weighs of up to seven pounds in parts of their range. The young probably serve as forage for larger predaceous fishes and fish-eating birds.

The large-scale sucker is known from only Cripple Horse Creek in the analysis area below the barrier falls.

Longnose Dace (*Rhinichthys cataractae*)
The longnose dace is widely distributed across north central North America from the Atlantic to the Pacific. They prefer the riffle areas of streams, but can be found along the shoreline of lakes where the substrate is composed of small rubble. It is a benthic species, living among the stones on the bottoms of streams. Longnose dace spawn in late spring/early summer on gravel bottoms of shallow riffles. Eggs, about 400 to 3,300 per female, are adhesive and are scattered on the substrate. The food of this species is primarily aquatic insect larvae. They reach a size of three to six inches. The adults and fry serve as food for a variety of game fish.

The longnose dace was found in streams above and below Libby Dam.

AMPHIBIANS

Threatened and Endangered Species: No threatened or endangered amphibians are known or suspected on the KNF.

The **western toad** (*Bufo boreas*) *i*s the only toad listed as sensitive in Region 1. The boreal toad was once common and widespread in western Montana but now is uncommon. The toad is however, still common on the KNF and found in many locations on the Libby Ranger District. Adult western toads are largely terrestrial and found in a variety of habitats from valley bottoms to high elevations; they breed in lakes, ponds, and slow streams, where they prefer shallow areas with mud bottoms. Breeding and egg laying in western Montana usually takes place one to three months after snowmelt, and tadpoles are typically two to three months old before they metamorphose. At metamorphosis, hundreds of small toads, many with the tail remnants still present, can be found on the shores of breeding ponds (Reichel and Flath 1995). Past surveys found the boreal toad to be present within the project area. Surveys showed the toad to be well dispersed and fairly abundant.
The **long-toed salamander** (*Ambystoma macrodactylum*) is the most common salamander in western Montana. They are found in a variety of habitats from sagebrush to alpine; typically breed in ponds or lakes, usually those without fish. Adults go to the breeding ponds immediately after snowmelt, and in western Montana, are usually the first amphibians to breed. Following breeding, they move to adjacent uplands. Eggs hatch in three to six weeks and metamorphosis takes two to14 months (Reichel and Flath

1995).

The long-toed salamander is known to occur in the analysis area. A total of nine sites were surveyed since 2004. Not all sites in the analysis area were surveyed but enough were located to prove that the long-toed salamander is the most wide spread amphibian in the East Reservoir area.

The **Pacific tree frog** (also known as the Pacific chorus frog) (*Pseudacris regilla*) is only regularly found in water during the breeding period in spring. They announce their presence during this time by calling frequently at night and sporadically throughout the day. Following breeding, they move into adjacent uplands and are rarely seen. In western Montana, they breed in temporary ponds in lower elevation forests and intermountain valleys shortly after snowmelt. Eggs hatch in two to three weeks and tadpoles take eight to ten weeks to metamorphose (Reichel and Flath 1995).

The Pacific tree frog was found only at one site.

The **Columbia spotted frog** (*Rana luteiventris*) is the most common frog in western Montana and is very common on the KNF. Spotted frogs are regularly found at water's edge in or near forest openings and wetlands at or near treeline.

Breeding takes place in lakes, ponds (temporary and permanent), springs, and occasionally backwaters or beaver ponds in streams. All egg masses in a particular pond are often found in the same location at the margin of the pond. Young and adult frogs often disperse into marsh and forest habitats, but are not usually found far from open water (Reichel and Flath 1995).

Surveying found the spotted frog within the analysis area. The spotted frog was found in available habitat and is probably understated in past surveys. The spotted frog likely lives in all mainstems of project area streams and maintains fairly high densities.

MOLLUSKS

Western Pearlshell Mussel (*Margaritifera falcata*)

The species range extends from Alaska and British Columbia south to California and east to Nevada, Wyoming, Utah and Montana. In Montana, it is the only coldwater trout stream mussel, and the only native mussel found on the west-side of the continental divide. It is an old-lived species with average life span of 60-70 years, though it can live to more than 100 years. The shell is elongate, compressed, dark colored and slightly concave on the ventral edge, erosion marks are frequently prominent on the umbo region. It has weakly developed teeth and purple nacre. The normal size is 50 to 85 mm with larger older specimens surpassing 10 cm.

Past surveying for the western pearlshell found them present in Fivemile Creek. The species was observed numerous times during other surveying of the stream. Although some impacts to the population have likely occurred, the species seems to be thriving in the drainage.

WATERSHED EXISTING CONDITION as RELATED to AQUATIC HABITAT

The proposed project has the potential to affect both native and nonnative fish species as well has western pearlshell mussels. This analysis will center on their habitat needs.

This section compliments the existing condition narrative in the watershed and soils section of this document. In an effort to minimize repetition, only select watershed condition information is summarized as it relates directly to the local threatened, endangered and sensitive fish populations. Mussels require similar habitat functions so the 19 indicators will apply to them as well. For a thorough review of the existing hydrologic condition, the reader is referred to the Hydrology Resources Section of this document. There are 19 habitat indicators in the FWS bull trout matrix (FWS 1998) used to evaluate effects on fish species, starting with the baseline condition. The following discussion addresses those 19 habitat

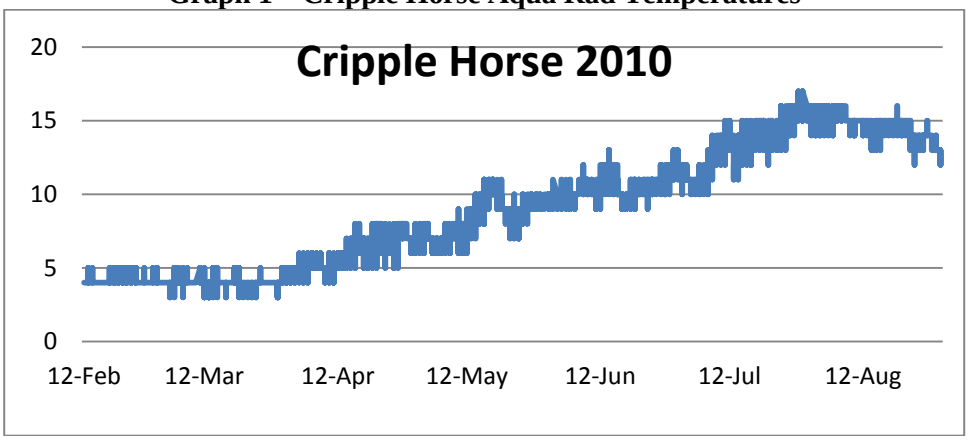
characteristics.

Habitat Indicators

Existing conditions for each habitat indicator are described and rated at a single scale the Columbia River Basin (CRB) 6th and 7th code HUCs. Stream habitat data exists from the analysis area with the bulk of the information on habitat and species composition. The 19 habitat indicators are good examples of high quality habitat for native salmonids.

1) Temperature - Extensive riparian harvest began on National Forest System (NFS) lands around the turn of the century and slowed after the 1910 fires. Past timber management within the East Reservoir area included both one and two sided riparian harvest. The drainages in the analysis area also have moderately high road densities and many roads within RHCAs. Some temperature data exists on Warland Creek and Cripple Horse Creeks. Libby Ranger District deployed a Hobo Temp in Warland Creek for one season and installed an Aqua Rod pressure transducer in Cripple Horse Creek in 2004. Graph 1 shows the latest temperature data from Cripple Horse Creek Aqua Rod. This graph is consistent with other data showing the 16^0C limit being exceeded for a short time in the summer months. Warland Creek shows a similar trend with water temperatures reaching this threshold. Warland Creek is intermittent where the Hobo Temp was installed. No other temperature data was collected by Libby Ranger District on streams within the analysis area. Temperature within Warland Creek is representative of other drainages within the analysis area. Other streams in the project area have similar orientations and drainage size.

Graph 1 – Cripple Horse Aqua Rad Temperatures



2) Sediment - The RMO for pool quantity was not met in most measured reaches (Table 3.46). The existing road system contains many stream crossings and overall the amount of roading within the analysis area is considered moderately high (Table 3.45). Land management has been moderate to high throughout the analysis area. A portion of the analysis area has been established as shelter watershed within the Cripple Horse drainage. These drainages will protect water quality from sediment inputs and maintain natural stream functions. The removal of beavers has changed sediment transport. Beaver dams are known to trap and transport sediment slowly downstream. Without these sediment traps any sediment produced from upstream is transported downstream filling habitat including pools. However, sediment from upstream waters above the dam will be transported into Lake Koocanusa. These sediments will be trapped in the Reservoir and not impact downstream waters. Dunn Creek flows into the Kootenai River below the dam. The Kootenai River is considered a sediment starved system below Libby Dam and does not show signs of excessive sedimentation on the KNF.

Macroinvertebrates have been collected in project area streams beginning in 1998. Macroinvertebrates are good indicators of water quality in streams and show changes in communities when factors outside the natural range of variability occur. Sediment affects water quality directly and macroinvertebrate

communities change to match the conditions with a different assemblage of insects that thrive in differing water quality. BCIs (Biotic Community Index) can be used to determine water quality in streams and is a good indicator to determine if a drainage is being affected from upstream impacts. Figures 1 through 4 show the condition trends at the sites. BCI numbers <70 indicate poor water quality, while numbers from 70-80 indicates fair water quality, numbers from 80-90 indicates good water quality, and numbers >90 indicates excellent water quality. The majority of measured sites have water quality ranging from good to excellent. Only 4 samples fell into the poor category.

Figure 1 - Fivemile Creek BCI

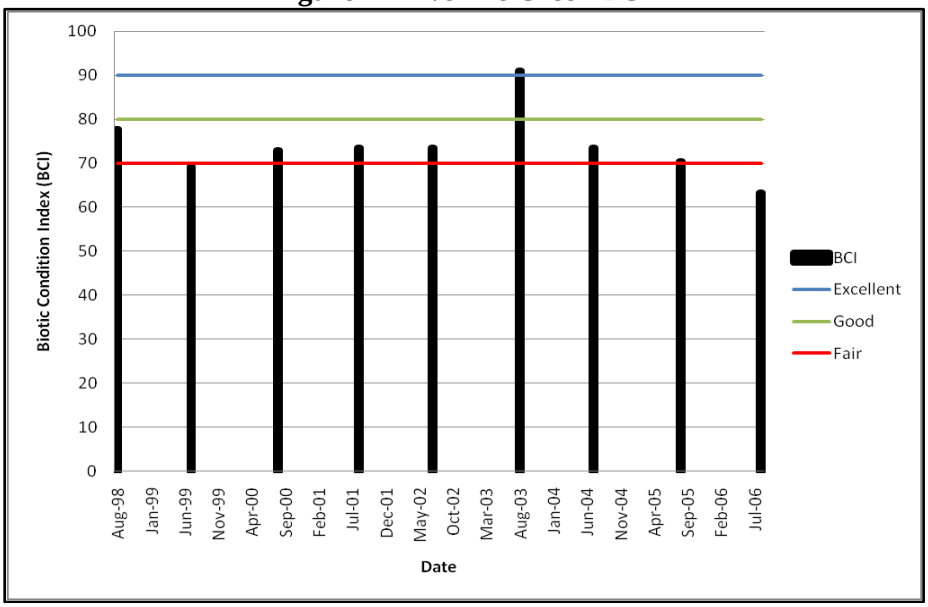


Figure 2 - Cripple Horse BCI

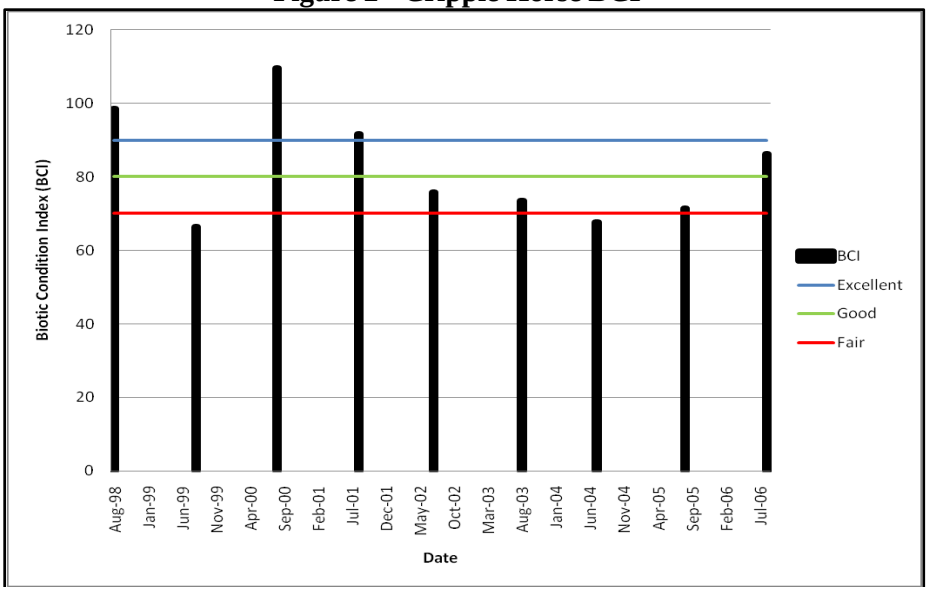


Figure 3 – North Fork Canyon

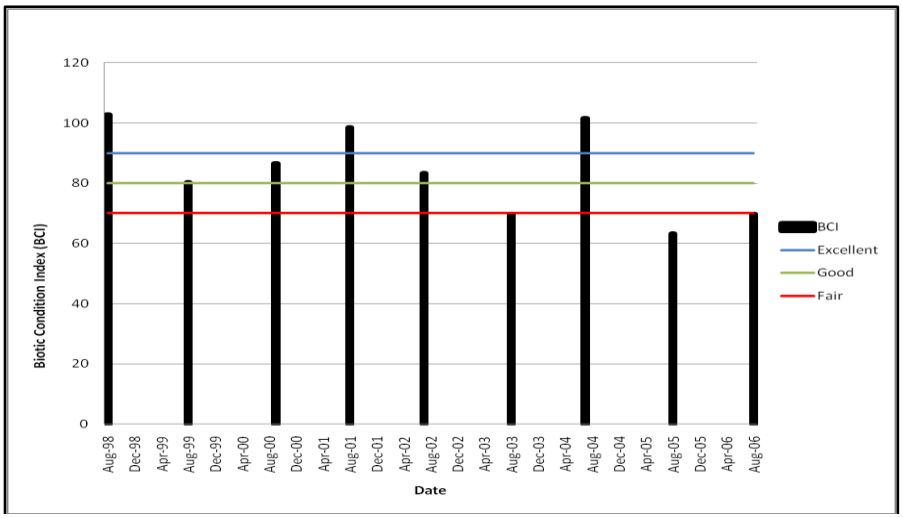
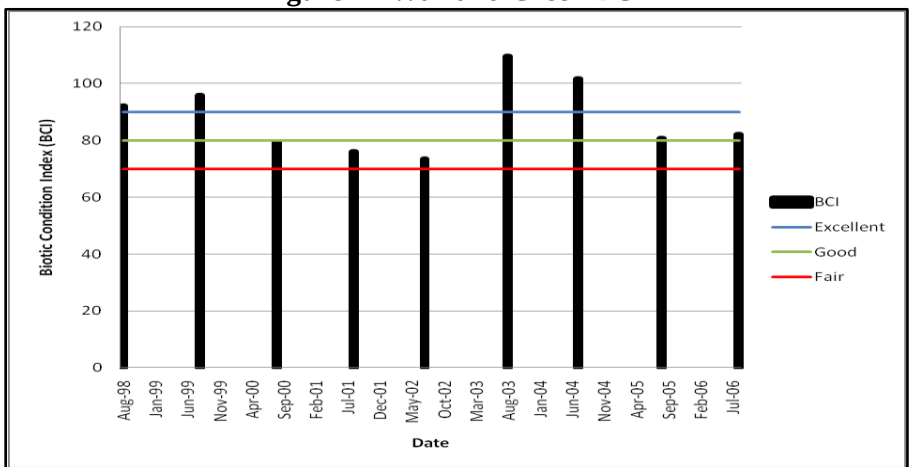


Figure 4 - Warland Creek BCI



3) Nutrients and Contaminants - As mentioned previously, the existing road system consists of many stream crossings and has moderately high road densities in the analysis area. The road network is a channel where products from upland activities can be routed directly into stream channels. Most roads occur high in the drainages on intermittent channels. Because of the intermittent flow in these drainages nutrients and contaminants can be moderated. However, with the existing road densities and densities of stream crossings the probability exists where overland flow could directly input nutrients and contaminants into live streams. Streams in the analysis area are showing signs of high sediment loads. Cripple Horse Creek's listing as a WQLS has been in part due to sedimentation.

4) Physical Barrier - As described previously, there are three barrier culverts in the analysis area. The structures on HWY 37 have been in place since the construction of Libby Dam and HWY 37 in the mid-1960s. The structure on Dunn Creek is a large pipe with a long steep gradient and a drop at the outlet. The culvert on Canyon Creek is a long, undersized culvert placed at a high gradient, with a drop at the outlet. These State of Montana Department of Transportation culverts are restricting migration of fish. Their management is outside FS decision space and therefore beyond the scope of this project.

The culvert on Warland Creek Road 566 lies on NFS and is considered as part of this baseline. The culvert is undersized and perched restricting aquatic organism passage. Warland Creek in this area is intermittent. Fishery use of the stream is dependent on water conditions from year to year. The use of the drainage is probably only for spawning and small rearing segment in the upper drainage. It is likely that fish trapped in the drainage over the summer would not survive due to dewatering of the stream channel.

The analysis area also contains 3 natural water fall fish barriers. These structures will continue to act as barriers to migration. The falls are mentioned previously, and will be considered part of the natural character of those watersheds.

5) Substrate - Inherently stable streams have large stable streambed substrates that are not mobile under most flows. If large streambed material becomes mobile they only move short distances before becoming stable again. Gravel substrates are inherently unstable. Large flows could easily move these substrates, which can cause significant bedload movement. The dominant substrate size class varies by reach within the drainages. Most of the upper drainages have cobble/boulder substrate while downstream reaches are mostly cobble. The drainages in the project area are fairly stable due to their cobble dominated substrate.

6) Large Woody Debris - Large woody debris (LWD) was measured as part of fisheries habitat surveys (Table 3.47). All measured reaches met the RMO for LWD, although in the 1970s and early 1980s fisheries improvement work included the removal of LWD. In the early 1990s, LWD was placed back into upper Cripple Horse Creek with mules and in Canyon Creek by hand as part of fisheries mitigation for the Dry Fork Fire. This LWD placement was not anchored into the banks. Most of the LWD was transported downstream to other areas and is creating some small amount of habitat. Past timber management activities utilized both one and two-sided riparian harvest within the project area. Riparian roading has the potential of impacting LWD delivery to streams not only through cutting of trees for the right-of-way but also from firewood cutters removing wood that would have fallen into the stream. Streams in the project area are currently meeting or exceeding this RMO.

7) Pool Frequency - Pool frequency was measured at the same time as LWD. The RMO (Table 3.46) was only partially met in the measured reaches. Surveys indicate that wood is in ample supply and flows are conducive to creating pools in some streams. However, few pools are being formed and maintained. Sediment from high roading could be filling pools and causing channel adjustments. The Dry Fork Fire burned in the upper reaches of Cripple Horse Creek and Canyon Creek. Effects of this fire could still be lingering and affecting pools within these drainages. Warland Creek and Fivemile Creek have had past grazing which also affects pool creation and stability. Trapping of beaver has nearly removed these animals from the project area. Beaver are an important source for creation and stability of pools within streams. Road systems parallel the mainstems of drainages in the project area. These road systems bisect and reduce the effect of the RHCA. These factors could all attribute to the general lack of pools in the project area.

8) Pool Quality - Quality pools are pools that are deep (minimum of three feet in depth) with sufficient cover to hide fish. Pool quality in the analysis area varied by reach. Deep pool creation in small streams is difficult, as these streams lack the hydrologic power to create and maintain pools of this depth. The mainstems of project area streams do possess sufficient flows and power to create quality pools. Fisheries habitat inventories measured few pools in measured reaches and even fewer quality pools. Past and ongoing activities including; grazing, riparian roading, fisheries LWD removal, beaver removal, and forest management have likely changed the streams ability to maintain deep pools.

9) Off Channel Habitat - Off channel habitat is that habitat which exists for fish and other aquatic organisms inside channels, tributary streams and springs within the RHCAs. The stream types in the analysis area are classic mountain streams with moderate gradients and moderate entrenchment ratios. This changes to deeply incised boulder/bedrock dominated streams in the headwaters and gentler gradient wider floodplain with lower incision ratios in the lower reaches (except where the streams enter the reservoir). The analysis area has moderate to high densities of roading and moderate to high number of drainage crossings (Table3.45). Riparian roading densities are high with roads running the lengths of most mainstems of larger streams. Due to this construction within the RHCAs, off channel habitat has been modified and in places removed from the systems. The roads will continue to impact this criterion into the future. To further impact off channel habitat, beavers have been nearly removed from the analysis

area. During surveying, many abandoned beaver flats were found in Dunn Creek, Canyon Creek, Cripple Horse Creek and Fivemile Creek. These beaver flats at one time created diverse high quality habitat for the aquatic environment. Since the beavers were removed the areas have become entrenched gullies with little connection to the RHCA.

10) Prime Habitat (Refugia) - The analysis area contains few areas of prime habitat. A small area has been set aside in Cripple Horse Creek as sheltered watersheds mostly on intermittent channels that provide little refugia for fisheries. There exist some old growth areas along RHCAs that will continue to function as refugia for aquatic organisms. But by far, past management, roading, and removal of beavers has changed the charter of the streams limiting the amount of prime habitat within the analysis area.

11) Pool Width/Depth Ratio - The majority of measured pools were shallow and wide. The analysis area contains stream types that are somewhat stable. However, the vast amount of pool habitat has a high W/D ratio. The streams within the analysis area are showing signs of past and current management.

12) Stream Bank Condition - Stream surveys showed bank stability to partially meet the RMO (Table 3.46) (which is not required in forested systems under INFS). However, it is a good indicator for showing signs of unstable banks due to upslope conditions. There were some measured reaches that showed unstable bank conditions. Overall, stream banks are in good condition; though high spring peak flows and grazing have the ability destabilize banks.

13) Floodplain Connectivity - Floodplains in the analysis area remain partially intact with some minor alterations where roads occur. Riparian functions remain mostly intact along stream channels within the analysis area. This is in part due to fertile soils and high growth rates of shrubs and trees. Recovery is occurring in places but where roads are constructed within the RHCA and constrict the channels these areas will continue to show impacts into the future.

14) Peak and Base Flows - Peak flows normally occur in May but can occur anytime between November and June. Streams in the analysis area are fairly stable but have the potential for; flooding, annually high suspended sediment levels, bedload movement and channel adjustments. Since the turn of the century, timber harvest, road construction, beaver removal and human development have changed the character of the watersheds and their response to weather events. Road densities and current harvest levels are considered moderate to high. Streams within the analysis area are fairly stable but will continue to show impacts of PFI from past activities into the future as timber management and roading continue to impact the hydrology of the streams.

15) Drainage Network - Road densities in the analysis area are considered moderate to high (Table 3.44). The road system within the analysis area is fairly stable due to past best management practices (BMPs). As mentioned previously, road systems follow the mainstems of all the larger analysis area streams. The roading in RHCAs has impacted the drainage network by constricting the floodplain and bisecting the streams and the RHCAs. Beaver removal has changed the hydrology of the streams impacting water storage, sediment transport and channel movement.

Table 3.44 - Water Yield 2011

WATERSHED	WATERSHED SIZE (ac)	TOTAL ECA	EXISTING % ECA	EXISTING PEAK FLOW %	ECA for 1% PFI
Dunn Creek	21,666	3,524	15	8	433
Canyon Creek	13,184	1,841	14	8	264
Cripple Horse Creek	21,823	4,336	20	11	436
Warland Creek	8,520	966	11	6	170
Fivemile Creek	18,434	2,130	12	6	369

16) Road Network - Road systems parallel most of the length of the mainstems of Dunn Creek, Canyon Creek, Cripple Horse Creek, Warland Creek and Fivemile Creek. Further, the headwaters and tributary streams have many road systems following their entire length. Road densities in these drainages are

considered moderate (Table 3.45). The table shows the relatively high number of road/stream crossings. The large amount of roading coupled with high numbers of stream crossings is routing large amounts of sediment into streams. Most of the drainages (except Dunn Creek) flow directly into Lake Koocanusa preventing any further sedimentation downstream into the Kootenai River. Below Libby Dam the Kootenai River is sediment starved.

Table 3.45 - East Reservoir TRD, RRD and SCD - 2010

WATERSHED	ROAD (mi)	TRD (mi/mi^2)	DISTURB FACTOR	RIPARIAN ROADS	RRD (mi/mi^2)	DISTURB FACTOR	STREAM CROSSINGS	SCD ($\#/mi^2$)	DISTURB FACTOR
Dunn Creek	121.2	3.6	High	13.6	3.2	High	138	4.1	High
Canyon Creek	59.1	2.9	Moderate	4.7	2.0	Moderate	60	2.9	Moderate
Cripple Horse Creek	95.2	2.8	Moderate	10.5	2.7	Moderate	89	2.6	Moderate
Warland Creek	35.3	2.7	Moderate	1.6	1.5	Moderate	34	2.6	Moderate
Fivemile Creek	71.9	2.5	Moderate	8.6	2.8	Moderate	65	2.3	Moderate

DISTURB FACTOR = DISTURBANCE FACTOR

17) Disturbance History - Natural disturbance regimes are highly variable in the analysis area. Natural disturbances are common, including flood events, bedload movement and deposition, channel braiding, and mass wasting. Windstorms resulting in blowdown have been minor and are generally associated with clearcuts. Fires have been relatively small with only one large fire occurring in the past 30 years (the Dry Fork Fire of 1989 which is still impacting streams), a large portion of the analysis area burned in 1910 and 1924 (but has since mostly recovered).

18) RHCAs - Land management in the analysis area began around the turn of the century. Timber harvest included both one and two sided riparian cutting techniques. Roads parallel the mainstems of most streams in the analysis area. Impacts to RHCAs include timber harvest, road encroachment, firewood harvest and road crossings. The amount of disturbance is moderate due to past management activities. RHCAs are mostly intact but the road system continues to impact the function of the RHCA.

19) Disturbance Regime - Natural disturbance regimes are stable in the analysis area. Streams in the analysis area have natural events including high peak flows from spring snowmelt and, although minor, some isolated impacts have occurred. Windstorms resulting in blowdown have been minor, generally associated with clearcuts. Fires have been relatively small with only the large Dry Fork Fire occurring recently and 1910 and 1924 fires which affected much of the project area. Although certain indicators of habitat quality have been compromised, overall conditions are considered moderate in analysis area due to the large buildup of fuels and the potential for another large fire.

Integration of Species and Habitat Conditions

The quality of aquatic habitat varies in the analysis area. Some areas contain fairly high quality habitat where RHCAs are intact, while other areas are showing signs of stress from past natural disturbance and management. Recovery from the Dry Fork Fire will continue to improve stream conditions. The shelter watersheds will continue to produce higher quality waters which will benefit downstream functions. RHCA harvest along with the existing road system has likely been a contributing factor impacting fisheries habitat to some extent. Past aquatic enhancement has included the additions of large woody debris to Cripple Horse Creek and Canyon Creek. Much of this woody debris did not stay in place and moved downstream and not meeting its intended purpose. Gravel was added to a segment of Canyon Creek above HWY 37 to improve spawning. High flows have removed most of this gravel. To further the issue, the culvert at the HWY 37 crossings has become a barrier to fisheries passage (Photo 3). Grazing has impacted streams in the analysis area to some extent. There were four grazing

leases in the analysis area at one time. Two of the leases, Cripple Horse and Canyon Creek are now inactive and have been that way for over 15 years. A riparian fence was constructed around a sensitive meadow of Warland Creek in 1995. The enclosure has been monitored and showed vast improvements to the stream within the fence. The Warland Creek allotment has been inactive for the past 5 years. The entire basin has been recovering due to this inactivity. A new permittee has showed interest in acquiring the Warland Creek allotment.

The only active grazing allotment in the analysis area is the Fivemile Creek. The grazing area is located in the lower and middle reaches of the drainage. The stream is showing some stress to banks and riparian vegetation. Drift fences and cattle guards have been construed to keep cows out of the stream where the western pearlshell beds are found.

Libby Dam construction has affected natural channel movement and riparian vegetation. The dam has however reduced large scale flooding downstream in the Kootenai River. Additional impacts to tributaries have occurred through riparian harvest and road construction. Major events have occurred over the past 10-20 years, such as large windstorms, one large fire and 100-year storm events. Although minor, isolated impacts were seen, systems continue to remain stable. Genetic analysis has shown the existence of one nearly genetically pure population of westslope cutthroat within Dunn Creek. It is apparent that fish, in Cripple Horse Creek, Canyon Creek, Dunn Creek and Fivemile Creek, are spawning and maintaining stable populations in available habitat.

DESIRED FUTURE CONDITION

As a result of the analysis, it was determined that Canyon Creek, Cripple Horse Creek, Dunn Creek and Fivemile Creek are restoration priorities. This is due to the westslope cutthroat trout population and other wild populations of trout within these drainages. Data from hydrologic and fisheries habitat surveys within the analysis area (Tables 3.46) were compared to the INFS Interim Riparian Management Objectives (RMOs).

Table 3.46 - Stream Geomorphology Data for Analysis Area Streams

INFS - RIPARIAN MANAGEMENT OBJECTIVE STANDARDS				
Bankfull Width (feet)	Pools/Foot	LWD/foot (> BFW)	Bank Stability (%)	Width/Depth
< 10	1 per 55	1 per 250	> 80	< 10
10 to 20	1 per 94	1 per 250	> 80	< 10
20 to 25	1 per 112	1 per 250	> 80	< 10
25 to 50	1 per 203	1 per 250	> 80	< 10

RIPARIAN MANAGEMENT OBJECTIVES DATA

Table 3.47 - Channel Conditions in Dunn Creek

SITE	YEAR	ROSGEN TYPE	BFW (FT)	POOLS PER FOOT	LWD PER FOOT	% BANK STABILITY	W/D RATIO	PFANKUCH STABILITY RATING	REACH CONDITION
1	2006	B3a	12.4	1/250	1/35.7	100	10.9	74	Fair
2	2006	B4c	18.6	Dry	Dry	100	31.6	66	Fair
3	2006	F4b	15	1/300.2	1/6.72	100	21.73	43	Good
4	2006	A4	6.42	0/129.4	1/2.81	No Data	9.41	46	Good
4A	2006	B4	18	0/360	1/10.2	100	22.29	57	Good
5	2006	B4	11.6	1/116.5	1/10.59	100	15.2	59	Good
6 (trib)	2006	F4a	9.61	1/192	1/5.05	100	26.57	55	Good
7	2006	B3a	9.03	1/185	1/4.87	100	15.19	41	Good
8 (trib)	2006	B4a	4.5	0/90	1/15	100	19.03	43	Good
9	2006	F4	9.5	1/192	1/9.6	100	17.61	74	Good
10	2006	F4b	5.5	0/110	1/22	100	22.1	46	Good

SITE	YEAR	ROSGEN TYPE	BFW (FT)	POOLS PER FOOT	LWD PER FOOT	% BANK STABILITY	W/D RATIO	PFANKUCH STABILITY RATING	REACH CONDITION
11 (trib)	2006	B1a	8.3	1/166	1/11.06	100	32.5	48	Fair

Gray shading = sites do not meet current INFS guidelines

Table 3.48 - Channel Conditions in Canyon Creek

SITE	YEAR	ROSGEN TYPE	BFW (FT)	POOLS PER FOOT	LWD PER FOOT	% BANK STABILITY	W/D RATIO	PFANKUCH STABILITY RATING	REACH CONDITION
1	2006	F4b	12.5	1/79.67	1/5.8	57	31.3	73	Good
2	2006	B3	10.38	1/208	1/8.6	No Data	13.16	64	Fair
3	2006	B4	7.9	0/158	1/4.94	100	14.5	48	Good
4	2006	F4b	9.06	0/181.2	1/10.65	100	33.57	51	Good

Gray shading = sites do not meet current INFS guidelines

Table 3.49 - Channel Conditions in Cripple Horse Creek

SITE	YEAR	ROSGEN TYPE	BFW (FT)	POOLS PER FOOT	LWD PER FOOT	% BANK STABILITY	W/D RATIO	PFANKUCH STABILITY RATING	REACH CONDITION
1	2006	F4b	24.5	1/15.23	1/14	No Data	23.6	56	Good
2	2006	F3	21.62	1/218.5	1/14.56	89.8	23.16	81	Good
3	2006	F3b	20.24	1/117	1/9.87	99	44.58	72	Good
3A (trib)	2006	E3a	6.59	Dry	1/16	Dry	7.37	42	Good
4	2006	F2b	20.37	1/136.3	1/7.71	100	18.53	56	Good
5	2006	E4b	6.7	Dry	1/15	Dry	7.16	69	Good
6	2006	B3	20.6	1/418	1/34.8	84.6	19.4	58	Good
6A	2006	B3	17.4	1/87	1/1/8.92	91	14.71	65	Fair
7	2006	B4c	11.35	1/77	1/9.2	100	15.88	56	Good
8	2006	E4a	8.79	0/176	1/3.59	100	8.96	44	Good
9	2006	B3a	11.3	0/226	1/4.19	100	11.2	73	Fair

Gray shading = sites do not meet current INFS guidelines

Table 3.50 Channel Conditions in Warland Creek

SITE	YEAR	ROSGEN TYPE	BFW (FT)	POOLS PER FOOT	LWD PER FOOT	% BANK STABILITY	W/D RATIO	PFANKUCH STABILITY RATING	REACH CONDITION
1	2007	E4	8.75	1/46.88	1/15.9	100	8.83	56	Good
1	2006	B4	8.46	1/56.7	1/11.3	100	8.4	61	Good

Gray shading = sites do not meet current INFS guidelines

Table 3.51 - Channel Conditions in Fivemile Creek

SITE	YEAR	ROSGEN TYPE	BFW (FT)	POOLS PER FOOT	LWD PER FOOT	% BANK STABILITY	W/D RATIO	PFANKUCH STABILITY RATING	REACH CONDITION
2	2006	F4b	26.2	1/262.5	1/17.58	96	12.59	68	Good
6	2006	F4b	19.8	0/463	1/7.23	100	23.38	51	Good
7	2006	B4c	19.39	1/381	1/18.14	98	22.54	66	Fair
9b	2006	E4	12.1	1/39.6	1/26.4	No Data	8.24	75	Good
10	2006	B4	20.09	Dry	1/8.73	Dry	12.6	60	Good
13A	2006	B2a	15.4	1/77	1/9.93	100	12.97	51	Fair
13B	2006	E3a	8.74	1/175	1/11.6	97	2.02	64	Fair
13C	2006	E4b	12.8	1/257	1/10.28	98	9.92	67	Good

Gray shading = sites do not meet current INFS guidelines

These figures were determined by converting the desired # of pools and LWD from pools/LWD per mile to pools and LWD per foot. For purposes of this analysis only individual reaches of each stream were measured rather than the entire channel length.

The fisheries habitat data shows that existing conditions currently meet or exceed interim RMOs with the exception of pool frequency in measured reaches. The vast majority of perennial flow is on private lands in Dunn Creek. The desired future condition would be where all RMOs meet or exceed INFS standards (The width to depth ratio is not representative of conditions on the KNF the values were calculated on coastal streams in Washing and Oregon).

Fish passage is a Regional priority. There are existing road crossing structures that need to be upgraded within the analysis area to provide fish passage.

ENVIRONMENTAL CONSEQUENCES

To remain productive, a fish population must have relatively stable habitat conditions over time. Forest management actions produce changes that are similar in kind and intensity to natural environmental variability. However, human-caused changes tend to persist for longer periods, either because they are more widespread, or because they add to natural factors that are already affecting fish productivity. Fish species vary in their tolerance for, and reaction to, adverse or positive environmental changes. Further, the response of one species may act as an additional negative effect on another species. Native trout species (bull trout, redband rainbows and westslope cutthroat trout) are particularly vulnerable to habitat changes and effects from sediment (Weaver and Fraley 1991).

The analysis area provides a small to moderate amount of recreational fishing on NFS lands (excluding Lake Koocanusa which receives high amounts of recreational fishing). Alternatives that degrade fish habitat can limit the number of adult fish available for fishing. Alternatives that change the current accessibility to fisheries resources can also impact recreational fishing opportunities. There may be some short-term adverse effects to fish habitat as a result of proposed timber harvest and road building. However, these effects are not expected to affect entire fish populations and would not result in a long-term trend in fish abundance. As long as INFS is met for given activities within an alternative, there should be no effect to recreational fishing. None of the alternatives decreases access to fishing. There are no other known potential effects to recreational fishing.

ALTERNATIVE 1 (No-Action)

Direct and Indirect

Vegetation in previously harvested units would continue to mature resulting in gradually decreasing water yields. Restoring stream and riparian function through the continued growth of harvested areas would increase depth, complexity and shading within analysis area aquatic habitats. This would provide for cooler water temperatures, reduced evaporation, and potentially more stable flows through the summer low flow period. Similar benefits would occur during winter low flows. Intact riparian communities provide an insulatory benefit that prevents streams from freezing during extreme cold. Deeper water also provides better aquatic habitat as it is less likely to freeze completely. Increasing the frequency of LWD not only can increase instream complexity but also serves as a long-term nutrient supply. If wildfires are successfully suppressed and prescribed burning does not occur, fuel loadings would increase, resulting in an increasing risk of high intensity fires.

Encroachment of Douglas-fir would continue in dry ponderosa pine habitat. Stands of Douglas-fir and ponderosa pine would remain at stocking levels higher than historic conditions. The risk of insect and disease activity would therefore remain high or increase. Wildfire potential and intensity would also remain high or increase and would remain higher than historic conditions. Existing roads would continue to channel surface flow and sediment to the streams. Stream flows would remain elevated until a majority of vegetative and hydrologic recovery had occurred. If these problems were not corrected, they would continue to contribute to aquatic habitat degradation. Peak flow increases would never fully recover to a natural condition with the existing road system in place. Undersized culverts could plug and wash out

resulting in large increases of sediment to streams. Fish barrier culverts would be left in place continuing the loss of genetic flow and impeding migration between sections of streams.

Activities on State of Montana Department of Natural Resource and Conservation (DNRC) and private lands would continue with the resulting change in watershed condition consistent with past activity. These activities include landowners accessing their lands for timber harvest and sale and development of private lands.

Cumulative Effects

Cumulative effects in the analysis area include the past and current effects of increased peak flows and sedimentation to watershed from past timber management (Tables 3.1, 3.2, 3.3), road-building activities, dam construction and natural events (i.e. fire, high flows from runoff). All presently authorized activities would continue and there is a high likelihood that proposed agency action would be implemented. These activities would incrementally affect fisheries habitat and fish populations. However, due to the State of Montana SMZ law, Plum Creek Timber Company (PCTC) Habitat Conservation Plan (HCP), INFS and BMPs, the level of effects would be similar to what currently exists and would not decrease the viability of native and wild fish populations within the analysis area. Impacts from forest management would continue as the DNRC and private landowners' remove timber and develop their lands.

Impacts to streams in the analysis area would continue to be from existing forest management, natural high flows and Lake Koocanusa operations. These impacts would not be reduced by long-term storage, culvert removal and replacement, and BMPs on roads in the analysis area as described in Chapter 2 as proposed for this project. Proposed BMPs and long-term road storage, under action alternatives, would not be completed and sediment routed to streams from roads would not be reduced. Natural events such as wildfire and flooding could slow or set back watershed recovery from past land management. Natural hydrologic recovery would continue as harvest units revegetate and past road decommissioning continues to recover.

The analysis area would continue to have forest management. Fisheries populations and aquatic habitat in the analysis area would continue to be impacted from sedimentation and peak flow increases (PFIs). Hydrologic recovery would continue to occur within the analysis area. However, roading, grazing, beaver removal, the Dry Fork Fire and past harvest would continue to negatively impact fish and their habitat. Libby Dam, completed in 1972, would continue to operate as a flood control structure and moderate flows to downstream areas. Streams below the high water mark no longer function properly entering Lake Koocanusa. Many of the drainages were poisoned by FWP to remove native fish. Past fisheries management was done to establish a large migratory westslope cutthroat trout population in the Reservoir. FWP has stocked the Reservoir and tributary streams with a number of native and non-native fish. These fish species are mostly gone now with kokanee salmon taking up much of the biomass in the lake. Brook trout have colonized the drainages above the dam and coastal rainbows have colonized much of Dunn Creek up to the natural barrier. Native fish will never recover to historic levels in the analysis area due to nonnative fish stocking and past management of native species by the State. Sediment and bedload transport in the Kootenai River has been affected by the dam. Natural stream processes are not occurring due to Reservoir operations and flow regulation.

The proposed Dunn Creek watershed connectivity project would result in immediate changes to the stream channel condition for the last 1.5 miles of Dunn Creek. This project is unfunded at the time and will require a separate analysis. Depending on the level of restoration implemented the following may occur, approximately 0.7 miles of FS Road 334 would be re-located on the hillside starting at approximately MP 1.4,the historic railroad concrete box culvert would be removed or bypassed; the culvert under Hwy 37 would be replaced or modified to accommodate aquatic organism passage; and the last ½ mile of Dunn Creek would be fully reconstructed to accommodate stream function as well as aquatic organism passage; large eroding banks 2 miles upstream of HWY 37 would be stabilized.

Relocation of Road 334 would require the new construction of approximately 0.7 miles of new system road. The road would be located on DNRC lands and PCTC lands. The existing road would be gated removing traffic near the stream. The new road location would be located across a dry hillside with no perennial stream channels. This would reduce overall sediment into Dunn Creek and protect water quality and fisheries habitat in lower Dunn Creek.

Removal of the historic railroad concrete box culvert would require removal and re-sloping of the railroad, plugging the existing channel, construction of a new stream channel to the confluence with the Kootenai River, and re-vegetation of the disturbed soil. Bypassing the railroad culvert would require excavation of a new channel around the structure, plugging the old channel downstream, and construction of a new channel to the confluence with the Kootenai River. Removal of the Hwy 37 culvert would require extensive excavation as the culvert is buried under approximately 30 feet of fill; in addition the culvert is 275 feet long and 10 feet high. The removal of this culvert is beyond the scope of this project. The culvert is administered by State of Montana Department of Transportation (DOT).

Modifications to the Hwy 37 culvert may include the installation of baffles to reduce flow velocity through the culvert and provide refuge areas for aquatic organisms and the construction of step-pool structures to connect the downstream channel to the culvert.

The entire stream channel for the last ½ mile of Dunn Creek would be fully reconstructed as a single channel, with low flow benches, bankfull benches, floodplain, and riparian areas. The braided reaches would become single channels, retaining low flows, in-stream structures would improve fish habitat and connectivity, streambank structures would reduce erosion and total suspended solids as well as improve fish habitat; realigning the confluence would reduce sediment and protect cultural resources. These activities would require the use of heavy equipment (excavators, dump truck, etc), large woody debris, large rocks and all applicable permits.

Bank stabilization up stream of the analysis area would be completed on PCTC lands. The area has three large unstable banks which are inputting large amounts of sediment into the stream annually. The banks would utilize techniques to push the stream flow away from them and allow vegetation to reestablish providing long term stability.

STATEMENT of FINDINGS/FOREST PLAN CONSISTENCY

Alternative 1, the no-action alternative, is consistent with INFS because existing conditions would remain stable. However, problems that would likely develop associated with aquatic habitat characters, (e.g., sediment and fish barriers) would need to be addressed in the near future to promote long-term recovery of analysis area streams. Culvert barriers under US HWY 37 would need to be replaced at some time in the future. These culverts are outside the scope of this project. Sedimentation from roading would need to be dealt with in the future. Past BMPs need reconstructing, undersized pipes need to be upsized and road surface drainage needs to be re-established. Natural fire needs to be brought back on the landscape due to the higher than natural densities of trees. Catastrophic wildfire is probable within the project area which could cause negative impacts to the available aquatic habitat.

ALTERNATIVES 2 and 3

Direct and Indirect Effects

Based on the potential level of effects to fish habitat and populations there is small difference between the action alternatives. The level of proposed harvest, burning and temporary road construction varies among the action alternatives and varies with respect to the effects to fisheries. Because increases in water yield are not expected to cause noticeable channel degradation, they should not have a measurable effect on trout habitat. RHCAs would protect habitat from non-channelized sediment inputs, maintain LWD recruitment, maintain water temperature and ensure nutrient delivery and storage. The surface flow and sediment that is channeled to the streams by roads would be reduced with BMP work and water-barring. This would accelerate hydrologic recovery of affected watersheds and reduce the potential for further

degradation of fisheries habitat. By replacing culverts and upsizing them to 100 year flows and AOP design, connectivity would be restored and the possibility of culvert failure would be reduced.

Short-term, small sediment increases would be expected with the road storage. Because increasing sediment production can decrease habitat diversity, degrade spawning and rearing habitat, and reduce aquatic insect production, the proposed roadwork could involve short-term effects on trout populations; however, the long-term benefits of reducing water routing and sediment input would outweigh the short-term effects caused by the roadwork.

Timber Harvest and Associated Activities

Timber harvest activities can impact fish and their respective habitat by increasing peak flow. Excessive peak flows can destabilize the stream channel causing degradation of fish habitat by decreasing habitat diversity (loss of pools, cover and stable substrates) and increasing in-channel sediment production. Channel instability occur when the scouring process leads to degradation (downcutting), or excessive sediment deposition results in aggradation (deposition) (Rosgen 1996).

Increasing sediment production is generally associated with ground based harvest systems and particularly road construction. Sediment decreases habitat diversity, degrades spawning and rearing habitat, degrades aquatic insect production, and consequently fish reproduction and survival. Fine sediment can greatly reduce the capability of winter and summer rearing habitats and when levels reach 30% or more, survival to emergence is significantly reduced (Weaver and Fraley 1991). Fine sediment may have the greatest impact on winter rearing habitat for juvenile salmonids by capping or filling interstitial spaces of streambed cobbles. Fine sediment has also been shown to cause alterations in macroinvertebrate abundance and diversity.

Under the various action alternatives, timber harvest, mastication and watershed restoration would occur. Precommercial thinning would have no effect on fisheries and will not be discussed further. Cumulative PFIs are not expected to exceed 14% in any drainage within the analysis area (Table 3.52).

Table 3.52 - Changes in Peak Flow by Alternative (% PFI) for 2012

WATERSHED	ACRES	2012 PFI	RECOMMENDED PFI (%)	PFI ALT 1	PFI ALT 2	PFI ALT 3
Dunn Creek	21,666	7	14	7	10	10
Canyon Creek	13,184	7	14	7	11	11
Cripple Horse Creek	21,823	10	14	10	13	12
Warland Creek	8,520	6	14	6	12	13
Fivemile Creek	18,434	6	14	6	9	8

Default INFS RHCAs would be required on all streams and wetlands which would protect them from non-channelized sediment inputs and adverse impacts to vegetation. A review associated with INFS (USDA Forest Service 1995) concluded that non-channelized sediment flow rarely travels more than 300 feet. Buffer widths of 200-300 feet are generally effective at protecting streams and wetlands from non-channelized sediment flow. The implementation of RHCAs would insure that riparian characteristics are protected within the analysis area. Typically, there is a 3 to 4 year increase in nitrogen and phosphorus in streams draining a newly harvested area. This brief increase in the two nutrients critical to stream productivity results from the breakdown of logging slash, the flushing of some soil nutrients normally taken up by trees, and in some cases, due to slash burning. These short-term indirect and cumulative water quality effects do not generally extend very far downstream. They settle out of instream sediments and are absorb by plants and animals. However, these nutrients are in general short supply in the affected area and would increase aquatic productivity for a short time. The vegetative treatments are mitigated either naturally or through project design for minimal effects.

Road Construction, Reconstruction and BMPs

Forest roads can cause serious degradation of salmonid habitats in streams (Furniss et al. 1991). Roads directly affect natural sediment and hydrologic regimes by altering streamflow, sediment loading, sediment transport and deposition, channel morphology, channel stability, substrate composition and water quality within a watershed. Roads can interrupt hill-slope drainage patterns and alter the timing and magnitude of peak flows and change base stream discharge and sub-surface flows.

Poor road location or concentration of surface and subsurface water by cross-slope roads can lead to road-related mass soil movements. Damaging direct effects to fish habitat occur if roads are located in RHCAs and especially if they cross streams where they can intercept water and sediment and directly route it to streams.

The action alternatives would result in BMP work on all roads associated with the project. Table 3.53 shows the range of new road and temporary road construction for the proposed project. All new permanent and temporary roads would be constructed to BMP standards. BMP monitoring on the KNF has been shown to be 95% effective in reducing sediment (KNF 2011). The Montana BMP 2012 Monitoring Report states that "across all ownerships, BMPs were effective in protecting soil and water resources 99% of the time" (MDNRC 2012 BMP Executive Summary p. 2). The report goes on to say that across all ownerships "for all applied BMPs, 98% were shown to be effective in preventing sediments from reaching draws or streams" (MDNRC 2012 BMP Executive Summary p. 5). Any new permanent road would be added to the Kootenai Forest road system.

Existing stored roads would be reused for this project. Stored roads are roads that were treated in the past and placed into a stored state making them hydrologically neutral. This would utilize past road segments to access units for the project. These roads were deemed to be needed in the near future in past NEPA analyses. Utilizing these roads at their present location would reduce overall affects to the environment far more than new temporary road construction on unaltered landscapes. They would however create sediment and increase routing of overland flow into stream channels. This would occur until the roads are put back to bed and the recovery process began. To facilitate sediment minimization the temporary use of these roads would only be in place for one season during management activities.

Table3.53 - Proposed New and Temporary Roads, and Temporary Stream Crossings

WATERSHED	ALT 1 (miles)	ALT 2 (miles)	ALT 3 (miles)
Dunn Creek	0	0.9/0.51/0	0.9/0.5/0
Canyon Creek	0	2.6/2/1	2.6/2/1
Cripple Horse Creek	0	0.4/0.95/0	0.2/0.39/0
Warland Creek	0	2.1/0.25/0	1.8/0.25/0
Fivemile Creek	0	2.3/0.51/0	1.5/0.51/0

BMP work would be conducted on all routes utilized in the analysis area. This project would utilize up to 176 miles of road for BMP upgrades. The surface flow and sediment that is channeled to streams by roads would be greatly reduced with this work by accelerating hydrologic recovery and reducing the potential for further habitat degradation. A list of existing roads to be put into long-term storage can be found in Tables 2.9 and 2.21 of this document. Road storage would occur on up to 17 miles of road within the analysis area (Table 3.54). This work would further improve the drainage network and would further reduce road densities. In addition, all disturbed areas would be seeded. Nonetheless, short-term increases in sediment are possible due to the risk of rain events occurring before the vegetation in disturbed areas is established.

Approximately 0.34 miles of the new road would be built on FS lands to allow the DNRC access to their lands. The DNRC intends to harvest timber on their lands within the Cripple Horse Creek drainage. Additionally the DNRC would construct approximately 2.15 miles of new permanent road within their lands. All roads constructed would use Forest Service BMPs on FS lands and would follow State of

Montana BMPs on DNRC lands.

Table 3.54 - Proposed Intermittent Stored Service and Decommissioning by Alternative

WATERSHED	ALTERNATIVE 1	ALTERNATIVE 2	ALTERNATIVE 3
Dunn Creek	0	0.58/2.4	0.0/2.4
Canyon Creek	0	1.02/0.0	1.02/0.24
Cripple Horse Creek	0	3.18/3.8	2.88/3.8
Warland Creek	0	3.38/2.6	6.76/3.45
Fivemile Creek	0	7.3/2.5	9.34/2.56

Prescribed Fire
Total acres affected by fuels treatments for this alternative are displayed in Tables 2.4, 2.5 and 2.18. As a result of this burning, any changes in fish habitat would be within natural environmental fluctuations.

Prescribed fire may be preceded by slashing, if necessary, to reduce the chance for ladder fuels to carry fire to tree canopies and to assist in carrying fire throughout the treatment unit. Some burns would be conducted in the spring when conditions are within prescribed parameters for weather and fuel moisture. Some burning would occur in the fall and are designed to be stand-replacing. The stand-replacing burns proposed would create openings in an otherwise continuous mature tree canopy. These openings would provide foraging areas for bears and other wildlife species.

Most of the burns would occur outside RHCAs. However, there are some burns that include RHCAs within the unit boundaries. Incidental and designed inclusion of RHCAs in burns would likely result in low intensity fire due to moist habitat in RHCAs (See Fire and Fuels section of this document for location and fire prescriptions).

Watershed Restoration Work
The bulk of the watershed restoration proposed with this project includes long-term storage of roads. Restoration would occur under all action alternatives. See Chapter 2 for description of road treatments for watershed restoration.

Removing culverts would re-establish stream courses and remove the threat of the structure plugging and transporting the fill slopes into downstream waters. Unnatural channel widths, slope and streambed form occurs upstream and downstream of stream crossings. Removing culverts and reconstructing the stream channels would reconnect aquatic habitats.

A short-term increase in sediment is expected with culvert removal especially at live stream crossings. Past culvert removal performed by Libby District fisheries and hydrology has shown very little sediment actually enters the stream. Sediment that does enter the steam is of small scale and normally settles out quickly downstream (USDA, KNF 1998). The long-term benefits of reducing water routing and sediment input and restoring aquatic connectivity would far outweigh the short-term effects of roadwork. Stream channels would also be reconstructed to minimize the channel's adjustment process and resulting sedimentation following culvert removal. Large, rocky substrate and woody debris would be used to armor the new channel and seeding of disturbed areas would minimize long term sediment input.

Noxious Weed Spraying
The proposed project would incorporate spraying of noxious weeds along NFS roads for all action alternatives. Weed spraying would follow application protocol and would utilize mitigation set in the KNF Weed EIS. Following these guidelines would ensure that the spraying of noxious weeds ouldl not have an impact on aquatic organism.

Recreation Proposal
The proposal involves the dispersed recreation sites on the south side of Fivemile Creek and at the

Yarnell camping area.

Currently the Fivemile area receives relatively little dispersed camping use due primarily to poor access. The area would need new road construction as some of the terrain would provide opportunities for dispersed campsites. Native rock ring fire pits, vault toilets and signage and other improvements may be provided.

The Yarnell area has been a very popular destination for dispersed camping. The site(s) are occupied primarily from Memorial Day through Labor Day and receives steady use. The road infrastructure is in place and the objective would be to improve the road without changing the character of the area. Other improvements, including vault toilets, may be identified through the analysis process.

Included with the proposed project is access management change on 36.6 miles of trail system (Table 3.55). The analysis area consists of a trial system designated as motorized and would be change to non-motorized. The trail system was not built to motorized standards and is a safety and resource damage issue. To make the trail system safe for users and protect resources, the trail system would become non-motorized. Alternative 3 includes a motorized route of nearly 10 miles. This route was brought forward into Alternative 3 from comments from the public (Tables 3.55 and 3.56). Recreation improvements would follow INFS and would be consistent with the KNFP.

Table 3.55 – Alternative 2 East Reservoir Trail Access Changes

TRAIL ID	LOCATION	EXISTING STATUS	POST-PROJECT STATUS	MILES
279	Warland Ridge	Motorized allowed	Non-Motorized Only	10.70
280	Warland Peak Lookout	Motorized allowed	Non-Motorized Only	2.30
281	Cripple Horse	Motorized allowed	Non-Motorized Only	6.22
420	Canyon Divide	Motorized allowed	Non-Motorized Only	9.83
426	Fivemile	Motorized allowed	Non-Motorized Only	1.82
500	Hornet Ridge	Motorized allowed	Non-Motorized Only	5.69
				TOTAL = 36.56 miles

Table 3.56 - Alternative 3 East Reservoir Trail Access Changes

TRAIL ID	LOCATION	EXISTING STATUS	POST-PROJECT STATUS	MILES
279	Warland Ridge	Motorized allowed	Non-Motorized Only	10.70
280	Warland Peak Lookout	Motorized allowed	Non-Motorized Only	2.30
420	Canyon Divide	Motorized allowed	Non-Motorized Only	6.38
426	Fivemile	Motorized allowed	Non-Motorized Only	1.82
500	Hornet Ridge	Motorized allowed	Non-Motorized Only	5.69
				TOTAL = 26.89 miles

Cumulative Effects

The expected cumulative PFIs from the alternatives range from 6-14% in perspective watersheds. KNFP standards of 14% increase in analysis area watersheds would be reached in Cripple Horse Creek (Table 3.57). By maintaining water yields near KNFP levels, streams would not have negative impacts to RMOs. Habitat conditions would remain stable and RMOs would not be retarded.

Table 3.57 - Changes in Peak Flow by Alternative (% PFI) for 2012

WATERSHED	ACRES	EXISTING PFI 2012	RPFI	ALT 1 PFI	CUM ALT 1 PFI	ALT 2 PFI	CUM ALT 2 PFI	ALT 3 PFI	CUM ALT 3 PFI
Dunn Creek	21,666	7	14	7	7	10	10	10	10
Canyon Creek	13,184	7	14	7	7	11	12	11	11
Cripple Horse Creek	21,823	10	14	10	11	13	14	12	13
Warland Creek	8,520	6	14	6	6	12	12	13	13

WATERSHED	ACRES	EXISTING PFI 2012	RPFI	ALT 1 PFI	CUM ALT 1 PFI	ALT 2 PFI	CUM ALT 2 PFI	ALT 3 PFI	CUM ALT 3 PFI
Fivemile Creek	18,434	6	14	6	6	9	9	8	8

The effective road density with the proposed activities would be nearly the same within the analysis area due to long-term road storage (Tables 2.9, 2.21).

There would be a net reduction of stream crossings through watershed restoration, which is the greatest long-term benefit to fisheries resources. The removal of culverts and associated fills would reduce the threat of these structures failing and depositing sediment into downstream waters. By reconstructing the stream channels through the road prism, aquatic habitat and stream function would begin to be restored. Short-term negative effects from this watershed restoration would be addressed and mitigated through timing restrictions and design.

Implementation of this project in conjunction with the current activities in the analysis area, which include all the ongoing agency actions and reasonably foreseeable actions described on pages 3-5 through 3-7, would not retard the attainment of INFS RMOs. Habitat conditions currently partially meet or exceed INFS standards (Table 3.46).

FOREST PLAN CONSISTENCY

The proposed activities implement default INFS RHCAs to protect riparian resources and function. Road storage would remove up to 17 miles of road and numerous stream crossing structures. Long-term road storage would utilize BMPs to prevent retarding the attainment of RMOs. Based on these factors, it is determined that Alternatives 2 and 3 are consistent with INFS and the KNFP.

ALTERNATIVE 2

Direct and Indirect Effects

Timber Harvest and Associated Activities

The proposed action was designed to meet the purpose and need and address issues and concerns identified internally. Placement of harvest, stand improvement and fuel treatment locations were designed with careful consideration to stand treatment need, fuel treatment need and location, stand resilience to potential climate change, connectivity, fragmentation and other resource needs.
Activities associated with the proposed action include vegetative treatments including timber harvest, slash treatment, site preparation and natural fuels reduction, tree planting, herbicide application to aid in reforestation, precommercial thinning, access management changes, construction of new temporary roads, access management, road storage, road reconstruction and implementation of BMPs.

Alternative 2 includes 4.26 miles of temporary road construction, timber harvest, site prep and slashing on 8,845 acres (Table 2.0). This would result in the creation of an additional 3-6% PFI (Table 3.57).
U.S. ARMY- Corps of Engineer: In addition to the aforementioned activities, vegetation treatments within the analysis area, on US ARMY- Corps of Engineer Libby Dam (COE) jurisdiction lands will be analyzed as part of the proposed action. The vegetation treatments include improvement harvest and fuels treatment on approximately 421 acres. The fuel treatments include thinning, slashing and/or burning (Table 2.12).

Management of COE lands would occur along the banks of the Kootenai River and lower Dunn Creek. The amount of harvest and management on these lands would not affect PFIs within either drainage. The small amount of management compared to the large size of Dunn Creek and the larger Kootenai River would not be measurable in either drainage. Harvest would follow INFS and the SMZ law protecting riparian areas.

Prescribed Burning

Total acres affected by fuels treatments for this alternative are 11,427 and are displayed in Tables 2.4 and 2.5. As a result of this burning, any changes in fish habitat would be within natural environmental fluctuations.

Prescribed fire may be preceded by slashing, if necessary, to reduce the chance for ladder fuels to carry fire to tree canopies and to assist in carrying fire throughout the treatment unit. Some burns would be conducted in the spring when conditions are within prescribed parameters for weather and fuel moisture. Some burning would occur in the fall and are designed to be stand-replacing. These openings would provide foraging areas for bears and other wildlife species.

Most of the burns would occur outside RHCAs. However, there are some burns that include RHCAs within the unit boundaries. Incidental and designed inclusion of RHCAs in burns would likely result in low intensity fire due to moist habitat in RHCAs.

Road Construction, Reconstruction and BMPs
Alternative 2 would result in approximately 175 miles of road related disturbance, and approximately four miles of temporary road. Spot reconstruction would occur on the existing road systems that are identified as haul routes to improve surface drainage.

BMP work would be conducted on all routes utilized by the project. Surface flow and sediment that is channeled to streams by roads would be reduced with this work. Hydrologic recovery would be accelerated and the potential for further habitat degradation would be reduced.

Roadway reconditioning would occur on ditches, drainage structures, shoulders, roadbeds and aggregate surfaces.

Watershed Restoration Work
The bulk of the watershed restoration proposed with this alternative includes road storage. Roads to be put into long-term storage and decommissioned total approximately 28 miles. The drainage network would be partially restored and the likelihood of sediment introduction from failed culverts would also be reduced. Roads slated for storage and decommissioning are listed in Table 2.9 and 2.10A.

This alternative removes stream crossings and includes BMP improvements to the road system.

ALTERNATIVE 3
This alternative was designed to address many of the issues raised by the proposed action (Alternative 2) internally, by the public in scoping comments, and further reconnaissance of the analysis area.

Timber Harvest and Associated Activities
Activities associated with the proposed action include vegetative treatments including timber harvest, slash treatment, site preparation and natural fuels reduction, tree planting, herbicide application to aid in reforestation, precommercial thinning, access management changes, construction of temporary roads, access management, road storage, road reconstruction and implementation of BMPs.

Alternative 3 includes approximately four miles of temporary road construction, timber harvest, site prep, and slashing on 7,782 acres (Table 2.15). This would result in the creation of an additional 2-7% PFI (Table 3.57).

Prescribed Burning
Total acres affected by fuels treatments for this alternative are 11,358 acres and are displayed in Tables 2.18 and 2.5. As a result of this burning any changes in fish habitat would be within natural environmental fluctuations. Prescribed fire would be similar to what is proposed under Alternative 2.

Road Construction, Reconstruction and BMPs
Alternative 3 would result in approximately 168 miles of road related disturbance. Spot reconstruction would occur on the existing road systems that are identified as haul routes to improve surface drainage. Culvert upgrades are the same as Alternative 2.

Trail Access Changes
Trail access changes would occur on approximately 27 miles of motorized trails (Table 2.20B). In addition, due to further field verification, several roads that access dispersed camping sites have been added for proposed access changes. Table 2.20A displays the roads that are proposed to be changed from restricted seasonally to motor vehicles, open to snow vehicles to open yearlong.

Watershed Restoration Work
Approximately 30 miles of road would be stored or decommissioned in order to improve watershed conditions, enhance wildlife security and maintain a safe and efficient transportation system. Tables 2.21 and 2.22 displays the roads proposed for treatment.

Undetermined Roads
Approximately 13.5 miles of road would convert to NFS roads (Table 2.10). These roads would be brought up to BMP standards to increase safety and reduce resource concerns. The roads are being utilized currently and are extremely low standard roads. The vast majority of the roads are to access dispersed camping areas near the reservoir. Sediment generated from these roads is being routed directly into the reservoir. Impacts are negligible with consideration of the size of Lake Koocanusa. There is little concern to aquatic organisms from these roads.

STATEMENT OF FINDINGS

Threatened, Endangered and Sensitive Species
Alternatives 2 and 3 would have **No Effect** on white sturgeon. This conclusion is based on the lack of evidence linking forest management to sturgeon viability.

Alternatives 2 and 3 would have **No Effect** on bull trout from the proposed project. There is a lack of evidence proving the existence of bull trout within streams in the analysis area. It is believed that bull trout have been replaced by brook trout in streams above the Reservoir and within Dunn Creek. Bull trout in the Reservoir will not be impacted by the proposed project.

This assessment constitutes the biological evaluation for sensitive species
Alternatives 2 and 3 **May Impact** habitat or individual westslope cutthroat and western pearlshell mussels **but will not likely contribute to a trend towards federal listing or cause loss of viability** to the population or species.

Alternatives 2 and 3 include the fisheries culvert replacement and upgrade. The possibility exists that individuals could be crushed during culvert replacement. Work would occur directly in the stream channel where fish are likely to be encountered. Sediment produced downstream may also impact spawning gravels. This would be a short-term negative but long-term benefit on improved genetic flow.

Sediment generated from timber harvest and road activities has the potential to generate sediment within the Fivemile Creek watershed. Some amount of sediment would be generated downstream onto mussel beds. This would be short-term increases which may impact individual mussels. The grazing allotment would remain open within the drainage. The potential for cows to escape upstream fences is high. Grazing along the banks of Fivemile would increase sediment as well. More importantly, the point of effect would likely occur from cows entering the stream and crushing individual mussels. This would occur

infrequently due to fence maintenance but has happened in the past.

WATER RESOURCE INTRODUCTION

This section outlines the results of the analysis for the physical aspects of the water resources in the East Reservoir analysis area. The biological aspects of the water resource are addressed in the Fisheries and Aquatic Species Section.

Law, regulation, and policy drive effects analysis, specifically:

- Compliance with the Clean Water Act and Protection of Beneficial Uses;
- Compliance with Protection of Riparian and Wetland Areas; and
- Compliance with Forest Plan Standards.

REGULATORY FRAMEWORK

The regulatory framework pertaining to water resources is summarized below. For additional information, please refer to the Soil and Water Project File.

STATE and FEDERAL LAWS and REGULATIONS

The *Clean Water Act (CWA)* established Federal water quality policies, goals, and programs. Both the Environmental Protection Agency (EPA) and the States have responsibility for carrying out the CWA. The objective of the Act is to "restore and maintain the chemical, physical, and biological integrity of the Nation's waters."

Section 313 of the Clean Water Act requires Federal agencies to comply with all Federal, State, interstate and local requirements, administrative authority, processes and sanctions with respect to control and abatement of non-point sources of water pollutants.

Section 404 of the Clean Water Act authorizes the Secretary of the Army (operating through the Army Corps of Engineers) to issue permits for the discharge of dredged or fill material into wetlands (33 CFR 323). Silviculture activities are exempt from the 404-permit process, as are associated roads if constructed and maintained using Best Management Practices (BMPs) (Federal Register 323.4(a), 7/91). Potential effects on wetlands will be analyzed and disclosed. If a practical alternative to affecting a wetland exists, the wetland will be avoided (40 CFR 230.1).

The authorities governing Forest Service water management are:
The Multiple-Use Sustained-Yield Act of 1960 - states that management of the National Forests must provide sustained yields without impairment of the productivity of the land.

The Forest and Rangelands Renewable Resources Planning Act of 1974 (as amended by the National Forest Management Act of 1976), Section 5 – directs the Secretary of Agriculture to use a systematic, interdisciplinary approach to achieve integrated consideration of physical, biological, economic and other sciences in National Forest land and resource management planning.

Clean Water Act, Section 313 **–** requires Federal agencies to comply with all Federal, State, interstate and local requirements, administrative authority, processes, and sanctions with respect to control and abatement of non-point sources of water pollutants. This requires the Forest Service (FS) to apply all reasonable land, soil, and water conservation practices, or specialized Best Management Practices (BMPs).

Water quality in the analysis area is currently managed through the application of BMPs. The use of BMPs is the foundation for meeting water quality standards in the State of Montana. This is documented in ARM 16.20.603, which states that, "land management activities must not generate pollutants in excess of those that are naturally occurring, regardless of the stream's classification." Naturally occurring, as defined by the ARM, is the water quality condition resulting from runoff or percolation over which man has no control or from developed lands where all 'reasonable' land, soil and water conservation practices (BMPs) have been applied. BMPs are considered reasonable only if beneficial uses are protected.

The Clean Water Act also requires states to establish water quality standards that allow for the protection of designated beneficial uses, and to identify waterbodies that do not meet these standards, called 'water quality limited segments' (WQLS). A WQLS is a waterbody that is not fully meeting water quality standards or is not fully supporting its intended uses.

The Montana Streamside Management Zone Law and Administrative Rules (HB 731 1995) establishes a system for classifying streams and determining widths of Streamside Management Zones (SMZs) and allowable activities within them. This law works in combination with Inland Native Fish Strategy (INFS) (described below under 'Forest Plan Direction'). In most cases, INFS Riparian Habitat Conservation Areas (RHCAs) specify a wider buffer than State mandated SMZs. A document summarizing the State SMZs, INFS RHCAs, and the Kootenai National Forest (KNF) Riparian Guidelines is attached can be found in the Soil and Water Project File. Any deviations from the SMZ Law require an Alternative Practice Permit from the Montana Department of State Lands.

Executive Order 11988, Floodplain Management directs that each agency shall provide leadership and shall take action to reduce the risk of flood loss, to minimize the impacts of floods on human safety, health and welfare, and to restore and preserve the natural and beneficial values served by floodplains in carrying out its responsibilities for: acquiring, managing, and disposing of federal lands and facilities; providing federally undertaken, financed, and assisted construction and improvements; and/or conducting federal activities and programs affecting land use, including but not limited to water and related land resources planning, regulation, and licensing activities.

Executive Order 11990, Protection of Wetlands Order directs that each agency shall provide leadership and take action to minimize the destruction, loss, or degradation of wetlands, and to preserve and enhance the natural and beneficial values of wetlands in carrying out the agency's responsibilities for: acquiring, managing, and disposing of federal lands and facilities; providing federally undertaken, financed, and assisted construction and improvements; and/or conducting federal activities and programs affecting land use, including but not limited to water and related land resources planning, regulation, and licensing activities.

FOREST PLAN

Objectives

Construct the minimum number of roads necessary to permit the efficient removal of timber and mineral resources. Construct and reconstruct roads only to the minimum standards necessary to prevent soil loss, maintain water quality, minimize safety hazards for a reasonable and prudent Forest user, and provide access for fire protection where needed to meet Management Area goals. (USDA Forest Service 1987b, #2)

Meet or exceed State Water Quality Standards (USDA Forest Service 1987a, p II-2 #19).

Ground-disturbing activities such as road construction, road reconstruction, and timber harvest will be accompanied by mitigating measures to prevent or reduce increases in sedimentation and stream channel erosion. The amount of harvest allowed will depend on the rate of hydrologic recovery after timber has been removed (USDA Forest Service 1987a, p II-7).

Municipal watersheds will be managed to provide current stream flows and keep water quality at current levels (USDA Forest Service 1987a, p II-7).

Standards

Those activities or standards that will prevent or reduce stream sedimentation will be implemented along with the soil and water conservation practices specified in Forest Service Handbook (FSH) 2509.22. Examples include: location of roadbeds out of stream bottoms, design of stream crossing structures to allow water to freely pass, rock surfacing of roads at stream crossings, keeping equipment from operating

in or alongside streams, and maintenance of roads to allow proper drainage. These practices will be implemented in order to help maintain water quality (USDA Forest Service 1987a, p II-7).
Soil and water conservation practices as outlined in the Soil and Water Conservation Practices Handbook (FSH 2509.22) will be incorporated into all land use and project plans as a principle mechanism for controlling non-point pollution sources, meeting soil and water goals, and protecting beneficial uses. Activities found not in compliance with soil and water conservation practices or State standards will be brought into compliance, modified, or stopped (USDA Forest Service 1987a, p II-23).

A floodplain/wetland analysis will be made for all management actions involving wetlands, streams, or bodies of water (USDA Forest Service 1987a, p II-24).

Projects involving significant vegetation removal will, prior to including them on implementation schedules, require a watershed cumulative effects feasibility analysis to ensure that water yield or sediment will not increase beyond acceptable limits. The analysis will also identify opportunities, if any exist, for mitigating adverse effects on water-related beneficial uses (USDA Forest Service 1987a, p II-24).

INFS (USDA Forest Service, 1995a) amended the KNF Land Management Plan. INFS established riparian goals, riparian management objectives (RMOs), and riparian habitat conservation areas (RHCAs). RMOs were created for pool frequency, water temperature, large woody debris, bank stability and lower bank angle, and width to depth ratio. RHCAs are buffers delineated adjacent to streams, lakes, and wetlands; their size is defined based on waterbody category (Table 3.50).

Table 3.50 - RHCA Default Buffer Widths

RHCA Default Buffer Widths			
Flow Regime	**Description**	**INFS**	**INFS RHCA Width**
Perennial	Perennial Fish Bearing Stream	1	300 feet on each side unless extended by ERV or slope
Perennial	Perennial Non-Fish Bearing Stream	2	150 feet on each side unless extended by ERV or slope
Wetlands	Lakes, ponds, and wetlands > 1 acre	3	150 feet on each side unless extended by ERV or slope
Intermittent/Ephemeral & Wetlands	Intermittent/Ephemeral Non-Fish Bearing Stream & Wetlands < 1 acre	4	50 or 100* feet on each side unless extended by ERV or slope

ERV = Edge of Riparian Vegetation *Priority watersheds (WS) have a 100 feet RHCA for Class 4

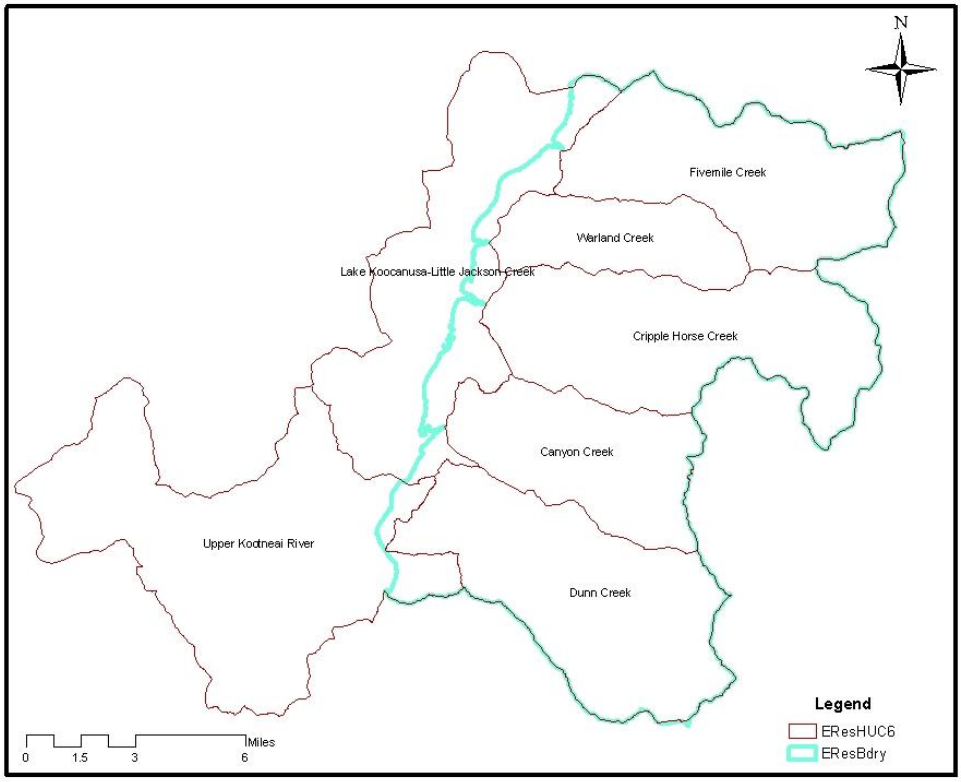
ANALYSIS AREA

For the East Reservoir project, analysis watersheds are delineated along hydrologic boundaries using GIS. In general, these watersheds roughly correspond to 6th code HUCs using the NRCS classification of hydrologic units (Department of Interior, USGS 2009). The East Reservoir analysis area consists of five 6th field HUCs; Dunn Creek, Canyon Creek, Cripple Horse Creek, Warland Creek and Fivemile Creek. Additionally, portions of the Lake Koocanusa and Kootenai River HUCs are included. All the watersheds are tributaries to Lake Koocanusa, except Dunn Creek is a tributary to the Kootenai River. There are small, diffuse (do not have a common outlet), intermittent, and non-fish bearing tributaries to Lake Koocanusa and the Kootenai River that are identified, but not carried through all analyses because they do not lend themselves to surveying, water yield, and/or sediment analysis. Figure 1 depicts the East Reservoir analysis area.

Direct, indirect and cumulative effects from past, current, proposed and reasonably foreseeable activities are discussed for water resources in the analysis area. In general, a cumulative effects boundary is adequate when all the upstream activities are included and the effects are not discernible at a downstream

boundary. Lake Koocanusa and the Kootenai River are the boundary. Therefore the cumulative effects boundary is the same as the direct and indirect effects boundary for this analysis.

Figure 1. East Reservoir Analysis Area



METHODS, ASSUMPTIONS and LIMITATIONS

Stream Flow

Timber harvest can increase the total water yield and/or peak flow generated during spring snowmelt or rainfall events. The increase in spring runoff can lead to localized adverse hydrologic responses. This depends on the magnitude of the increase, the stream type and the channel condition. In northwest Montana, increases in peak flows are primarily due to modifications in snow accumulation, snowmelt runoff and changes in evapotranspiration rates (USDA Forest Service 1973b). These increases are then modified by components of the transportation network (roads and stream crossings) that interrupt normal runoff patterns.

The only Kootenai National Forest Plan (KNFP) standard for stream flow is the following:

Projects involving significant vegetation removal will, prior to including them on implementation schedules, require a watershed cumulative effects feasibility analysis to ensure that water yield or sediment will not increase beyond acceptable limits. The analysis will also identify opportunities, if any exist, for mitigating adverse effects on water-related beneficial uses (USDA Forest Service 1987a, p II-24).

The KNFP suggests using the Water Yield Guidelines in Appendix 18 of the KNFP (USDA Forest Service 1987b). The intent of the water yield analysis process is to protect beneficial uses from the potential effects of peak flow increases. However, threshold-type water yield increase numbers such as

those identified in the KNFP and in subsequent documents are to be used as "red flags" to indicate instances where the potential is higher for channel damage from flows. The intent is that these "red flags" would show a need for more extensive field reviews that would ultimately result in either modifications or mitigation. In instances where time limitations did not allow for field review, activity would be reduced or rescheduled until levels fall below the threshold. The threshold numbers are not necessarily static and can change based on the condition or trend of the stream channel.

Water yield increase thresholds, ranging from 10 to 20% peak flow increase (PFI), represented the best information available at the time the KNFP was written. These numbers were developed over time as watersheds were compared with modeled results, beginning in the 1970s with the release of Hydrology Part 2 (USDA Forest Service 1974). The thresholds were based on a qualitative survey that gave each stream a rating of poor, fair, good, and excellent.

An equivalent clearcut acre (ECA) calculator was used in conjunction with the R1 Water and Sediment Yield Model (R1-WATSED) to predict PFIs for the existing and expected conditions of the watersheds in the analysis area. ECAs are a commonly used tool to analyze the change in peak flow by translating canopy removal from timber harvest, road building and natural disturbances to a common unit, an ECA. ECA units are in acres, but are usually displayed as a percentage of the watershed area. The ECA calculator takes into account the initial percentage of crown removal and the recovery through re-growth of the vegetation after the initial harvest or disturbance.

The ECA figures are then used to calculate water yield, in the form of PFIs, using regression curves generated from running the R1-WATSED Model over a variety of watershed sizes and precipitation regimes. The values generated from these calculations are used along with other information such as stream condition and channel type to interpret the existing and potential impacts resulting from past, present and proposed land management activities.

The R1-WATSED was used to predict existing and expected conditions of watersheds from logging, fire and roads. It was designed to simulate the effects of natural disturbances and land management activities on average monthly water yields and peak flows.

The R1-WATSED model was used to compare alternatives with regard to changes in stream flow. The model begins by estimating the average annual water yield for a given watershed in an undisturbed condition. R1-WATSED assumes a fully forested watershed. These calculations use precipitation in inches by landtype, hydrologic regime (reflected through a representative gauged stream) and a natural runoff function (precipitation to annual discharge conversion) to produce acre-feet of average annual water yield. R1-WATSED uses this estimated natural runoff and the existing computed disturbed areas (harvest, roads, and other disturbed acreage ECAs) to determine the total water yield increase. Next, R1-WATSED uses an Average Water Yield Increase Factor to estimate increases in runoff due to proposed management and/or fire. This factor expresses changes in evapotranspiration, interception and snow accumulation and storage resulting from activities in the drainage. In addition, R1-WATSED uses an equation that is based on reductions of infiltration and increased drainage efficiency due to roads, to determine the runoff increases resulting from new roads. Logarithmic curves, based on habitat type groups, are then used to determine the vegetative/hydrologic recovery following logging, site preparation, and fire activities. Finally, R1-WATSED uses this recovery rate in conjunction with the above information to aid in the determination of the yearly water yield increase.

R1-WATSED was not designed, nor is it used, to develop exact estimates of flow. The model provides a consistent method of comparing alternatives to each other as well as to modeled natural conditions and/or measured stream conditions. The values generated by the model, in concert with other water resource information such as stream condition and channel type, are used to interpret the potential effects to a

stream channel as a result of implementing a proposed land management activity. Values generated by the model are not to be considered as an absolute measure against verifiable standards, nor by themselves provide an answer in regard to the effects land management activities have on peak flow.

Conditions of the Model that require additional evaluation and documentation include episodic climatic events such as rain-on-snow (ROS), high-intensity thunderstorms, saturation caused mass soil movement, or shorter-duration peak flow events (majority of these are not prevalent in the analysis area – refer to existing condition section). Analysis of these, where needed, must be done outside of the model. Refer to the Soil and Water Project File for additional information on ECA and R1-WATSED models.
It is important to note that effects will be analyzed with regard to normal or average conditions and impacts to watershed processes in order to focus the analysis and more clearly contrast the alternatives. Precipitation events with return intervals greater than six years are highly variable in nature and largely speculative in terms of quantifying effects (Grant et al. 2008). Large fires, major floods and extreme episodes of bank instability and sediment movement are normal for these larger events (Benda et al. 1998). The magnitudes of these events far overshadow the potential effects of this project proposal. Project impacts are not analyzed in this context, but rather within the context of the desired conditions in the watershed – stable banks, healthy riparian and aquatic habitat, and attainment of full support of all designated beneficial uses.

Stream Channel Condition
Extensive field data including, Rosgen channel classification, stream flow, and water quality, has been collected in the East Reservoir analysis area for more than ten years. Field data is on file at the Canoe Gulch Ranger Station. This data was the foundation for the existing condition and the effects analysis for this project. The stream classification, stability, dimensions and substrate data were collected using the Rosgen (1996) methodology and the Region 1 Aquatic Ecosystem Unit Inventory (AEUI) technical guide. This data provides a good indicator of trends in watershed condition. Stream channels change as a result of both man-caused and natural events; these changes are an indicator of the effects past disturbance has had on the watershed and/or the sensitivity of the watershed to disturbance. It is important to note that not all measured parameters have to fall within reference parameters for a stream to be considered healthy. These are natural systems and even unmanaged reference streams do not fit entirely within each individual category.

Representative reaches previously identified in the East Reservoir analysis area were resurveyed. These reaches are assumed to represent the overall condition of the watershed. Other portions on the stream channel that have not been quantitatively monitored may have varying levels of stability. Stream survey sites are located throughout the watershed and represent areas that could have no impact and areas that could be impacted from the proposed activities. Areas that have the highest potential for effects, known as response reaches, will continue to be monitored following implementation of the proposed activities.

Water Quality
Roads and Motorized Trails
Roads and motorized trails are known to re-route surface runoff and sub-surface flow; and/or increase sedimentation. Non-point sources of pollution are the primary cause of degraded water quality. For over 25 years, studies have shown that poorly maintained and located roads are often the highest contributors of non-point source sediment in forested areas (Brooks et al. 1997; Luce and Wemple 2001), and impact aquatic habitat (Furniss et al. 1991). A study on the KNF found that fine sediment in channels correlated with road density (MacDonald et al. 1997).

Roads and motorized trails may also affect the hydrologic response of a watershed, including the timing and magnitude of the hydrograph. Wemple and Jones (2003) found that depending on the nature of storm events, watershed characteristics and road segment attributes, storm flow response may be more rapid and

have greater peaks because of the effect roads have on hillslope flow. The amount of road or motorized trail adjacent to stream courses is an important indicator of potential impacts. Sediment sources within 300 feet of a water body have higher probabilities of delivering sediment into the water bodies (Belt et al. 1992, Furniss et al. 2000). Roads or motorized trails within RHCAs preclude the growth of trees, decrease tree density in the riparian area, reduce the availability of LWD for recruitement, decrease shading and impact riparian and aquatic habitat. Roads or motorized trails immediately adjacent to streams degrade habitat by increasing fine sediment levels, reduce pool volumes, increase channel migration and exacerbate seasonal temperature extremes.

Total road density (TRD), riparian road density (RRD), and stream crossing density (SCD) were used in this analysis to describe watershed conditions and assess potential sediment sources. TRD is the ratio of road length per watershed area; RRD is the ratio of road length per RHCA area, and stream crossing density is the ratio of stream crossings per watershed area. The watershed condition factors (Table 3.51) were acquired from the Upper Kootenai Sub-basin Review.

Table 3.51 - Watershed Condition Evaluation

WATERSHED CONDITION or INTEGRITY – DISTURBANCE EVALUATION FACTORS	DISTURBANCE FACTOR SCALING		
	HIGH	MODERATE	LOW
% ECA for the WATERSHED	>30%	15-30%	<15%
STREAM CROSSING DENSITY (#/mi^2 of watershed)	>3/MI^2	1.5-3/MI^2	<1.5/MI^2
Riparian Area Road Density	Factor based on Mean Annual Precipitation (MAP) for the 6th HUC Watershed: *MAP >40"* >2.0 mi/mi^2 = HIGH 0.5-2.0 mi/mi^2 = MDT <0.5 mi/mi^2 = LOW *MAP 20-40"* >3.0 mi/mi^2 = HIGH 1.0-3.0 mi/mi^2 = MDT <1.0 mi/mi^2 = LOW *MAP <20"* >3.0 mi/mi^2 = HIGH 1.5-3.0 mi/mi^2 = MDT <1.5 mi/mi^2 = LOW		
Total Watershed Road Density	Factor based on Mean Annual Precipitation (MAP) for the 6th HUC Watershed: *MAP >40"* >3.0 mi/mi^2 = HIGH 1.5-3.0 mi/mi^2 = MDT <1.5 mi/mi^2 = LOW *MAP 20-40"* >3.5 mi/mi^2 = HIGH 1.5-3.5 mi/mi^2 = MDT <1.5 mi/mi^2 = LOW *MAP <20"* >5.0 mi/mi^2 = HIGH 1.5-5.0 mi/mi^2 = MDT <1.5 mi/mi^2 = LOW		

The analysis of total road density, riparian road density and stream crossing density was used as a surrogate for the potential of roads affecting flow alteration and sedimentation. The use of this methodology does have some limitations:

- There are site-specific differences on each road that could affect erosion or transport of sediment.
- Landtypes vary throughout the watersheds.
- Precipitation regimes differ slightly within the watersheds.
- There is no differentiation of road distance to streams and therefore, the potential to route sediment to streams is the same for each road.
- Mapped roads may be overgrown and may not be an active sediment source.

This methodology does not provide absolute numbers. However, it does provide estimates for comparison of alternatives. In addition, road density calculations are commonly used as a watershed indicator within the agency as well as among other agencies and researchers.

Additionally, roads identified during the Travel Analysis Process (TAP) for National Forest Management Act (NFMA) as potential intermittent stored service opportunities were assessed for water resource concerns. Road stream crossings were surveyed for appropriate structure sizing, alignment and function; and whether or not best management practices (BMPs) were being met. This information was used to determine the appropriate treatment

AFFECTED ENVIRONMENT

REFERENCE CONDITIONS

The watersheds in the East Reservoir analysis area have developed over time by adjusting to changes in climate, flow regimes, sediment inputs and vegetation. Long before human-induced changes began to occur, natural disturbances were present across the landscape due to beavers, insects, disease, wildfire and climate. Pre-settlement conditions in this area were likely to have been a repetitious cycle of disturbance and recovery, a pattern referred to as a pulse disturbance regime. Under a pulse disturbance regime, a disturbance occurs, resulting in a quick increase in water and/or sediment delivery that could potentially trigger some channel destabilization. The affected channel would then recover through time and generally stabilize until the next disturbance event. These disturbances typically occurred in a patchy, mosaic pattern (in both time and space), so that some areas remained undisturbed by a given event and provided refuge habitat for fish and other aquatic organisms.

Historically, the most prevalent large-scale disturbance in the analysis area was wildfire. High-intensity/ stand replacing fires varied in frequency but had pronounced effects. Once high-intensity fire passed through an area, sediment delivery and water yield increased until forest floor and canopy vegetation had sufficiently recovered. During the fire disturbance cycle, large woody debris usually remained within channels and riparian zones and greatly aided the recovery of this area. It is very likely that increased erosion followed these fires, especially on steep slopes and in headwater channels where most vegetation would have been removed. More frequent and lower-intensity fires likely had little effect on this watershed due to the minimal loss of overstory trees and understory duff layers.

Other disturbances that occurred were floods, debris slides, beaver dam failures and beaver dam construction. Floods may have affected several adjacent drainages or even the entire analysis area at the same time and occurred in a similar temporal pattern as the wildfires, usually providing time for recovery between major events. Channel stability and aquatic habitat can be affected by floods. Steep reaches tend to scour and the material may be deposited in lower gradient reaches. Un-vegetated or unstable streambanks may be destabilized further and contribute sediment to the system. There are sites in the East Reservoir analysis area were debris slides may have occurred though not common across the landscape. There are remnant beaver dams in Fivemile Creek, Cripple Horse Creek, Warland Creek and Dunn Creek; evidence of historic beaver activity in the analysis area. The failure of beaver dams would result in flooding and contribute a sediment pulse to the stream system subsequently impacting stream morphology and function temporarily. Conversely, beaver dam construction would convert free flowing streams (lotic) to ponds (lentic). Beaver ponds would help capture sediment derived elsewhere in the system, capture

spring runoff, and retain water throughout the year longer thus sustaining flows during the dry season.

Over the last century, there has been an anthropogenic change in the watershed disturbance regime. Management activities in the analysis area, including road building, forest canopy removal, riparian harvest, railroad construction, beaver extirpation and cattle grazing have resulted in changes to water and sediment routing, stream morphology and hydrology. These changes tend to be lower in magnitude than post-disturbance effects from natural disturbances. However, the watersheds have not returned to a pre-management level due to the persistence of water and sediment increases contributed from roads in the riparian area and at stream crossings, continued cattle grazing, and other ongoing management activities. Sustained, moderate increases in water and sediment yields have resulted in the establishment of a 'press' disturbance regime (Wegner 1996) that has influenced the watershed for the last 40-50 years.

The existing press disturbance regime is characterized by nearly constant, moderate levels of effects (increased water and sediment yields). The historic pulse disturbance regime had higher levels of effects, but the disturbances were less frequent and typically allowed time for system recovery between disturbance events.

EXISTING CONDITIONS

The existing conditions are the result of past management activities (road construction, timber harvest, prescribed burning, cattle grazing, fish habitat enhancement, riparian area enclosure, extirpation of beavers, etc.) and natural events (wildfire, floods, landslides, etc.) that occurred in the analysis area. Information pertaining to historical timber harvest, prescribed burning and wildfire can be found in Chapter 3 of this DEIS. Currently, there are cattle grazing allotments in Canyon Creek, Cripple Horse Creek, Warland Creek, and Fivemile Creek. The only active grazing allotment is in Fivemile Creek. The other grazing allotments have not been active for several years.

Past fish habitat enhancement projects have included installing large woody debris (LWD), gravel, k-dams, and constructing riparian/stream enclosures. LWD was installed in Cripple Horse Creek from 1990 to 1992. Gravel and k-dams were installed in Canyon Creek in 1994, and LWD was installed in 1996. A riparian/ stream enclosure to keep cattle out of a sensitive area was built in Warland Creek in 1995 and expanded in 1996; the enclosure encompasses 20 acres. No fish habitat enhancement projects have occurred in Dunn Creek and Fivemile Creek.

Geology and Climate

The physical environment of streams and lakes is determined by the geologic and climatic characteristics of the watershed. Geology and climate are important because some watersheds are inherently more sensitive to disturbance than others. Watersheds with higher mean annual precipitation have greater potential for flood events and erosion of sensitive areas or steep slopes. For example, all things being equal, a watershed with 50" of mean annual precipitation is much more susceptible to problems than a watershed with 20" due to the additional volume of water. The greater the input of water, the greater the potential for soils to become saturated, leading to surface runoff. In addition, areas with shallow soils (bedrock) have less water holding capacity and are therefore more likely to have higher runoff.

The analysis area has been influenced by continental glaciers. The glaciers scoured the ridge tops and noses and filled the side-slopes and valleys. Lacustrine and glacial outwash terraces exist along the Koocanusa Reservoir and the Kootenai River. Elevation ranges from 2,200 feet near the Kootenai River to 6,051 feet at the top of Davis Mountain.

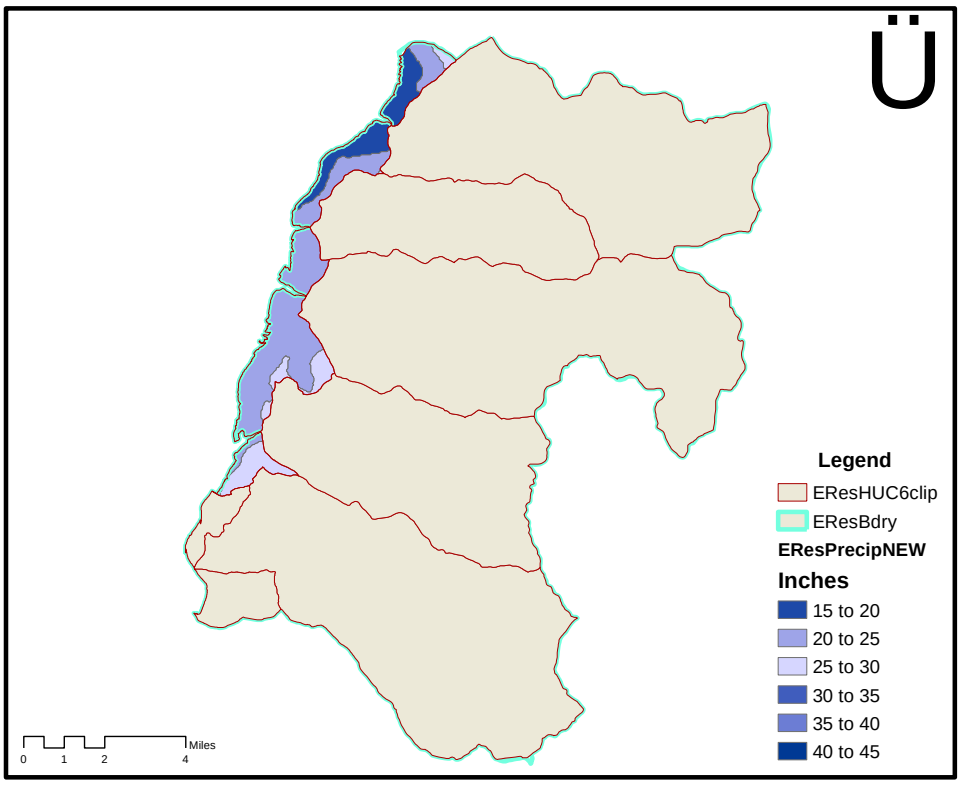
The analysis area is underlain by metamorphic sedimentary rocks; quartzites, argillites, and siltites, known as the Belt Formation. These rocks were formed approximately one billion years ago from fine sediment deposits of sand, silt, clay, and carbonate that accumulated at the bottom of ancient seas. These

deposits were changed into hard dense rock formations under great pressure and heat. They form a relatively stable foundation for the watersheds in this area (Kuennen and Gerhardt 1995). For more information on the geology in the analysis area, refer to the Soils Section of the Document.

The analysis area falls within KNF Hydraulic Region III, which is occasionally influenced by rain-on-snow events (USDA Forest Service 1990; Hoffman 1993; MacDonald et al. 1997). The mean annual precipitation in the analysis area ranges from 15- 20 inches near Lake Koocanusa to 35-40 inches in the headwaters (Figure 2). At lower elevations, most of the precipitation falls as rain; while in the upper elevations most of the precipitation falls as snow.

Geological and climatic attributes are discussed here to describe a watershed's inherent sensitivity to disturbance. These inherent conditions do not change as a result of management. They merely set the stage for analysis of effects. Therefore, geology and climate will only be discussed further in this analysis as they pertain to other indicators.

Figure 2 - Precipitation Ranges for East Reservoir Analysis Area



Stream Flow

Stream flow can be discussed in terms of annual yield or PFIs. The greatest potential for change within a stream channel occurs during high-flow periods (King 1989). Therefore, increases in magnitude and duration of peak flows are of the most concern.

Spring peak flows in the analysis area normally occur during May or June (Hoffman 1993), but elevated flows can occur throughout the year in response to precipitation events. The timing, magnitude and duration of runoff events may be changed when vegetation is removed by management activities or natural disturbances.

The removal of forest canopy through natural disturbances or management activities affects snow accumulation and melting processes, commonly resulting in an increase in snow-pack accumulation and snowmelt rates, thereby increasing runoff magnitude and volume (MacDonald et al. 1997; and Hoffman 1993). Generally, there is an increase in water yield due to the combination of reduced evapotranspiration and precipitation interception.

Runoff patterns can be affected when water is rerouted by roads. The compacted soils associated with roads and trails can act as sources of overland flow and can intercept groundwater, converting it to surface flow. Roads and corresponding ditches, if not properly drained, can extend the stream channel network, increasing the drainage efficiency of the watershed. Changes in flow patterns can result in higher but shorter peak flows and/or a series of smaller, more prolonged peak flows depending on aspect, elevation, precipitation, drainage pattern, etc. Interception and re-direction of runoff by roads, landings, and trails can contribute additional runoff.

The existing percent ECA was acquired from the KNF Watershed Condition Rating and in the analysis area indicates that Cripple Horse Creek and Dunn Creek have a moderate disturbance level and Canyon Creek, Warland Creek and Fivemile Creek have a low disturbance level. The streams in the analysis area were described as being in fair to good condition. The recommended peak flow increase (RPFI) was set at a conservative 14% (fair = 12-16%; good = 14 to 18%) for the streams in the analysis area based on existing ECA and PFI. The KNFP allows for a +/- 2% adjustment based on stream conditions. The peak flow associated with the existing ECA, calculated for the year 2012, range from 6 to 10. The PFI is within the allowable range given the existing channel conditions of fair to good. The ECAs, PFIs, and ECA recovery per year for the East Reservoir analysis area are presented in Table 3.52.

ECAs and PFIs were not calculated for streams that concurrently reside in the proposed analysis area and in the Lake Koocanusa-Little Jackson and the Upper Kootenai River HUCs because these streams are intermittent/ephemeral and there is no channel condition data to assess potential impacts.

Table 3.52 - Existing ECA's, PFI's, and ECA Recovery by Watershed – 2012

WATERSHED	WATERSHED SIZE (acres)	TOTAL ECA	EXISTING % ECA	EXISTING PEAK FLOW %	ECA FOR 1% PFI	ECA RECOVERY PER YEAR
Dunn Creek	21,666	2,968	14	7	433	143
Canyon Creek	13,184	1,678	13	7	264	81
Cripple Horse Creek	21,823	4,048	19	10	436	144
Warland Creek	8,520	867	10	6	170	50
Fivemile Creek	18,434	1,892	10	6	369	119

Additionally, there are two active stream flow monitoring locations within the East Reservoir analysis area, one on Cripple Horse Creek and one on Warland Creek. Cripple Horse Creek and Warland Creek have been monitored since 1992 and 1994, respectively. Figures 3 and 4 depict the stage/discharge relationship and R^2 values for the stream flow stations in the analysis area for the years of 2002 to 2011. In a perfect situation (or a concrete flume study) the relationship (R^2) would equal 1. That is, an increase in water stage (ft.) and its corresponding increase in water discharge (cubic feet per second = cfs) would have a consistent relationship. For natural stream systems, the closer the R^2 value is to 1 the better and if the R^2 value can be maintained over the course of many years then the stream channel at that location is considered to be very stable. Lower values indicate a stream channel in transition (either in a positive or negative direction). Outliers in the datasets for Warland Creek and Cripple Horse Creek were removed to get a best fit line; outliers may be attributed to human error during discharge and gage height measurement collection and/or lack of sufficient high flow data.

Warland Creek and Cripple Horse Creek at the monitoring locations are stable (Figures 3 and 4), with R^2

of 0.83 and R^2 of 0.87 respectively. Past and current PFIs are not causing channel changes in and around the monitoring sites in Warland Creek and Cripple Horse Creek, though other locations in the watersheds may be in a state of transition. Stable conditions at the Warland Creek monitoring location are attributed to the construction of an enclosure to keep cattle out of a sensitive riparian area. The Warland Creek site has been fenced off for more than 10 years and in that time the riparian vegetation; alder and willows, have colonized the streambanks and provide stability during peak flows. The Cripple Horse Creek site is located in a grazing allotment but active grazing has not occurred there for 10 years. The stable conditions at the Cripple Horse Creek site are attributed to the lack of grazing activity.

Figure 3 - Stage/Discharge Relationship and R^2 Value for Warland Creek (2002-2011)

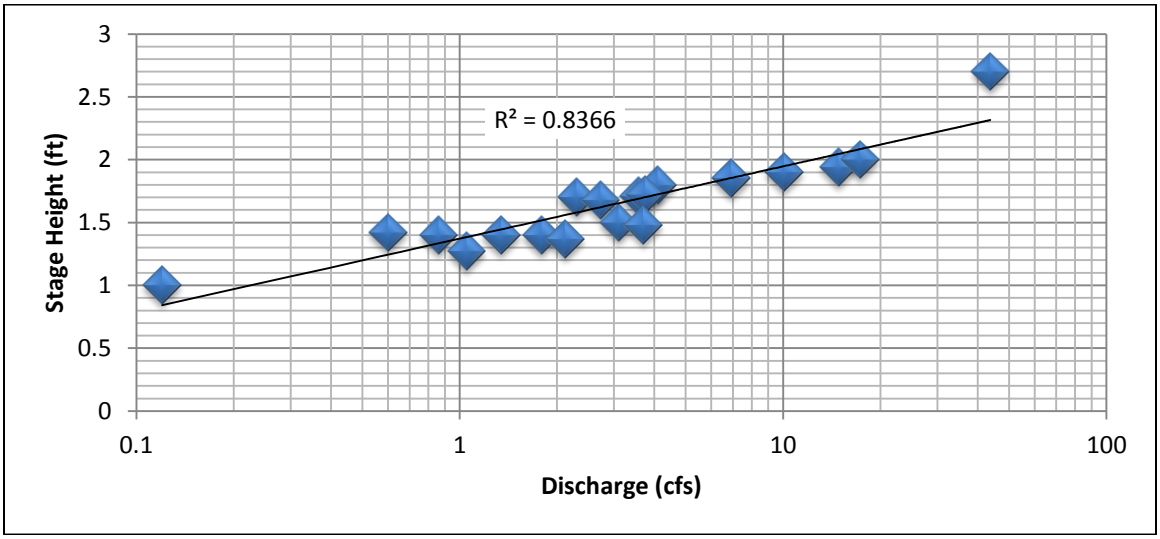
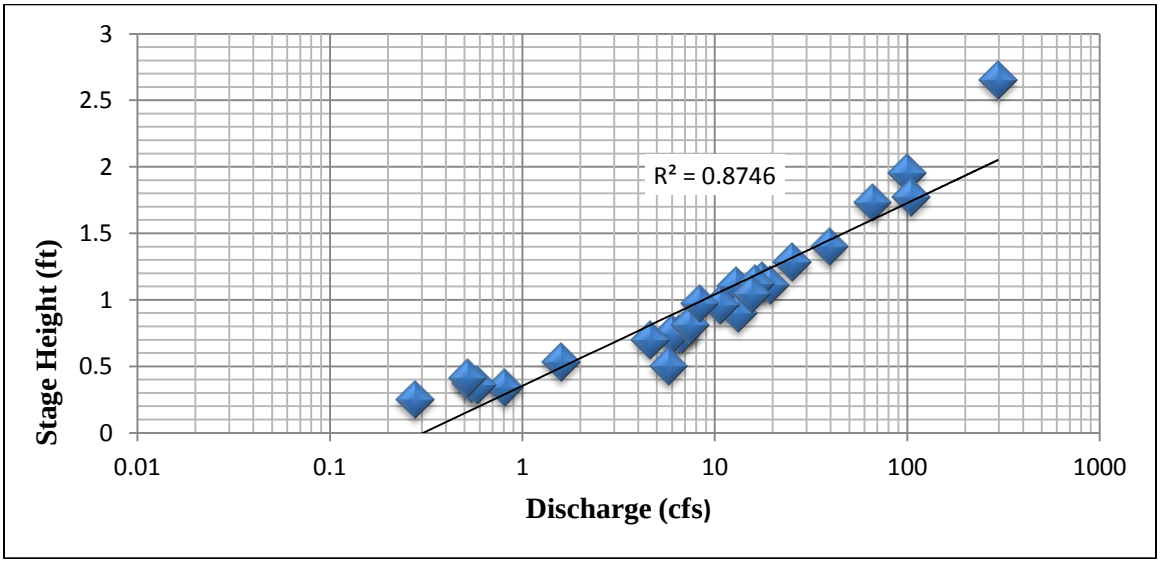


Figure 4 - Stage/Discharge Relationship and R2 Value for Cripple Horse Creek (2002-2011)



Stream Channel Conditions

The Rosgen Stream Classification System (Rosgen 1996) was used in this analysis to help explain the processes, functions and patterns of channels and to predict channel responses. The Rosgen Classification is derived from field measurements of stream attributes including entrenchment, width-depth ratio (W/D),

sinuosity and slope. These channel attributes are maintained by bankfull flows. Bankfull flows typically occur every 1.5 to 2 years. The major stream types found in the analysis area are depicted in Table 3.53.

Table 3.53 - Rosgen Channel Types Identified in the East Reservoir Analysis Area

STREAM TYPE	DESCRIPTION	ENTRENCHMENT RATIO	W/D	SINUOSITY	SLOPE	LANDFORM/FEATURES
A	Steep, entrenched, cascading, step-pool, high energy debris transport. Very stable if bedrock or boulder dominated.	<1.4	< 12	1.0-1.2	.04-.10	High relief. Frequently spaced deep pools in step-pool sequence. May be used for rearing by juvenile fish, if fish are present.
B	Moderately entrenched, moderate gradient, riffle dominated channel with infrequent pools. Stable banks, stable plan and profile.	1.4 – 2.2	> 12	> 1.2	.02-.039	Moderate relief. Moderate entrenchment and W/D. Predominantly rapids with scour pools. Important spawning habitat.
E	Low gradient, meandering riffle/pool stream with low width/depth ratio, and high meander width ration. Very stable.	>2.2	<12	<1.5	<.02	Broad valley/ meadows. Alluvial materials w/floodplains. Highly sinuous, riffle/pool morphology w/very low width/depth ratios.
F	Entrenched, meandering riffle-pool channel with low gradient and high W/D.	<1.4	> 12	> 1.2	< .02	Entrenched. Gentle gradient, high W/D. Riffle-pool. Laterally unstable with high bank erosion rates.

A numerical classification of particle size is added to the basic Rosgen Level II Channel Type to characterize the size of the material that makes up the channel bed. Bed material size is important to channel stability and response because smaller particles can be eroded and transported by lower energy flows than larger particles. The bed material description and size is depicted in Table 3.54.

Table 3.54 - Rosgen Bed Material Size Categories (from Rosgen 1996)

CATEGORY	DESCRIPTION	PARTICLE SIZES (MM)
1	Bedrock	N/A
2	Boulder	> 256
3	Cobble	64 - 256
4	Gravel	2 - 64
5	Sand	.062 - 2
6	Silt or Clay	< .062

The reach condition (Rosgen 1996, Table 4) is a conversion of the Pfankuch channel stability rating based on stream type (Table 3.55). The objective of a stream type conversion with the rating values from the original channel stability rating system is to reflect the naturally inherent and differing value ranges for each stream type, values shown are simply an index to channel stability (Rosgen 1996). The reach condition can indicate (1) a stream's potential departure from typical stability conditions, (2) sensitivity to potential change associated with channel disturbance, and (3) increased sensitivity and potential for erosion due to increases in stream flow magnitude and duration. A stability rating of 'fair' or 'poor' does not indicate that a channel is currently in 'fair' or 'poor' condition, but that it has a higher chance to become destabilized with increased peak flows or sediment delivery. These ratings do not necessarily

indicate departures from natural channel conditions. A stream channel in "poor" condition could be displaying these effects from natural events, i.e. intense flood event, wildfire induced debris flows, etc.

Table 3.55 - Pfankuch Stability Rating and Rosgen Reach Condition

PFANKUCH STABILITY RATING	ROSGEN REACH CONDITION
< 38	Excellent
39 - 76	Good
77 – 114	Fair
>115	Poor

Stream channels are variable in how they respond to changes in the natural levels of runoff (peak flows) and/or the amount of sediment that is input into the stream system. The response of streams to increased levels of these items above natural levels is dependent on the makeup of the stream channel and how that particular stream channel recovers from disturbances. The response of streams to imposed change is not uniform among stream types. Table 3.56 lists the interpretations for the stream's sensitivity to changes in flows and sediment, recovery potential, natural sediment sources from the stream channel and stream bank erosion potential for the geomorphic stream type found in the analysis area.

Table 3.56 - Sensitivity of Stream Types in the Analysis Area to Changes in Streamflow and/or Sediment Supply (Rosgen 1996)

ROSGEN STREAM TYPE	SENSITIVITY to INCREASED PEAK FLOWS and/or SEDIMENT	RECOVERY POTENTIAL	NATURAL SEDIMENT SOURCES from STREAM CHANNEL	STREAMBANK EROSION POTENTIAL
A4	Extreme	Very Poor	Very High	Very High
B1a	Very Low	Excellent	Very Low	Very Low
B2a	Very Low	Excellent	Very Low	Very Low
B3	Low	Excellent	Low	Low
B3a	Low	Excellent	Low	Low
B4	Moderate	Excellent	Moderate	Low
B4a	Moderate	Excellent	Moderate	Low
B4b	Moderate	Excellent	Moderate	Low
B4c	Moderate	Excellent	Moderate	Low
E3a	High	Good	Low	Moderate
E4	Very High	Good	Moderate	High
E4a	Very High	Good	Moderate	High
E4b	Very High	Good	Moderate	High
F3	Moderate	Poor	Very High	Very High
F3b	Moderate	Poor	Very High	Very High
F4	Extreme	Poor	Very High	Very High
F4a	Extreme	Poor	Very High	Very High
F4b	Extreme	Poor	Very High	Very High
G3	Very High	Poor	Very High	Very High

a - Includes increases in streamflow magnitude and timing and/or sediment increases.
b – Assumes natural recovery once cause of instability is corrected.
c – Includes suspended and bedload from channel derived sources and/or from stream adjacent slopes.
d – Vegetation that influences width/depth ratio-stability.

Roads in RHCAs may constrain the stream channel and reduce valley width. Consequently, the stream profile, pattern and form may adjust and find a new equilibrium to accommodate for the reduced valley width. This can result in down-cutting and/or lateral migration away from the armored roadbed. Both processes may contribute to increased sediment loading.

Furthermore, cattle grazing in RHCAs can reduce riparian vegetation which decreases root density and

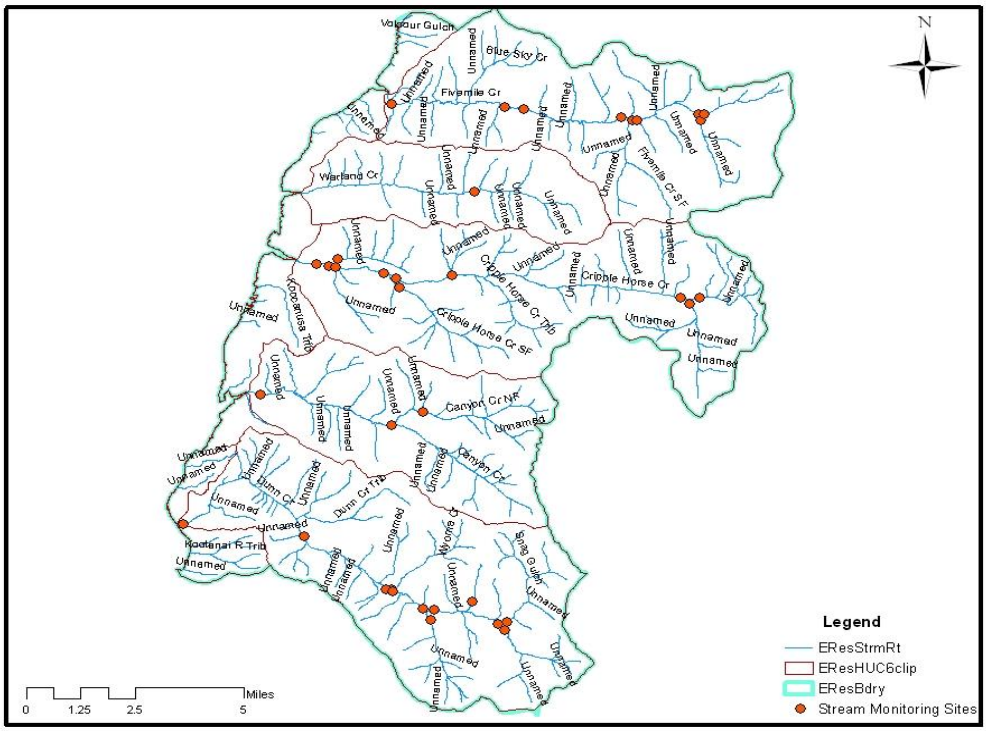
strength. The trampling of streambanks by cattle increases width/depth ratios, while at the same time weakening stream banks, and making them more susceptible to erosion (Bengeyfield 2007). In-stream sediment increases also result from the trampling of streambanks by cattle.

Moreover, the elimination of beavers from the watersheds can result in changes to the geomorphology, hydrology and riparian/wetland structure as well as vegetation. Beaver dams raise local water table elevations, divert streamflow into the subsurface, enhance surface and groundwater interaction and increase hydraulic residence time (Apple 1985; Woo and Waddington 1990; Lautz et al. 2006; Westbrooke et al. 2006). Elevated water tables cause changes in pressure heads of groundwater, which can result in greater groundwater upwelling downstream of beaver dams which may result in cooler water temperatures downstream (White 1990). Alternately shallow ponds receive more solar radiation and may reduce the influence of upwelling on downstream water temperatures (Fuller and Peckarsky 2011). Beaver dams also reduce water velocity and enable suspended sediment to settle which also supports riparian vegetation.

With regard to the changes discussed above, the implementation of RHCAs and BMPs are the best available management tools to improve stream channel conditions within the analysis area. For more detailed information on BMPs refer to the INFS.

Stream channel surveys at permanent monitoring sites in the analysis area were conducted in 2006. Stream channel surveys are conducted approximately every five years to assess geomorphic changes, either due to natural or land management actions. Stream channel condition data for Dunn Creek, Canyon Creek, Cripple Horse Creek, Warland Creek and Fivemile Creek is displayed in Tables 3.57, 3.58, 3.59, 3.60 and 3.61. Stream channel monitoring locations are displayed in Figure 5.

Figure 5 - Stream Monitoring Locations East Reservoir Analysis Area



Dunn Creek

Reaches monitored in Dunn Creek display a variety of conditions, Table 3.57. The stream types found in the Dunn Creek area range from Rosgen type A4 to F4b. The Pfankuch stream stability ratings range from 41 to 74 and indicate that the middle and upper reach conditions are either fair or good. Stream channel conditions in the lower portion of Dunn Creek are being affected by an undersized Montana Department of Transportation (MDOT) culvert on Hwy 37 and the undersized historical railroad concrete box culvert. The undersized MDOT culvert has resulted in aggradation and stream channel braiding upstream. Subsequently, the stream is no longer aligned with the culvert and water is bypassing the culvert and flowing under Hwy 37 through the large aggregate. Additionally, the MDOT culvert is perched and a large scour pool has developed at the outlet. The undersized historic railroad concrete box culvert has resulted in aggradation, stream channel braiding upstream and erosion at the edges of the structure; there is also a large scour pool at the outlet, and a large head-cut has formed further downstream. The head-cut is expected to progress upstream towards the structure and potentially undermine it, and streambank erosion is occurring upstream of the structure. The entire lower reach goes dry during the late summer and early fall and is an aquatic organism barrier at those times; the historical railroad concrete box culvert is a barrier during high and low flows; and the MDOT culvert is and aquatic organism barrier year round.

Table 3.57- Channel Conditions in Dunn Creek

SITE	YEAR	ROSGEN STREAM TYPE	BFW (FT)	ENTRENCHMENT RATIO	WIDTH/ DEPTH RATIO	SINUOSITY	SLOPE	PFANKUCH STABILITY RATING	REACH CONDITION
1	2006	B3a	14	1.8	11.4	1.12	4	74	Fair
2	2006	B4c	14.8	1.6	35.23	1.3	1.5	66	Fair
3	2006	F4b	15.5	1.22	19.8	1.07	3.3	43	Good
4 (trib)	2006	A4	6.4	1.25	9.41	1.28	5.4	46	Good
4A	2006	B4	15.6	1.82	22.29	1.19	2.7	57	Good
5	2006	B4	11.7	1.88	15.2	1.4	2.8	59	Good
6 (trib)	2006	F4b	9.3	0.89	26.57	1.19	8.3	55	Good
7	2006	B3a	8.2	1.83	15.19	1.3	4.4	41	Good
8 (trib)	2006	B4a	6	2.21	20	1.2	9.6	43	Good
9	2006	F4	8.1	1.32	17.61	1.18	0.6	74	Good
10	2006	F4b	5.3	1.28	22.1	1.01	5.2	46	Good
11 (trib)	2006	B1a	8.9	1.36	32.5	1.28	9.9	48	Fair

Canyon Creek

Reaches monitored in Canyon Creek display a variety of conditions, Table 3.58. The stream types found in the Canyon Creek area range from Rosgen type B3 to F4b. The Pfankuch stream stability ratings range from 48 to 73 and the reach conditions are either fair or good.

Table 3.58 - Channel Conditions in Canyon Creek

SITE	YEAR	ROSGEN STREAM TYPE	BFW (FT)	ENTRENCHMENT RATIO	WIDTH/ DEPTH RATIO	SINUOSITY	SLOPE	PFANKUCH STABILITY RATING	REACH CONDITION
1	2006	F4b	11.2	1.28	28.7	1.26	2.8	73	Good
2	2006	B3	10	2.01	12.65	1.46	2.3	64	Fair
3	2006	B4	9	1.77	14.5	1.5	3.4	48	Good
4	2006	F4b	9.4	1.07	33.57	1.07	4	51	Good

Cripple Horse Creek

Reaches monitored in Cripple Horse Creek display a variety of conditions, Table 3.59. The stream types found in the Cripple Horse Creek area range from Rosgen type B3 to F4b. The Pfankuch stream stability ratings range from 42 to 81 and the reach conditions are either fair or good.

Table 3.59 - Channel Conditions in Cripple Horse Creek

SITE	YEAR	ROSGEN STREAM TYPE	BFW (FT)	ENTRENCHMENT RATIO	WIDTH/ DEPTH RATIO	SINUOSITY	SLOPE	PFANKUCH STABILITY RATING	REACH CONDITION
1	2006	F4b	22.2	1.34	23.6	1.4	2.3	56	Good
2	2006	F3	18.3	1.26	23.46	1.34	2	81	Good
3	2006	B3	19.3	1.47	41.95	1.29	2.7	72	Good
3A (trib)	2006	G3	5.6	3.45	7.17	1.21	7.5	42	Good
4	2006	F2b	18.6	1.17	24.8	1.34	4	56	Good
5	2006	E4b	7.6	4.86	7.16	1.05	3	69	Good
6	2006	B3	18.3	1.57	20.56	1.39	3	58	Good
6A	2006	B3	18.1	1.19	16.16	1.07	3.3	65	Fair
7	2006	B4c	13.5	1.57	16.07	2.24	1.7	56	Good
8	2006	E4a	8.7	3.18	8.96	1.04	6.1	44	Good
9	2006	B3a	11.6	1.47	11.2	1.4	5.2	73	Fair

Warland Creek

The stream types found in the Warland Creek area are Rosgen type B4 and E4, Table 3.60. The Pfankuch stream stability ratings are 56 and 61and the reach conditions are good. The Warland Creek monitoring site is located in a grazing allotment. The site was initially fenced off in 1995 and was expanded in 1996. The 20 acre site was excluded from cattle grazing to help restore the riparian habitat and a wetland area adjacent to the stream. The stream channel conditions within the enclosure still exhibit some of the effects of cattle grazing though riparian habitat is recovering and the streambanks are slowly stabilizing. This is also illustrated in the R^2 values depicted in Figure 3. Stream channel conditions elsewhere in the watershed are unknown though also show some impacts from cattle grazing.

Table 3.60 - Channel Conditions in Warland Creek

SITE	YEAR	ROSGEN STREAM TYPE	BFW (FT)	ENTRENCHMENT RATIO	WIDTH/ DEPTH RATIO	SINUOSITY	SLOPE	PFANKUCH STABILITY RATING	REACH CONDITION
1	2007	E4	6.8	3.37	8.83	1.31	1.9	56	Good
1	2006	B4	5.5	1.89	7.74	1.33	2.4	61	Good

Fivemile Creek

Reaches monitored in Fivemile Creek display a variety of conditions, Table 3.61. The stream types found in the Fivemile Creek area range from Rosgen type B2a to F4b. The Pfankuch stream stability ratings range from 51 to 75 and the reach conditions are either fair or good.

Table 3.61 - Channel Conditions in Fivemile Creek

SITE	YEAR	ROSGEN STREAM TYPE	BFW (FT)	ENTRENCHMENT RATIO	WIDTH/ DEPTH RATIO	SINUOSITY	SLOPE	PFANKUCH STABILITY RATING	REACH CONDITION
2	2006	F4	24.3	1.14	16.3	1.07	0.5	68	Good
6	2006	F4	18	1.13	25	1.02	1.86	51	Good
7	2006	B4c	16	1.56	23.1	1.21	1.13	66	Fair
9b	2006	E4	12.2	4.48	8.59	1.04	1.4	75	Good
10	2006	B4	19	2.23	12.58	1.16	2.2	60	Good
13A	2006	B2a	14.4	1.9	12.97	1.62	9.7	51	Fair
13B	2006	E3a	8.3	2.49	7.34	1.2	8	64	Fair
13C	2006	B4a	12.3	2.6	10.92	1.68	5.6	67	Good

Water Quality

The Clean Water Act (CWA) requires states to identify waterbodies they believe are not meeting water quality guidelines and are at risk of not supporting their designated beneficial uses. These waterbodies are called Water Quality Limited Segments (WQLS). Cripple Horse Creek is listed on the 1996 303(d) list.

The listed probable impaired uses are aquatic life support and cold water fishery, the cause siltation, and the source agriculture, natural sources and silviculture. Watersheds in the analysis area do contribute surface flow to the Kootenai River which is listed as a WQLS. The Kootenai River is listed for flow alteration and thermal modifications caused by the Libby Dam. Future management actions will not affect the existing flow alteration or thermal modifications to the Kootenai River therefore it will not be discussed further.

Roads

There are approximately 121 miles of road in Dunn Creek, 14 miles in the RHCA, and 138 stream crossings; 59 miles of road in Canyon Creek, 5 miles in the RHCA, and 60 stream crossings; 95 miles of road in Cripple Horse Creek, 11 miles in the RHCA, and 89 stream crossings; 35 miles of road in Warland Creek, 3 miles in the RHCA, and 34 stream crossings; 72 miles of road in Fivemile Creek, 9 miles in the RHCA, and 65 stream crossings. The highest road impact, RRD and SCD, is observed in Dunn Creek. These high densities are partially attributable to the many other roads (Montana Department of Natural Resources and Conservation, Plum Creek Timber Company) in the watershed. While Cripple Horse Creek has moderate RRD and SCD compared to other watersheds in the analysis area, it would have a higher priority for road work as it is a WQLS. The existing watershed condition class, based on the Upper Kootenai Sub-basin Review evaluation factors, is displayed in Table 3.62. Figure 6 depicts the stream crossings in the analysis area; they were derived from intersecting the KNF existing road layer with the National Hydrologic Data layer for streams.

The condition rating indicates the potential impact of roads on water resources; decreased stream buffers, channel hydraulic changes, reduced floodplain capacity, sediment sources, reduced thermal cover, and/or decreased large woody debris recruitment. Roads located within the RHCA and road stream crossings are efficient conduits of sediment to perennial and ephemeral/intermittent streams. Overall, with regard to road densities, the watersheds in the East Reservoir analysis area have a moderate disturbance factor.

Table 3.62 - East Reservoir TRD, RRD, and SCD - 2010

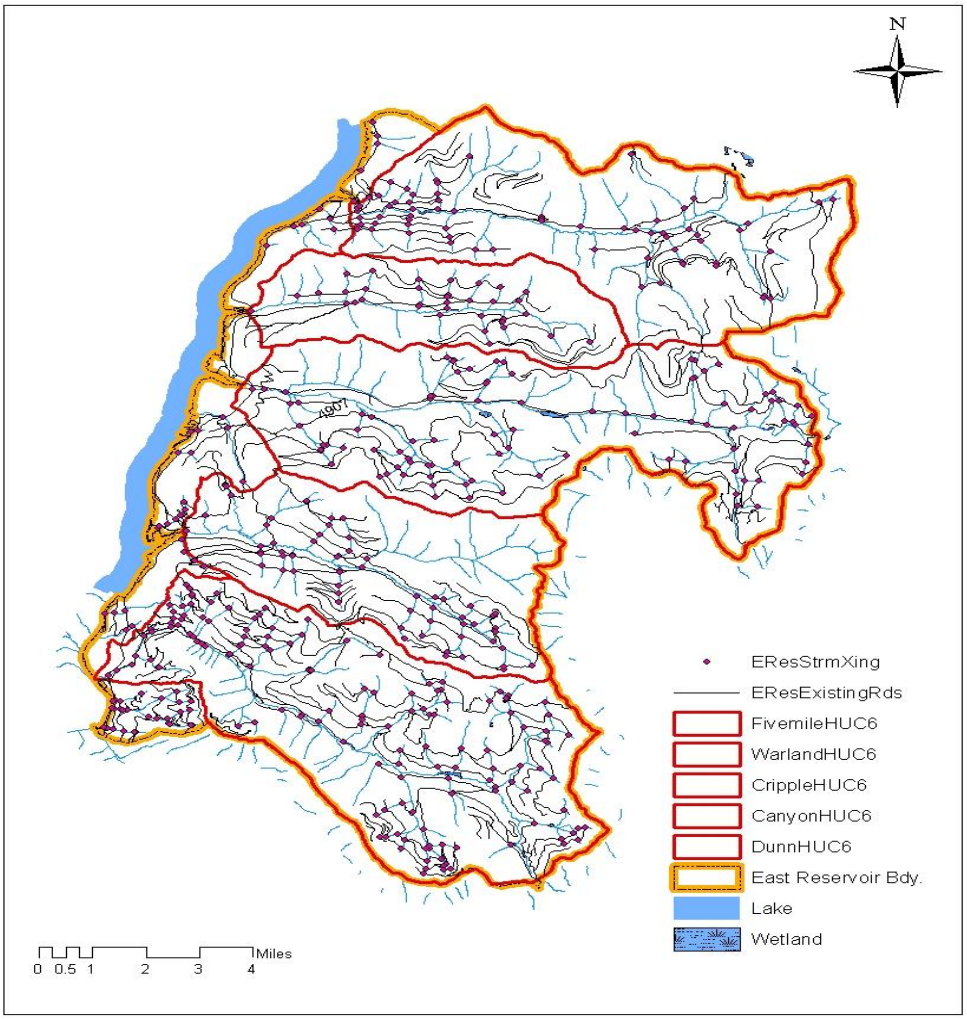
WATERSHED	ROAD miles	TRD (mi/mi^2)	DISTURBANCE FACTOR	RIPARIAN ROADS	RRD (mi/mi^2)	DISTURBANCE FACTOR	STREAM CROSSINGS	SCD ($\#/mi^2$)	DISTURBANCE FACTOR
Dunn Creek	121.2	3.6	High	13.6	3.2	High	138	4.1	High
Canyon Creek	59.1	2.9	Moderate	4.7	2.0	Moderate	60	2.9	Moderate
Cripple Horse Creek	95.2	2.8	Moderate	10.5	2.7	Moderate	89	2.6	Moderate
Warland Creek	35.3	2.7	Moderate	1.6	1.5	Moderate	34	2.6	Moderate
Fivemile Creek	71.9	2.5	Moderate	8.6	2.8	Moderate	65	2.3	Moderate

A streambank erosion and sediment loading survey was conducted in Dunn Creek during the summer 2011 to ascertain and quantify in-stream sediment sources that may impact the proposed watershed connectivity project (See Appendix J). The Bank Erosion Hazard Index (BEHI) method (Rosgen 2008) was used to evaluate streambank condition (See Appendix J). The BEHI method integrates data pertaining to bank length, average bank height, bank condition, bank materials, vegetation type and density, Near Bank Stress (NBS) and land use into a numerical rating. Cumulatively, these ratings generate a qualitative assessment of erosion severity. Current bank erosion rates for the Dunn Creek watershed were determined by calibrating said data to measured bank erosion rates from the Blackfoot River; based on similar geology and stream type.

The Dunn Creek watershed was divided into five reaches (Snag Gulch, Wyoma, Middle Dunn, Canyon and River) based on stream type and valley type characteristics. The sediment survey evaluated a total of 42 streambanks in these reaches. BEHI qualitative ratings ranged from low to extreme and sediment loss ranged from 0.13 tons/year to 169 tons/year. The streambanks contributing the majority of sediment, 32 and 33, were identified in the Canyon Reach, on non-FS land in Section 3. Cumulatively, these two

streambanks are contributing more sediment to the system (193 tons/year) than all other measured banks combined (169 tons/year). These bank occur in the reach where Dunn Creek is constricted by FS Road #334, it has degraded and migrated laterally to the south and is undercutting the toe of a large deposit of glacial outwash. The glacial outwash consists primarily of sand and silt, the sediment that results from the erosion of these soils is particularly damaging to the spawning habitat of fish (Soil Survey of Kootenai National Forest Area, Montana and Idaho, 1995). Per verbal communication with Montana Fish, Wildlife, and Parks personnel the lower section of Dunn Creek historically was a primary fish spawning site (Dunnigan and Hensler 2010). The sediment derived from these banks is being deposited upstream of the Hwy 37 culvert and is contributing to the channel braiding observed there. For the more detailed Dunn Creek Sediment Investigation Report (see the East Reservoir Project File and Appendix J for restoration recommendations).

Figure 6 - Stream Crossing Locations East Reservoir Analysis Area



Motorized Trails

There are currently approximately 37 miles of motorized trails in the East Reservoir project area (Table 3.63). Trail 279 traverses the ridgeline between Warland Creek, Fivemile Creek and Cripple Horse Creek; the trail has one stream crossing in Warland Creek. Trail 280 traverses the ridgeline between Warland Creek and Cripple Horse Creek; the trail has no stream crossings. Trail 281 traverses the divide between Cripple Horse Creek and Canyon Creek; the trail has no stream crossings. Trail 420 traverses the divide between Cripple Horse Creek and Dry Fork Creek as well as the divide between Canyon Creek and Dry

Fork Creek; the trail has one stream crossing. Trail 426 originates in the South Fork of Fivemile Creek and connects to trail 279 on the divide between Fivemile Creek and Cripple Horse Creek. Trail 500 traverses the divide between Dunn Creek and Canyon Creek; the trail has no stream crossings.

The motorized trails have minimal stream crossings and are typically located on ridge lines which are dominated by bedrock. The motorized trial locations limit the potential impacts to water resources. However, the trails were not designed for motorized traffic (see the Recreation Section), as such there is an increased potential for soil rutting, rilling and erosion as well as associated downslope impacts. It is highly unlikely that overland transport of sediment would reach the stream system. For more detailed information pertaining to landtypes that the motorized trails are located on refer to the Soils Section.

Table 3.63 - East Reservoir Motorized Trails

TRAIL ID	LOCATION	EXISTING STATUS	MILES
279	Warland Ridge	Motorized	10.7
280	Warland Peak Lookout	Motorized	2.3
281	Cripple Horse	Motorized	6.22
420	Canyon Divide	Motorized	9.83
426	Fivemile	Motorized	1.82
500	Hornet Ridge	Motorized	5.69

Riparian Areas and Wetlands

Riparian areas are a transition zone between permanently saturated wetlands and dryer upland areas. These areas exhibit vegetative or physical characteristics reflective of permanent surface or subsurface water influence (USDI Bureau of Land Management 1993). Natural, undisturbed or well-managed riparian/ wetland areas provide values and benefits far in excess of the land area they occupy (Brooks et al. 1997). Riparian areas maintain the integrity of aquatic ecosystems by (1) influencing the delivery of coarse sediment, organic matter and woody debris to streams, (2) providing root strength for channel stability, (3) shading the stream, and (4) protecting water quality (USDA Forest Service 1995). Depending on the stream channel type and volume (rate of flow), the relative magnitude of these functions can vary widely. For example, large woody debris (LWD) is often a significant component of physical channel structure in small streams that do not have enough flow to easily move LWD, but plays a significantly smaller role in large rivers where LWD is continuously moved through the system.

Riparian areas are defined based on proximity to streams and rivers. Wetlands are defined by having a water table usually near the ground surface or where the land is at least seasonally covered by shallow water. Riparian areas and wetlands are important components of the overall landscape, forming some of the most dynamic and ecologically rich areas on the landscape. No timber harvest, skid trail construction or firebreak construction would occur in the riparian areas and wetlands. The existing road system has many miles in riparian areas but no temporary roads or permanent roads would be constructed in the riparian areas. Table 3.64 depicts riparian areas and wetlands in the East Reservoir analysis area (KNF Watershed Condition Rating).

Table 3.64 - East Reservoir Riparian Areas and Wetlands

WATERSHED	STREAM (mi)	RIPARIAN (ac)	WETLAND (ac)
Dunn Creek	72	2,744	25
Canyon Creek	39	1,447	0
Cripple Horse Creek	65	2,474	44
Warland Creek	20	721	0
Fivemile Creek	50	1,958	9

ENVIRONMENTAL CONSEQUENCES

Direct and indirect effects on water resources are described below for proposed activities identified in Chapter 2. This section considers the effects of proposed management activities in addition to existing conditions, including all past activities.

MEASUREMENT INDICATORS

The measurement indicators for compliance with law, regulation, and policy are:

- Changes in stream flow- P*eak flow increases*
- Changes in stream channel condition – *Reach condition*
- Changes in water quality –*Roads, motorized trails, and stream crossings*

STREAM FLOW

ALTERNATIVE 1

Direct and Indirect Effects

Under Alternative 1, there would be no additional impacts to in-stream channel conditions as peak flows would not be increased because there would be no timber harvest, skid trail construction, prescribed fire, and fuels and wildlife treatment activities. Existing peak flows would continue to undermine the stability of eroding streambanks, in particular the large glacial lacustrine deposits in Dunn Creek. As vegetation continues to grow, the existing PFIs would decrease and hydrologic recovery would occur in past harvest units. Additionally, no activities would occur in RHCAs and there would be no prescribe fire, or fuels and wildlife treatment thus any risk of slope failure due to changes in soil properties, increased or concentrated runoff and reduced root strength. Subsequently, no direct effects to stream channel conditions. Indirectly, there is the potential for stream channel conditions to change because the potential for high-severity stand replacing wildland fires would increase due to continued vegetation growth. The wildland fire risk analysis is located in the Fire and Fuels Section of Chapter 3. Due to the unpredictable nature of wildfires, effects from this natural disturbance could not be meaningfully quantified in this document.

Under Alternative 1, no roads would be placed in intermittent stored service or decommissioned; thus there would be no direct impacts to the stream channel or streambanks from culvert removal and upgrades, re-establishing stream channels and re-contouring road segments. No management activities would occur in the RHCA thus there would be no direct effects to stream channel conditions and existing conditions would be maintained unless a large scale natural disturbance were to occur (fire, insect, disease, etc.).

Indirectly however, some of the road system and culverts in the analysis area would continue to be a sediment source to the stream systems, thus possibly impacting stream channel condition. The risk of undersized culverts failing and/or road failure; contributing sediment to the stream system, and impacting stream condition would persist. Road BMPs and culvert upgrades would occur under the normal maintenance program as funding permits. The anticipated reduction in sedimentation would occur at a slower rate than with Alternatives 2 and 3.

This alternative is expected to maintain beneficial uses at current levels because there would be no increase in PFIs or other activities that would have potential impacts to stream channel conditions.

ALTERNATIVES 2 and 3

Direct and Indirect Effects

The streams in the analysis area were determined to be in fair to good condition. Under Alternatives 2 and 3, PFIs would increase for each watershed (Table 3.65); all action alternatives are below the RPFIs of 14%. The PFIs for all action alternatives reflect as if the project were implemented in 2012; the project is anticipated to be implemented in 2014 thus there would be more ECA recovery (Table 3.52). Alternative 2 would have the highest increase in PFIs posing a higher risk to water resources. However, the differences between the alternatives are small and a 1% to 2% difference would probably not be measurable in the stream channel at the larger scale. Alternatives 2 and 3 are anticipated to maintain

beneficial uses because proposed PFIs are within the allowable range identified for streams in fair to good condition.

Table 3.65 - Changes in Peak Flow by Alternative (% PFI) for 2012

WATERSHED	ACRES	2012 PFI	RECOMMENDED PFI (%)	PFI ALT 1	PFI ALT 2	PFI ALT 3
Dunn Creek	21,666	7	14	7	10	10
Canyon Creek	13,184	7	14	7	11	11
Cripple Horse Creek	21,823	10	14	10	13	12
Warland Creek	8,520	6	14	6	12	13
Fivemile Creek	18,434	6	14	6	9	8

Roads can substantially alter hillslope hydrology by reducing soil infiltration, concentrating water through road drainage structures, and converting subsurface flow to surface flow (Luce 2002). The existing road system has extended the stream network and contributes to the PFIs in the analysis area; 1 mile of road is equivalent to 4 ECAs. All action alternatives include specific BMPs which are designed to disconnect the road system from the stream (e.g. prevent sediment from going down ditches directly into the stream). The implementation of BMPs may also diffuse the effects of roads intercepting and rerouting water. In addition, upgrading undersized culverts would enable the streams to accommodate higher flows more readily without resulting in aggradation or degradation at the inlets and outlets of culverts. The implementation of BMPs identified in the NFMA process would reduce the impact of roads on streams. Additionally, stream crossing upgrades and road decommissioning proposed under Alternatives 2 and 3 would help reduce the existing hydrologic connection between the road system and stream system as well as road contributions to PFIs.

With regard to PFIs, all action alternatives are expected to maintain beneficial uses because PFIs would be kept within the RPFI for the given stream channel conditions.

Proposed prescribed fire, and fuels and wildlife treatments can be found in Chapter 2 of the DEIS. Prescribed fire, and fuels and wildlife treatments would not result in changes to PFIs because implementation would be conducted within predetermined limits on fuel moisture, wind and other variables to minimize fire intensity subsequently reducing the potential for crown removal. The proposed burning activities would incorporate firelines, excavator and hand dug. Firelines have the potential to intercept shallow groundwater, concentrate overland flow and potentially increase PFIs. All firelines would adhere to RHCA guidelines and BMPs; in addition they would be re-vegetated following burning activities. Subsequently, no direct or indirect effects to PFIs are anticipated from prescribed burning and fuels and wildlife treatments.

STREAM CHANNEL CONDITION

ALTERNATIVE 1

Direct and Indirect Effects

Under Alternative 1, there would be no additional impacts to in-stream channel conditions as peak flows would not be increased because there would be no timber harvest, skid trail construction, prescribed fire, and forest wide fuels activities. Existing in stream sediment regimes would continue to contribute sediment; with respect to Dunn Creek the high volumes of sediment would contribute to instability in the lower reaches. As vegetation continues to grow the existing PFIs would decrease and hydrologic recovery would occur in past harvest units. Additionally, no activities would occur in RHCAs and there would be no prescribed fire, or fuels and wildlife treatments, thus any risk of slope failure due to changes in soil properties, increased or concentrated runoff, and reduced root strength. Subsequently, no direct effects to stream channel conditions. Indirectly, there is the potential for stream channel conditions to change because the potential for high-severity stand replacing wildland fires would increase due to continued vegetation growth. The wildland fire risk analysis is located in Chapter 2 of the DEIS.

Under Alternative 1, no roads would be placed in intermittent stored service thus there would be no direct or indirect impacts to the stream channel or streambanks from culvert removal and upgrades, re-establishing stream channels, and re-contouring road segments. No management activities would occur in the RHCA thus there would be no direct effects to stream channel conditions and existing conditions would be maintained unless a large scale natural disturbance were to occur (fire, insect, disease, etc.).

However, some of the road system and culverts in the analysis area would continue to be a sediment source to the stream systems thus possibly impacting stream channel condition. The risk of undersized culverts failing and/or road failure; contributing sediment to the stream system and impacting stream condition would persist. Road BMPs and culvert upgrades would occur under the normal maintenance program as funding permits. But the anticipated reduction in sedimentation would occur at a slower rate than with Alternatives 2 and 3.

This alternative is expected to maintain beneficial uses at current levels because there would be no increase in PFIs thus potential impacts to stream channel conditions.

ALTERNATIVES 2 and 3

Direct and Indirect Effects

Alternatives 2 and 3 would have a higher potential for changes, either positive or negative to stream channel conditions. The magnitude, type and frequency of channel adjustments are specific to a reach and unique to each stream channel. The spatial distribution of reach types within a drainage basin influences the distribution of potential impacts and responses to disturbance (Montgomery 1998). However, measureable geomorphic changes to the streams are not anticipated because the allowable PFI for each watershed are based on the existing stream condition (fair and good, Tables 3.57 to 3.61) and are below the PFI threshold (KNFP) in which degradation is anticipated to occur.

Additionally, no timber harvest and skid trail construction would occur in RHCAs; thus, there would be no direct effects to the stream channel condition. The establishment of RHCAs maintains a physical barrier between the stream and timber harvest and skid trail construction thus minimizing any indirect effects to stream channel condition. RHCAs are intended to provide vegetative roughness and maintain infiltration rates than can slow or absorb overland flow and filter sediment out of the overland flow before it reaches a stream or waterbody (Litshcert and MacDonald 2009). Likewise, the protection of RHCAs maintains the vegetative component that contributes to streambank stability including bankfull width, and width to depth ratios.

Under Alternatives 2 and 3, prescribed fire, and fuels and wildlife treatments are proposed. Prescribed burning, and fuels and wildlife activities would avoid direct ignition in RHCAs and would occur during the springtime or late fall when high fuel moistures would minimize fire intensity. Prescribed fire and underburning associated with fuels and wildlife activities however, may burn into to RHCAs thus reducing shrubbery, small diameter trees and other material that intercept overland flow, increase infiltration and capture sediment. A reduction in riparian vegetation may result in a short-term (generally less than 1 to 2 years) increase of sedimentation to water resources but over the long-term there is a reduction in the potential of stand replacing wildland fires which could significantly contribute sediment to the watersheds. The proposed burning activities would also incorporate firelines, excavator and hand dug. Firelines are potential sources of sediment to streams depending on location and design thus may impact stream channel conditions. Under Alternatives 2 and 3, all firelines would adhere to design criteria, BMPs and RHCAs in order to minimize direct and indirect effects to stream channel conditions. Following all prescribed fire, and fuels and wildlife treatments, firelines would be rehabilitated; drainage ditches installed and reseeded in order to reduce the potential for short-term sediment impacts which may impact stream channel condition.

Under Alternatives 2 and 3, there would be road maintenance, improvements and BMPs (Appendix D) to all haul routes (Table 3.69) and roads placed in intermittent stored service. These activities may include

installation of water bars, drivable dips, ditch relief culverts, culvert upgrades and ditch clearing. Road maintenance, improvements and BMPs may contribute short-term sediment but would help reduce long-term sediment derived from roads and ditches, disconnect roads and ditches from the stream system, and disperse overland flow captured by the road system; all of which would reduce potential impacts to stream channel conditions. Some activities particularly culvert upgrades or removal, stream re-establishment and road re-contouring, would have direct and indirect effects to the stream condition at specific locations. At sites where the culvert is upgraded, cross-veins may be installed to maintain the stream gradient and to prevent degradation of the channel upstream and downstream of the structure. Increased pipe size also allows for flood flows and debris to more freely pass through reducing the risk for impounding water at the inlet and/or accelerating through the pipe. At sites where the culvert is removed, the natural stream profile would be restored to include low flow bank, bankfull benches, floodplain (Figure 12) and in-stream features such as woody debris or rock gardens. Road re-contouring would occur at sites where the cut and fill banks are unstable and are eroding. Stabilization of these sites would re-connect surface and subsurface flow, and eliminate a sediment source that undermines stream channel condition. Although minor sedimentation is possible, the long-term (generally more than 1 to 2 years) effects of these activities would be beneficial because stream connectivity would increase, aquatic organism passage improved, and natural fluvial geomorphic function enabled such as channel adjustment, sediment transport and woody debris transport. Additionally, the potential risk of culvert or road failure would be reduced and sediment sources. Short-term sediment inputs are expected to be minimized or eliminated through the use of BMPs and adhering to INFS guidelines (USDA Forest Service 2002; USDA Forest Service 1995). For further analysis please refer to project file documents “Road/Sediment Analysis” and “Short vs. Long-term Effects” in the Water Resources Project Record.

All action alternatives are expected to maintain or improve channel conditions and beneficial uses at current levels because all PFIs are within the KNFP range, RHCA guidelines provide a buffer around streams which capture overland flow and sediment; road maintenance, improvements and BMPs would reduce sediment and disconnect roads and ditches from the stream system.

WATER QUALITY
ALTERNATIVE 1
Direct and Indirect Effects

Under Alternative 1 there would be no timber harvest, skid trail construction, prescribed fire, or fuels and wildlife treatments, thus there would be no direct effect to water quality. No sediment would be generated from timber harvest and skid trails, no vegetation in RHCAs removed from burning or sediment generated associated with vegetation removal, no chances of hazardous waste being spilt in RHCAs, and no sediment generated from fireline construction. Indirectly, continued fuel loading has the potential to increase wildland fire risk and the possibility of a crown replacing fire; consequently, there is the potential for water quality impairment (See Fire and Fuels Section for risk analysis). Alternative 1 would maintain existing beneficial uses.

Under Alternative 1, no new road construction, temporary road construction and/or subsequent decommissioning, and intermittent stored service would occur. There would be no short-term sediment increases due to road construction, culvert upgrades or development of stream crossings; likewise, there would be no long-term benefits to water quality from increased road improvements and BMP application. The road density, riparian road density and stream crossing density would remain the same. Regular district road maintenance (approximately 3 to 4 miles per year) would continue as funding becomes available. The proposed road maintenance levels associated with all action alternatives exceeds that associated with regular road maintenance.

Under Alternative 1, no motorized trails would be converted to non-motorized trails. The continued access of motorized traffic on trails not designed to accommodate said activity could result in increased rutting, rilling and erosion. However, due to trail location, minimal stream crossings, and the distance

from water resources, it is unlikely that increased erosion would contribute to water quality degradation.

This Alternative is expected to maintain beneficial uses and water quality at current levels.

ALTERNATIVES 2 and 3

Direct and Indirect Effects

Under Alternatives 2 and 3, there would be timber harvest, skid trail construction, temporary road construction, new road construction, upgrades to stream crossings, prescribed fire, and fuels and wildlife treatments which have the potential to impact water quality. Timber harvest, skid trail construction and temporary road construction expose soil to erosion, capture and concentrate overland flow and reduce infiltration. Stream crossing upgrades expose soil to erosion and result in temporary increases to turbidity from working in the stream channel. Prescribed fire requires fireline construction, a potential sediment source which can remove vegetation in RHCAs which intercept overland flow and sediment and utilize fuel to ignite fires, a contaminant. The incorporation of design criteria, BMPs and RHCA guidelines are anticipated to minimize or eliminate potential risks to water quality from the aforementioned activities. Design criteria include rehabilitation of disturbed soils, hydrologically stabilize skid trails and firelines by installing waterbars, placing woody debris to deflect overland flow and capture sediment. There would be no ignitions in RHCAs (other design criteria are listed in Appendix A). BMPs are displayed in Appendix C. As a result of these measures, no direct or indirect effects to water quality are anticipated from timber harvest, skid trail construction, prescribed burning and forest-wide fuels treatments.

Under Alternatives 2 and 3, there are roads designated for intermittent stored service and decommissioning (Table 3.66). The objective of road intermittent stored service and decommissioning would be to hydrologically stabilize the road in a manner to reduce connectivity to water resources, restore overland drainage patterns, restore groundwater flow and minimize soil erosion. All activities associated with intermittent stored service and decommissioning would adhere to BMPs identified in FSH 2509.22 (USDA FS 2010). Roads utilized as haul routes for the proposed project would have all necessary BMPs implemented prior to being placed in intermittent storage or decommissioned following use. BMP treatments on roads that are not haul routes but are identified for intermittent storage or decommissioning are contingent on future funding.

Techniques that may be implemented under intermittent stored service and decommissioning include culvert upgrades or removal, re-establish stream channels, road re-contouring on unstable fills, installation of water bars, road surface ripping, woody debris placement, seeding and fertilizing. Culvert upgrades would be sized at a minimum for a 100 year event to meet KNFP standards and/or stream simulation. All roads identified for decommissioning would at a minimum be closed to traffic and have the stream crossing culverts removed and road segments within the RHCA re-contoured.

Culvert upgrades or removal would include diversion of the stream, removal of the fill and removal of the existing culvert. There is the potential for short-term sediment increases to the stream system and decreased water quality. Re-establishing the stream channel would include reshaping the stream channel and streambanks to pass expected flows, to minimize potential for undercutting or slumping of streambanks, and maintain continuation of channel dimensions and longitudinal profile through the crossing site. Re-establishing stream channels would also result in short term in-stream sediment increases and decreased water quality but over the long-term benefit water resources. Road recontouring would occur on some road segments, particularly at stream crossings and areas with shallow groundwater. Road re-contouring, installation of water bars and road surface ripping exposes soil and may increase the risk of erosion. Depending on location and soil type these activities could potentially increase erosion and decrease water quality in the short-term but over the long-term would benefit water resources. Woody debris placement and seeding would also benefit water quality by reducing potential overland flow. Fertilizing is not anticipated to have a measureable impact on water quality because the application is small in quantity, would occur during the dry season, and the area is small.

Table 3.66 - Proposed Intermittent Stored Service and Decommissioning by Alternative

WATERSHED	ALTERNATIVE 1	ALTERNATIVE 2	ALTERNATIVE 3
Dunn Creek	0	1.46/1.9	0.89/1.3
Canyon Creek	0	1.01/1.3	101/1.1
Cripple Horse Creek	0	7.2/3.7	5.6/3.7
Warland Creek	0	5.58/2.3	5.58/2.1
Fivemile Creek	0	7.9/2.5	7.9/2.5

Under Alternatives 2 and 3, there would be new road construction and temporary road construction (Table 3.67). New system roads and temporary roads would be built to FS standards, the culverts sized at a minimum for a 100 year event and/or designed for stream simulation, and all applicable BMPs would be implemented. New system roads would remain on the landscape whereas proposed temporary roads would be used for one season, not allowed to sit over the winter after harvest completion, and then decommissioned. The overall TRD, RRD and SCD in the watersheds would be slightly increased due to new road construction but temporary roads would not impact TRD, RRD, and SCD.

The proposed construction of temporary roads would result in a short-term (generally less than 1 to 2 years) impact on water resources due to the alteration of overland drainage patterns, interception and alteration of groundwater flow, and increased soil erosion. Temporary roads would be designed to minimize the potential impacts to water resources, the road template would be short and stream crossings avoided as much as possible. In addition, the implementation of design criteria and BMPs is anticipated to minimize the impact to hydrologic recovery and the amount of sediment generated. All roads would be designed to prevent water and sediment generated by the road, particularly ditch water, from entering streams.

The KNFP and INFS recommend not constructing temporary roads in RHCAs except at stream crossings. Roads in RHCAs may contribute to the bank destabilization, concentration of overland and subsurface flow, and concentrated sedimentation near water resources. The temporary construction of new culverts would result in a short-term increase in sediment and silt; and alter stream dimension, pattern, and profile. The subsequent decommissioning of temporary roads would require suitable measures to re-establish slope contours, as well as surface and subsurface hydrologic pathways where necessary to avoid or minimize adverse effects to soil, water quality, and riparian resources (Forest Service BMP, 2010).

Table 3.67 - Proposed New and Temporary Roads, and Temporary Stream Crossings

WATERSHED	ALTERNATIVE 1	ALTERNATIVE 2	ALTERNATIVE 3
Dunn Creek	0	0.9/0.51/0	0.9/0.5/0
Canyon Creek	0	2.6/2/1	2.6/2/1
Cripple Horse Creek	0	0.4/0.95/0	0.2/0.39/0
Warland Creek	0	2.1/0.25/0	1.8/0.25/0
Fivemile Creek	0	2.3/0.51/0	1.5/0.51/0

Overall there is not a significant change in TRD, RRD and SCD under all action alternatives; the disturbance factors (Table 3.51) do not change for any of the watersheds (Table 3.68). On the ground some roads, roads in the RHCA, and stream crossings would be created and at other sites removed. The localized sediment inputs may be increased or decreased, but a measureable reduction in sediment on the watershed scale is not anticipated because the overall changes to the road network are not substantial. Table 3.68 displays the potential changes to the road system by alternative.

Table 3.68 - East Reservoir TRD, RRD, and SCD by Alternative

WATERSHED	AREA (mi^2)	ROADS (mi)	RHCA (mi^2)	ROADS RHCA (mi^2)	STREAM CROSSINGS	TRD	RRD	SCD
EXISTING CONDITION								
Dunn Creek	34	121.2	4.3	13.6	130.0	3.6	3.2	4.1

Canyon Creek	21	59.1	2.3	4.7	55.0	2.9	2	2.9
Cripple Horse Creek	34	95.2	3.9	10.5	98.0	2.8	2.7	2.6
Warland Creek	13	35.3	1.1	1.6	33.0	2.7	1.5	2.6
Fivemile Creek	29	71.9	3.1	8.6	63.0	2.5	2.8	2.3
ALTERNATIVE 2								
Dunn Creek	34	120.9	4.3	14.1	130.0	3.6	3.3	4
Canyon Creek	21	62.4	2.3	5	54.0	3	2.2	3.1
Cripple Horse Creek	34	92.5	3.9	10.2	105.0	2.7	2.6	2.6
Warland Creek	13	36	1.1	1.4	36.0	2.7	1.3	2.8
Fivemile Creek	29	75.2	3.1	8.9	65.0	2.6	2.9	2.3
ALTERNATIVE 3								
Dunn Creek	34	121.4	4.3	13.6	130.0	3.6	3.2	4
Canyon Creek	21	62.4	2.3	5	54.0	3	2.2	3.1
Cripple Horse Creek	34	92.3	3.9	10.3	105.0	2.7	2.6	2.6
Warland Creek	13	35.9	1.1	1.7	37.0	2.7	1.5	2.8
Fivemile Creek	29	73.5	3.1	8.9	63.0	2.6	2.9	2.3

All action alternatives were designed to reduce the impacts that roads have on aquatic resources by identifying and treating known sources as well as potential sources of road-derived sediment through BMP upgrades, culvert upgrades, intermittent road storage and road decommissioning. Road drainage improvements would focus on preventing water and sediment generated by the road network, particularly ditch water, from entering streams. Improvements would emphasize disconnecting storm water runoff from perennial and intermittent/ephemeral streams. The primary methods for accomplishing this are improvements to road surface and ditch drainage, surfacing, and modifying stream crossings (Furniss et al. 1991). These activities fall under the definition of road maintenance. Improvement activities contractually required under timber sales would occur prior to the commencement of harvest activities and would be inspected after harvest to ensure they still meet specifications.

Alternatives 2 and 3 include road BMP improvements on all haul routes that are contractually required under timber sales (Table 3.69). All alternatives are similar, with regard to potential BMP improvement road miles and stream crossings improved. This work is assured and the timing would be tied to the timber sales, distributed over the next 10 years. Because the timber sales would accomplish road work, contractual road improvements done with timber sales would be in a shorter timeframe compared to Alternative 1, and above and beyond what the Forest road maintenance budget could achieve in any given year. Therefore it is expected that Alternatives 2 and 3 would have a greater potential to benefit water quality in a shorter time-frame than Alternative 1 due to BMPs tied to timber sales and proposed intermittent road storage.

Research has shown that improved road design and road maintenance can reduce road-related erosion (Gucinski et al. 2001; Kennedy 1997). Road maintenance in Alternatives 2 and 3 would focus on reducing the distance water flows in ditches, reducing road surface erosion, disconnecting ditch water before entering streams and reducing the probability of stream crossing failures. Although inputs of sediment into streams are possible during maintenance operations, the long-term benefit is a reduction in routed water and sediment. Short-term sediment inputs into streams are expected to be minimized or eliminated through the use of BMPs and adhering to INFS guidelines (USDA Forest Service 2002; USDA Forest Service 1995). Road related improvements in Alternatives 2 and 3 would at least maintain, and probably improve, water quality and beneficial uses in the analysis area. Table 3.69 displays the proposed road maintenance and improvements by alternative.

Table 3.69 - Road Maintenance/Improvements by Alternative

TIMBER SALE FUNDED ACTIVITIES	ALT. 1	ALT. 2	ALT. 3
Potential Miles of Road BMP Improvements	0	176	168
Total Miles of Road in Analysis Area	561	561	561
Potential % of Roads being Improved	0	31	30

TIMBER SALE FUNDED ACTIVITIES	ALT. 1	ALT. 2	ALT. 3
Potential Stream Crossings Improved	0	232	210

*BMP improvements would only be implemented on haul roads; haul roads may change as the purchaser has the choice.

Under Alternative 2, all the motorized trails (approximately 37 miles) would be converted to non-motorized status. Under Alternative 3, approximately 27 miles of motorized trails would be converted to non-motorized status. Trail 281 would remain open to motorized traffic. Soil rutting, rilling and erosion associated with motorized use would be reduced on all the trails except Trail 28. Sediment derived from non-motorized traffic would be less than the existing condition. The conversion of motorized trails to non-motorized would probably improve, water quality and beneficial uses in the analysis area.

All action alternatives are expected to maintain beneficial uses and water quality at current levels or improve them because RHCA guidelines provide a buffer around streams which capture overland flow and sediment, BMPs minimize the amount of sediment generated from timber harvest related activities; road maintenance, improvements, and BMPs would reduce sediment and disconnect roads and ditches from the stream system; and intermittent road storage and road decommissioning would reduce the hydrologic impact roads have on the stream system.

ALTERNATIVES 1, 2 and 3

Cumulative Effects

Cumulative effects are the result of all the impacts past, current and reasonably foreseeable activities have on a resource. A summary of activities are listed in Chapter 3 of the EIS. Past activities have resulted in the "Existing Condition" described previously. The anticipated effects from proposed activities were then added to the existing condition and described in the sections titled "Direct and Indirect Effects." The sum of the existing condition and the direct and indirect effects of proposed actions in combination with current and reasonably foreseeable actions result in the cumulative effects described in this section.

The analysis area for cumulative effects with regard to water resources consists of the same watersheds identified earlier in the document. The East Reservoir watersheds are tributaries to Lake Koocanusa and the Kootenai River.

Overall, the existing condition to water resources is anticipated to be maintained or improved under all action alternatives. This is based on past monitoring of stream flow, water quality and channel stability and all laws, regulations and policies being met. Rationale for this conclusion follows.

CURRENT and REASONABLE FORESEEABLE ACTIONS

In the following discussion, the effects of past, current and/or reasonably foreseeable activities are considered cumulatively with activities proposed in this project. The effects were either described as not contributing effects, contributing indiscernible effects or having a measurable effect on water resources. Those actions that may have measureable effects were then analyzed further, by the same indicators used in the Direct and Indirect Effects Sections.

Vegetation Management and Fuels Reduction Activities

There are no current or reasonably foreseeable FS commercial timber sale projects planned within the analysis area. Therefore, no additional effects would be contributed from these activities to stream flow, stream channel condition, and/or water quality.

It is expected that there would be salvage of blown-down trees within the analysis area. Treatment acres are not expected to exceed 20 acres per year over the next 10 year. Removal of blown-down trees does not affect peak flows and therefore would not contribute additional effects to water resources. However, some short-term sediment could be generated from ground disturbance related to mechanized equipment. Such equipment is typically restricted to existing trails, roads and firelines, but there are cases where new disturbance is created. It is expected that BMPs, riparian buffers and design criteria would minimize or eliminate the risk of generated sediments reaching live streams. This assumption is supported by the KNF

BMPs (Appendix C) and the KNF BMP Monitoring Summary (Appendix D). Therefore, with regard to sediment, the salvage of blown-down trees is expected to contribute indiscernible effects to water resources.

In 2011, three Forestwide Fuels units (2001 Forestwide Fuels Reduction and Wildlife Habitat Enhancement EA) were slashed in preparation to be burned (910 acres). These units are FWF545 (Gopher Hill) which is 265 acres, FWF536 (Warland Peak) which is 195 acres and FWF52403 (Warland Peak) which is 450 acres. These units are scheduled to be underburned between 2013 and 2015. In 2010, 170 acres of FWF589 was slashed. Twenty-five of those acres are in old growth and are expected to be burned in 2013. Burning associated with post-harvest fuel treatment and wildlife improvement does not result in crown removal that would change water yields but may burn into to RHCAs thus reducing shrubbery, small diameter trees, and other materials that intercept overland flow, increase infiltration, and capture sediment. A reduction in riparian vegetation may result in a short-term increase of sedimentation to water resources but over the long-term there is a reduction in the potential of stand replacing wildland fires which could significantly contribute sediment to the watersheds. Burning activities have the potential to impact water resources but the implementation of design criteria and BMPs are anticipated to mitigate these activities and protect beneficial uses.

Approximately 760 acres of precommercial thinning has been approved and contracts have been awarded in the Cripple Horse and Canyon Creek drainages. This thinning is will be on-going over the next five years. Precommercial thinning does not result in measurable crown removals thus any significant ECAs or PFIs and there is no additional ground disturbance. All thinning projects would allow INFS direction. Ongoing and reasonably foreseeable precommercial thinning activities within the analysis area would contribute indiscernible effects to riparian vegetation and structure, peak flows, sediment delivery and water quality within the analysis area and beneficial uses would be protected.

Christmas trees/boughs can be harvested for individual use or commercially on National Forest land. Each of these activities requires a permit. These activities are both current and are reasonably foreseeable within the analysis area for the next ten years. Commercial permits include design criteria (i.e. follow INFS direction) to minimize impacts on associated species. This activity does not remove tree overstory or create additional ground disturbance and therefore would not contribute additional effects to water resources.

Cattle Grazing

The analysis area provides range for four grazing allotments including the Canyon, Cripple Horse, Warland, and Fivemile allotments. Currently, only the Fivemile allotment is actively grazed and the trends in livestock grazing numbers are stable in Fivemile Creek. The Warland allotment has had sporadic use over the years, though currently there is renewed interest to graze 22 cow calf-pairs. Both the Canyon and Cripple Horse allotments have been inactive for many years. Much of the forage in the allotments is transitory and occurs along roads and in harvest openings. Because of road construction and past harvests in the riparian areas, cattle can readily access the streams. Most of the wetlands and ponds within the analysis area are also easily accessed by cattle. Because the Fivemile allotment is active, there is a higher risk of streambank destabilization and sedimentation due to loss of vegetation cover and trampling. The potential for the Warland allotment to become active would result in a higher risk of streambank destabilization and sedimentation. The Cripple Horse Creek and Canyon Creek grazing allotments have been closed and disturbed sites in Cripple Horse Creek and Canyon Creek would continue to recover.

Current and reasonably foreseeable grazing activities within the analysis area would not contribute additional PFIs, however due to a higher risk of streambank destabilization as a result of cattle grazing; an increase in PFIs from other activities may result in increased W/D ratios. Additionally, grazing could contribute measureable effects to riparian vegetation and structure, sediment delivery and/or water quality. Currently, there is a single enclosure in Warland Creek that was installed in 1993 to protect a stream segment that was degraded due to grazing.

The cumulative effects of continued livestock grazing in Fivemile Creek in conjunction with proposed management activities may have measureable effects on water resources. Potential impacts from cattle grazing in Fivemile Creek would be mitigated by monitoring stream channel conditions, minimizing grazing in the RHCA and following the Fivemile Creek Grazing Allotment Plan (Project File). Further analysis and conclusions can be found in the Water Quality Section further on in this section of the DEIS.

Noxious Weed Treatments

The control of noxious weeds on National Forest System (NFS) land is an ongoing activity that normally occurs from late spring to early fall. Most herbicide treatments are conducted along existing roads although some treatments occur in harvest units. The 2007 Kootenai National Forest Invasive Plant Management ROD provides direction for noxious weed control on the District. Noxious weed control is expected to continue over the next ten years.

This activity is expected to contribute indiscernible effects to water resources as defined by the Kootenai National Forest Invasive Plant Management Project (USDA Forest Service 2007). Approved application methods and design criteria would be used. Water quality monitoring has shown that no chemical contamination has occurred. Although new weed infestations may occur due to ground disturbance activities, improvements in treatment chemicals and use of BMPs during timber sale and burning operations should minimize the occurrence and effects of new infestations. The level of noxious weed control within the analysis area is not expected to increase over the next ten years. Therefore, no measureable effects are anticipated.

Wildfire and Fire Suppression

One large fire has occurred recently within the analysis area. The Dry Fork Fire in 1988 burned approximately 13,000 acres, primarily in Cripple Horse Creek and Canyon Creek. The Cripple Horse Fire in 1994 burned approximately 590 acres in the Cripple Horse Creek watershed. Multiple fires of various sizes have occurred in the analysis area prior to 1988.

The probability of a large fire occurring within the next 10 years is considered low due to recent wildfire activity, improved fire detection and suppression techniques, existing transportation system, and recent vegetation management and fuel treatment. A large fire within the analysis area could have measurable effects on water resources in the future. These effects could include higher sedimentation rates and/or higher nutrient levels. However, due to the unpredictable nature of wildfires, cumulative effects from this natural disturbance could not be meaningfully quantified in this document.

Fire suppression activities would occur as needed and may include the construction of firelines, helispots and safety zones by hand or equipment. Effects from wildfire suppression would vary with location and size of the fire. Suppression activities are expected to follow KNFP direction. Retardants would be used outside of RHCAs when feasible. Suppression of small fires would contribute indiscernible effects to water resources within the analysis area. The suppression of large fires could have measurable effects to water resources. These effects could include bank destabilization and/or bank erosion. However, due to the unpredictable nature of wildfires, cumulative effects from future wildfire suppression activities could not be meaningfully quantified in this document.

Road Management

Routine road maintenance would occur as needed on the 561 miles of road in the analysis area. This is separate from any road maintenance identified in this project. Maintenance includes road blading, gate repair/replacement, cleaning ditches and culverts, installing culverts, replacing culverts with larger diameter culverts, installing drain dips and surface water deflectors, placing riprap to armor drainage structures, placement of aggregate, brushing and debris removal. Road maintenance follows BMPs identified in the Soil and Water Conservation Handbook and INFS direction. In the long-term, road maintenance reduces the risk of road failures that can contribute large quantities of sediment into live channels by disconnecting storm water flows from streams. No significant changes in road maintenance are expected over the next 10 years. Ongoing and reasonably foreseeable road maintenance activities

within the analysis area could contribute measurable effects to water resources, primarily short-term increases in sedimentation rates and a long-term benefit by reducing sediment sources, within the analysis area. Short-term increases in sediment may temporarily reduce water quality. In the long-term (generally more than 1 to 2 years) reduced sediment sources would improve water quality.

Recreation Maintenance

Routine maintenance would occur on approximately six miles of existing non-motorized trails in the project area. Maintenance of the trails may include brushing, removing blowdown, debris and hazard trees, repairing or adding waterbars, repairing treads, repairing or replacing signs, and improving vistas. Routine trail maintenance would have indiscernible effects to water resources because trails are individually small, scattered across many watersheds, primarily located on ridge tops away from water resources, and activities are not all occurring in the same year.

The Koocanusa Marina and Resort, is permitted for 70 acres in the Lake Koocanusa-Little Jackson HUC, part of the analysis area. Marina expansion is anticipated to occur within the next ten years. The expansion would encompass 3 to 4 acres, and include the addition of 33 new seasonal RV sites, construction of an access road to the sites, extension of an existing waterline, new septic drain fields and lines and a new well. Additionally, all asphalt surfaces would be chip sealed. Appropriate design criteria, RHCA boundaries and all applicable BMPs would be implemented. No measureable impacts to water resources are anticipated from the marina expansion because the area proposed to be developed is small in scale, the receiving waterbody is large is scale, there would be no increase in PFIs, the drain fields would be sufficiently setback from water resources, and project implementation would occur during the dry season.

Public Uses

Recreational use of the analysis area is expected to include hiking, camping, fishing, hunting, photography, small forest product gathering (berries, mushrooms, cones, boughs), Christmas tree cutting, firewood gathering, driving for pleasure, mountain biking, sightseeing, wildlife viewing, cross-country skiing, snowshoeing, trapping and snowmobiling. These activities are expected to continue over the next ten years. Because of the increasing number of people moving into the local communities, it is expected that some of these activity levels would increase. Recreational activities would contribute indiscernible effects to water resources within the analysis area and would protect beneficial uses. This conclusion is based on the fact that these activities are individually small and scattered across the watershed. In addition, terms of the firewood cutting permit prohibit cutting within 100 feet of a live channel. This ensures streambanks are protected, LWD is available and minimizes the potential for sediment production.

Off-highway vehicle (OHV) use was left off the list because it is currently limited only to existing trails and open roads (OHV Record of Decision and Plan Amendment for Montana, North Dakota, and Portions of South Dakota 2001). There is the potential for illegal OHV use to impact water resources, though the level of impact can vary from year to year.

The proposed Cripple Horse Small Stone Sale would occur within the next ten years. This project would involve the collection of 20 to 200 tons of stone from the talus slopes along FS Road 835 between MP 5 and MP 7.5. Design criteria and BMPs were established for this project to minimize soil disturbance, the potential for erosion and associated impacts to water resources. Criteria included no removal of vegetation in RHCAs, implementation during the dry season, and preferred rock removal was either by hand or using a crane system. This project is not anticipated to cumulatively impact water resources because there would be no increase in PFIs, and the projected is limited in scope and time.

Private Property

Private land accounts for approximately 8,986 acres in the East Reservoir analysis area, 7,604 acres belong to Plum Creek Timber Company (PCTC), primarily in the Dunn Creek watershed. The other 1,381 acres are scattered throughout the watersheds. At this time PCTC has no plans to harvest their lands.

Though continued development on other private land is expected and could include commercial timber harvest, land clearing, home construction, road construction, septic field installation, water well drilling, livestock grazing and stabilization of migrating stream banks.

The construction of roads, clearing of vegetation, construction of residences and installation of improvements during the development process can create a variety of changes to the landscape. Land development can have varied effects on the aquatic environment depending on the magnitude of the development, the type of development, and the amount of private land on the landscape. Montana State BMPs apply to some of these activities. In consideration of recent trends in land development, the activities on private land have the potential to impact water resources by increased ECAs, PFIs and sediment, but are not quantifiable due to a number of unknown attributes.

State Land

The Montana Department of Natural Resources and Conservation (DNRC) manage 4,049 acres in the East Reservoir analysis area. There are no current timber sales however, there are plans to harvest approximately 228 acres within the next ten years,198 acres in Cripple Horse Creek and 30 acres in the Lake Koocanusa-Little Jackson HUC. The timber harvest prescriptions would either be regeneration or sanitation/salvage. For the purpose of this analysis, regeneration was assumed to be 99% crown removal (99% ECA) and sanitation/salvage was assumed to be 10% crown removal (less than 1%ECA). The amount of timber harvest proposed by the DNRC would not contribute to a significant ECA or measureable increase in PFIs. Skid trail construction, 0.89 miles of road construction, ditch construction and development of a stream crossing have the potential to contribute sediment to Cripple Horse Creek. However, the DNRC is required to following MT BMPs and water quality standards. The implementation of BMPs is anticipated to minimize potential impacts to water quality. Table 3.70 displays the proposed ECA and associated PFI for timber harvest on DNRC lands.

Table 3.70 - ECA and PFI's from DNRC Lands

WATERSHED	DNRC ACRES	HARVEST ACRES	ECA	PFI
Cripple Horse Creek	335	198	196	1

STREAM FLOW

Cumulative effects water yield analysis includes ECAs from past, present, proposed and reasonably foreseeable activities on federal, state timber and private lands. Effects of timber harvest, prescribed fire, forest-wide fuels reduction and road management were incorporated into the cumulative effects analysis of peak flow through consideration of: effects from past, proposed, current and reasonably foreseeable activities and disturbances; past decisions and analyses; monitoring data; and KNFP standards and guidelines. The results of cumulative effects analysis of past, present, proposed, and reasonably foreseeable activities are displayed in Table 3.72.

The PFI numbers displayed in Table 3.72 represent the maximum PFI that would occur if all harvest, including the federal, state and private activities identified previously, took place in 2012. Realistically, the harvest on federal lands would most likely not begin until 2014, activity would be spread over the next five to ten years, and areas that contribute to the existing condition ECA levels would proceed to recover. In addition, the DNRC activities would take place in either 2013 or 2014. Under all alternatives, there would be a measureable increase in PFIs as a result of cumulative activities. Alternative 2 does not meet the KNFP RPFI as calculated for 2012, however given ECA recovery for Cripple Horse Creek is 144 acres by the time the project is anticipated to be implemented in 2014 an additional 432 acres of recovery would have occurred and RPFIs would be met. Alternative 2 would have the highest increase in PFIs of all the alternatives, posing a higher risk to water resources. The PFIs for Alternative 3 are within KNFP ranges. The differences between the alternatives are small and a 1% to 2% difference is not anticipated to be measurable in the stream channel at the larger scale. Given proposed implementation of BMPs and the protection of RHCAs beneficial uses are anticipated to be protected.

Table 3.71 - Changes in Peak Flow by Alternative (% PFI) for 2012

WATERSHED	ACRES	EXISTING PFI 2012	RPFI	ALT 1 PFI	CUM ALT 1 PFI	ALT 2 PFI	CUM ALT 2 PFI	ALT 3 PFI	CUM ALT 3 PFI
Dunn Creek	21,666	7	14	7	7	10	10	10	10
Canyon Creek	13,184	7	14	7	7	11	12	11	11
Cripple Horse Creek	21,823	10	14	10	11	13	14	12	13
Warland Creek	8,520	6	14	6	6	12	12	13	13
Fivemile Creek	18,434	6	14	6	6	9	9	8	8

The proposed Dunn Creek aquatic habitat improvement project would result in immediate changes to stream flow due to channel condition changes for the last ½ mile. This project is unfunded at the time and would require a technical stream channel design. In the interim, the MDOT culvert on Hwy 37 and the historic railroad concrete box culvert would continue to be an aquatic organism barrier; Dunn Creek would stay braided upstream and downstream of the culvert and continue to not flow perennially; water would continue to bypass the culvert and flow under Hwy 37; and the streambanks would continue to erode near the historic railroad concrete box culvert.

If implemented, the Dunn Creek aquatic habitat improvement project would not result in measureable ECAs and PFIs, as 433 ECAs are required for a 1% PFI (Table 3.52). All action alternatives are expected to maintain beneficial uses because proposed PFIs are within the RPFI for the given stream channel conditions unless a large scale natural disturbance were to occur (fire, insect, disease, etc.).

STREAM CHANNEL CONDITION

Stream channel conditions are the culmination of cumulative effects within a watershed. Stream channels are formed and maintained by physical interactions between valley slopes, riparian vegetation, stream flow regime and channel materials. Over time, stream types can be altered in their dimension, pattern and profile by various influences. These influences can affect factors such as stream flow, sediment supply and channel stability (Rosgen 1996). Activities such as timber harvest, road construction and livestock grazing are examples of such influences that can alter stream channel processes and lead to changes in channel processes.

The Rosgen Classification provides management interpretations for various stream types based on sensitivity to disturbance (including increases in stream flow magnitude, timing and/or sediment increases), recovery potential (assumes natural recovery once the cause of instability is corrected), sediment supply (including suspended and bed-load from channel derived sources and/or from adjacent slopes), stream bank erosion potential, and vegetation as a controlling influence for stability (vegetation that influences width/depth ratio). These elements suggest the manner in which channels could respond to disturbance (Table 3.56).

When analyzed cumulatively in all alternatives, the proposed construction of temporary roads in areas where roads were stored could delay hydrologic recovery at stream crossings depending on the road location and how the stream crossings and ditch relief are designed. Roads in high precipitation zones, RHCAs, and with multiple stream crossings would have a greater impact than roads located in low precipitation zones, outside of RHCAs, and with no stream crossings. Temporary road construction in RHCAs at stream crossings would also be a short-term source for sediment. The implementation of design criteria and BMPs is anticipated to minimize the impact to hydrologic recovery and the amount of sediment generated. All roads would be designed to prevent water and sediment generated by the road, particularly ditch water, from entering streams. The proposed construction of temporary roads in RHCAs is not recommended and is not supported by INFS and the KNFP. Roads in RHCAs can contribute to the destabilization of these areas with loss of riparian vegetation for LWD recruitment, pool production, thermal protection and bank stabilization; capture and concentration of overland flow as well as subsurface flow, and concentrated sedimentation and siltation near water resources.

Road maintenance, decommissioning and intermittent stored service work would occur under Alternatives 2 and 3, both with the timber sales and when funding becomes available. Where culvert removal occurs the streams would be restored to match natural channel form (width, depth, and gradient); where culvert upgrades occur the new structure would be sized for a 100 year flood event and/or stream simulation. Restoration of stream crossings would benefit stream channel function and help disconnect the road system from the stream system. Road maintenance in Alternatives 2 and 3 would focus on reducing the distance water flows in ditches, reducing road surface erosion, filtering ditch water before entering streams and reducing the probability of stream crossing failures. Stream crossing improvements would improve the ability for streams to handle stream flow and sediment that may be restricted in some cases due to undersized structures. With all road work, there would be some short-term sediment introduction from crossing restoration, but the long-term potential sediment yield from each site would decrease.

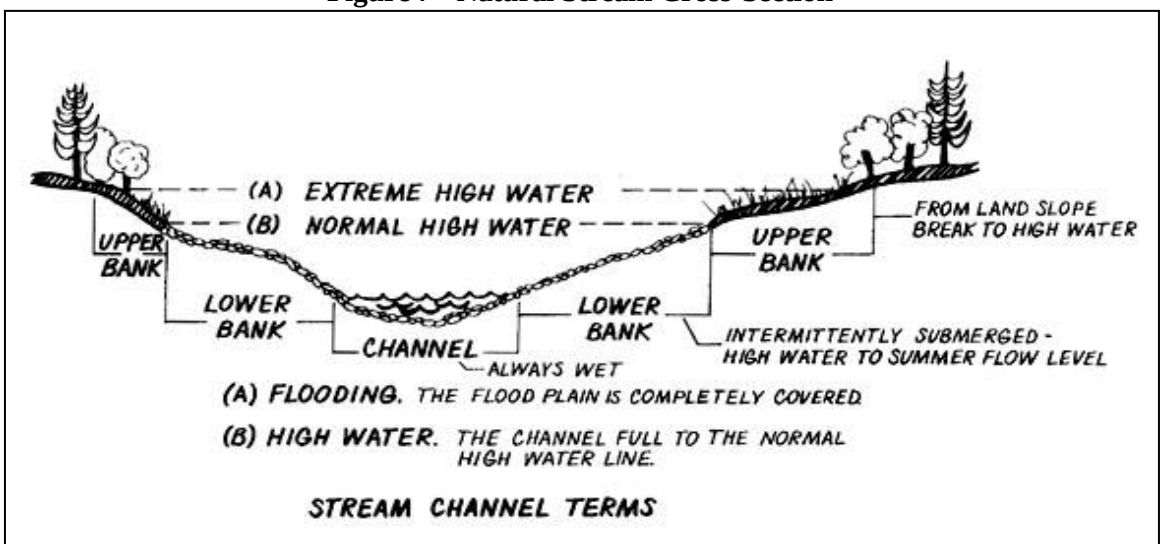
Under all action alternatives, the closure of the Cripple Horse Creek and Canyon Creek grazing allotments would eliminate the future potential for stream channel degradation by cattle. Streambank vegetation and stability would continue to improve, soil compaction would be reduced, and in-stream sediment would be reduced with intact riparian areas benefit stream channel conditions. However, the Fivemile Creek grazing allotment would be active and in conjunction with the proposed project activities there is a greater risk to stream channel condition. Potential impacts from cattle grazing in Fivemile Creek would be mitigated by monitoring stream channel conditions, minimizing grazing in the RHCA and following the Fivemile Creek Grazing Allotment Plan (Project File).

In summary, Alternatives 2 and 3 have the potential to affect stream channel processes. However, the implementation of design criteria, BMPs, RHCA standards, road maintenance and improvements, and road intermittent storage are anticipated to mitigate these potential impacts. This conclusion is based on the analysis of direct, indirect, and cumulative effects to sediment delivery, stream flow, riparian condition, and/or channel stability.

The proposed Dunn Creek aquatic habitat improvement project would result in immediate changes to stream channel conditions for the last ½ mile. This project is unfunded at the time and would require additional analysis. In the interim, the MDOT culvert on Hwy 37 and the historic railroad concrete box culvert would continue to be an aquatic organism barrier; Dunn Creek would stay braided upstream and downstream of the culvert and continue to not flow perennially; water would continue to bypass the culvert and flow under Hwy 37; and the streambanks would continue to erode near the historic railroad concrete box culvert.

Depending on the level of implementation the following would occur; approximately 0.7 miles of FS Road 334 would be re-located up on the hillside starting at approximately milepost (MP) 1.4, the existing roadbed removed and/or approximately 500 feet of stream channel would be moved away from Banks 32 and 33 (Appendix J) and wood cribbing would be installed at the base of said banks; pending private landowner consent, approximately 900 feet of braided stream channel would be relocated into a historic single channel and LWD would be placed in the channel; on COE land the historic railroad concrete box culvert would be removed and the last ½ mile of Dunn Creek would be fully reconstructed into a single channel and LWD would be placed in the channel. These activities are expected to improve aquatic habitat by stabilizing riffles and pools. The project would create a step into the large Hwy 37 culvert to remove the hydrologic barrier to fisheries passage. The proposed project(s) would result in a stream channel similar to that depicted in Figure 7.

Figure 7 - Natural Stream Cross-Section



In the long-term, implementation of the Dunn Creek aquatic habitat improvement project would benefit stream channel conditions. Relocation of FS Road 334 would permit bankfull benches and a small floodplain to be reconstructed, riparian vegetation would be re-established on the floodplain and provide bank stability, and the channel could migrate laterally. Installation of wood cribbing would prevent the stream from migrating laterally to the base of Banks 32 and 33. The wood cribbing would eliminate the largest in-stream sediment sources to Dunn Creek which subsequently may minimize aggradation downstream of the existing Hwy 37 culvert. The relocation of approximately 900 feet of Dunn Creek into the historic single channel would facilitate sediment transport, improve aquatic habitat, and may improve stream flow during the dry season. Removal of the concrete box culvert would eliminate aggradation upstream and degradation downstream, stream constriction and lateral upstream migration.

Reconstruction of a single stream channel would facilitate sediment transport, improve aquatic habitat, re-establish a floodplain, and may improve stream flow during the dry season. Removing the hydraulic drop at the Hwy 37 culvert would reduce velocities through the culvert and reduce scouring/degradation below the structure. Reducing velocities would reduce bank stress, channel migration and braiding.

WATER QUALITY

Cumulative effects to water quality analysis include ECAs from past, present, proposed and reasonably foreseeable activities on federal, state timber and private lands. Effects of timber harvest and road management were incorporated into the cumulative effects analysis of water quality through consideration of: effects from past, proposed, current and reasonably foreseeable activities and disturbances; past decisions and analyses; monitoring data; and KNFP standards and guidelines. The findings of this assessment conclude that timber harvest related activities, prescribed fire, and fuels and wildlife treatments within the analysis area would cumulatively contribute indiscernible effects to sediment delivery because of proposed design criteria, effective BMP implementation (Appendix C) and RHCA standards. Road related activities would cause some short-term increases in sedimentation but an overall reduction in long-term sedimentation because the roads would be disconnected from the stream system. Streambank destabilization would continue to contribute sediment to the stream system. The Dunn Creek aquatic habitat improvement project would contribute discernible short-term impacts to water quality but over the long-term reduce sedimentation and improve stream function. Therefore, overall water quality within the analysis area would be maintained and may be improved.

Under Alternatives 2 and 3, timber harvest related activities, prescribed fire, and fuels and wildlife treatments have the potential to create soil disturbance and increase overland flow, resulting in soil erosion and sediment delivery to streams. This is primarily due to soil compaction and disturbance

associated with skid trails and landings. Studies of erosion and sediment transport in harvest units have shown that application of BMPs, including installing skid trail drainage and designating riparian buffers, results in sediment retention within the harvest unit and riparian buffer (Croke et al. 1999; Wallbrink and Croke 2002; Litschert and MacDonald 2009) and adequately protect streams from sediment introduction. Additional research has shown that the level of sediment production resulting from timber harvest is dependent on the level of planning and attention to site-specific conditions (Chamberlin et al. 1991). All proposed harvest and fuels treatment activities would be conducted with strict adherence to applicable BMPs (Appendix C). KNF monitoring has shown that BMPs have been properly implemented 97% of the time and have been 95% effective in reducing and/or eliminating sedimentation (Appendix D). A list of BMPs, specific to this project, can be found in Appendix C. These measures, combined with specified design criteria (Appendix A), adherence to INFS Standards and Guidelines for RHCAs (USDA Forest Service 1995), and the Water Resources Monitoring Plan (Appendix I) are expected to prevent negative impacts to water quality and beneficial uses. The proposed timber harvest activities are not expected to measurably affect sedimentation levels in streams through the use of design criteria, RHCA buffers, and BMPs.

Studies have shown that roads are often the highest contributors of non-point source sediment in forested areas (Brooks et al. 1997; Luce and Wemple 2001; Reid and Dunne 1984; Waters 1995), and impact aquatic habitat (Furniss et al. 1991; Schnackenberg and MacDonald 1998). A study on the KNF found that fine sediment in channels correlated with road density (MacDonald et al. 1997). Roads can affect streams directly by accelerating erosion and sedimentation, altering channel morphology, and/or changing the runoff characteristics of the watershed (Furniss et al. 1991; Gucinski et al. 2001); roads can also intercept groundwater and convert it to surface flow. Water flowing on roads often picks up and carries sediment that is more readily available on non-vegetated native road surfaces. Sediment laden water can be delivered directly into the stream channel where roads cross streams. Additionally, ditch relief culverts in riparian areas can also deliver water and sediment if they carry enough water to scour a channel that eventually connects to a stream. Improperly drained and/or located roads can accelerate erosion rates and increase sedimentation in streams. The frequency and amount of sediment delivery to streams is highly variable and is largely influenced by road segment length, slope and location within the watershed (Luce and Black 1999; King and Tennyson 1984; Reid and Dunne 1984; Schnackenberg and MacDonald, 1998).

The effects of roads on stream systems can be minimized once the interactions of water, soil, vegetation, and topography are understood. A single road surface gully that forms can contribute large amounts of road-derived sediment to a stream channel. Predicting the probability of these types of failures is difficult. Reducing the likelihood or risk of these occurrences through road maintenance and application of BMP standards protects both the roads and the stream systems.

Under all action alternatives, the closure of the Cripple Horse Creek and Canyon Creek grazing allotments would eliminate the future potential for water quality degradation by cattle. Streambank vegetation and stability would continue to improve, soil compaction would be reduced, and in-stream sediment would be reduced; intact riparian areas benefit water quality. However, the Fivemile Creek grazing allotment would be active and in conjunction with the proposed project activities there is a greater risk to water quality. Potential impacts from cattle grazing in Fivemile Creek and Warland Creek would be mitigated by monitoring stream channel conditions, minimizing grazing in the RHCA, and following the Fivemile Creek Grazing Allotment Plan (Project File). If the Warland Creek Grazing Allotment becomes active, a Warland Creek Grazing Allotment Plan would be drawn up to be least impactive.

Mass soil movement associated with roads is rare in the analysis area, but could occur due to culvert failure. There are approximately 517 miles of existing road within the analysis area. Alternatives 2 and 3 propose approximately 9 and 8 miles of new road construction, respectively; 4 miles of temporary road construction; 16 and 18 miles of intermittent stored service, respectively; and 6 miles of road decommissioning. Additionally, the action alternatives propose approximately 176 and 168 miles of haul

routes, respectively. In order to reduce the likelihood of road failure and minimize sediment sources, all new roads, temporary roads and haul routes would have appropriate BMPs applied.

Cumulatively, there is the potential for measurable short-term negative effects and long-term positive effects to water quality (Wegner 1999; Hickenbottom 2001). Over ten years of monitoring has shown that similar levels of activity have maintained or improved conditions within the watersheds (refer to Existing Condition). All alternatives are anticipated to maintain or improve existing conditions to water resources.

The proposed Dunn Creek aquatic habitat improvement project would result in short-term impacts but long-term benefits to water quality for the last ½ mile. This project is unfunded at the time and would require additional analysis. In the interim, the MDOT culvert on Hwy 37 and the historic railroad concrete box culvert would continue to be an aquatic organism barrier; Dunn Creek would stay braided upstream and downstream of the culvert and continue to not flow perennially; water would continue to bypass the culvert and flow under Hwy 37; and the streambanks would continue to erode near the historic railroad concrete box culvert.

Implementation of the proposed Dunn Creek aquatic habitat improvement project(s) would have short-term impacts but long-term benefits to water quality. This project is unfunded at the time and would require additional analysis. Depending on the level of implementation, the following would occur; the relocation of FS Road 334 would result in sediment being temporarily deposited in the stream channel during project implementation but long-term sediment from the road surface would be reduced; and/or the installation of wood cribbing at the base of Banks 32 and 33 would result in sediment temporarily being deposited in the stream channel but over the long term significantly reduced. The relocation of Dunn Creek into the historic channel above the Hwy 37 culvert would result in a short-term sediment increase but an increase in stream capacity. Removal of the historic railroad concrete box culvert and complete channel reconstruction would result in short-term sediment increases due to newly excavated streambanks and streambed; over the long-term sediment would be reduced due to stabilization of banks and elimination of multiple channels.

The sediment increases are not anticipated to have a measureable impact on Dunn Creek compared to the current levels of sediment entering the stream. The project(s) are located in the lower most section of the watershed and travel distance is short. The project(s) duration would be short and occur during the low flow season to minimize the sediment transport. Sediment discharged to the Kootenai River system is not anticipated to have a measureable impact on water quality given the size of the receiving water and the short duration of the project(s). Additionally, project(s) design criteria such as timing restrictions and low flow restrictions would minimize the amount of sediment associated with implementation. Overall the Dunn Creek aquatic habitat improvement project(s) is anticipated to enhance stream function in the lower ½ mile.

CONSISTENCY with REGULATORY FRAMEWORK

COMPLIANCE with the CWA – PROTECTION of BENEFICIAL USES

The Clean Water Act (CWA) established federal water quality policies, goals and programs. The objective of the CWA is to "restore and maintain the chemical, physical, and biological integrity of the nations' waters." The Environmental Protection Agency (EPA) and the State of Montana have the responsibility to implement the intent of the CWA. States are required to establish water quality standards that allow for the protection of beneficial uses. Any action within a given watershed should maintain or improve stream conditions within that watershed. ***All alternatives comply with the CWA. Each alternative is expected to maintain and potentially improve stream conditions in the analysis area. This expectation is based on: surveys of existing watershed conditions; the conclusion of the Water Yield analysis that PFIs would not exceed recommended levels; the designation of RHCAs, the application of BMPs to all proposed road work, timber harvest and underburning activities; evidence from Forest monitoring results and the literature regarding the effectiveness of BMPs; and the conclusion that the***

effects of BMP improvements to roads would reduce existing water and sediment contributions from the road network.

The CWA requires states to identify waterbodies that do not fully support all their designated beneficial uses. These impaired waterbodies are called Water Quality Limited Segments (WQLS). ***Cripple Horse Creek is a WQLS stream. Implementation of the proposed activities, including the design criteria and BMPs specified in the DEIS and Soil and Water Project File, would at least maintain beneficial use conditions and may improve them.***

In a Memorandum of Understanding (MOU) between the FS and the State of Montana, the FS has been designated as the management agency responsible for water quality protection on NFS lands. In the MOU, the FS has agreed to follow State Water Quality Standards established under the Montana Water Quality Act, primarily through implementation of BMPs. These are designed to ensure that water quality and beneficial uses are protected both during and after implementation of land management activities. ***The EIS and Soil and Water Project File outline the BMPs designated for each potential activity. These measures are fully expected to minimize soil disturbance and erosion. The 2011 KNF Monitoring Summary (USDA Forest Service 2011) states that monitoring between 1991 and 2011 shows that 95% of the BMPs implemented during that time were effective. Road drainage improvements are designed to disconnect storm water flow from the stream network. The improvements are expected to reduce chronic sediment delivery in the long-term, which is anticipated to improve aquatic habitat conditions in Dunn Creek, Canyon Creek, Cripple Horse Creek, Warland Creek and Fivemile Creek. Based on Wegner (1999), a measurable decrease in percent fine sediment in pool tails is expected. The monitoring plan for this analysis area is in Appendix I.***

Compliance with Protection of Riparian Areas and Wetlands
Section 404 of the CWA authorizes the Secretary of the Army to issue permits for the discharge of dredged or fill material into wetlands (33 CFR 323). Silviculture activities are exempt from the 404 permit process, as are associated road construction and maintenance that adhere to BMPs (33 CFR 323.4a). ***Silviculture treatment and roadwork near wetlands would be done in accordance with the KNF Riparian Guidelines, as amended by the Montana SMZ Law and INFS.***

The Riparian Area Guidelines in Appendix 26 of the KNFP (USDA Forest Service 1987b), as amended by the Montana Streamside Management Zone (SMZ) Law and INFS (USDA Forest Service 1995), provide standards and guidelines for activities in riparian areas and wetlands. ***These regulations would be strictly followed during sale design and layout and any other action resulting from the decision.***

Forest Plan Consistency
All alternatives are consistent with the KNFP direction for maintaining water quality and protecting wetland and riparian areas. Implementation of any alternative would at least maintain, and action alternatives over the long-term would likely improve, the support of beneficial uses. For additional information with regard to KNFP Monitoring refer to the following website:
http:www.fs.fed.us/r1/Kootenai/publications and look for Forest Plan Monitoring Reports.

FIRE and FUELS MANAGEMENT INTRODUCTION

The fuels in the East Reservoir analysis area, like any forested environment, are dynamic and change over time. These changes occur slowly over the course of many years unless a major disturbance event occurs. Expected fire behavior changes as stands age and succession leads to changes in structure, function, species composition and fuel loading. Tree mortality caused by any number of natural and human caused events can lead to increases in standing and down woody debris; thereby, increasing surface fuel loads. Ingrowth of new trees and other vegetation can affect the abundance of ladder and crown fuels over time. This report describes the regulatory framework of fire and fuels management and the affected environment as it relates to expected fire behavior under existing conditions and post-treatment conditions by alternative.

REGULATORY FRAMEWORK

National Fire Plan

The National Fire Plan (USDI and USDA 2000) provides the national direction for hazardous fuels reduction, restoration, rehabilitation, monitoring, applied research and technology transfer. It also established the framework for a 10-Year Comprehensive Strategy (USDI and USDA 2001). Four priority goals were established from the 10-Year Comprehensive Strategy which includes:

- Improve Prevention and Suppression;
- Reduce Hazardous Fuels;
- Restore Fire Adapted Ecosystems;
- Promote Community Assistance.

Federal Policy

Federal wildland fire policy is guided and directed by the Federal Wildland Fire Management Policy (1995 and revised in 2001). Applicable guiding principles include:

- Firefighter and public safety is the first priority in every fire management activity.
- The role of wildland fire as an essential ecological process and natural change agent will be incorporated into the planning process.
- Sound risk management is a foundation for all fire management activities.
- Fire Management Plans and activities incorporate public health and environmental quality considerations.

The Federal Wildland Fire Management Policy clearly states that wildland fire analysis will carefully consider the long-term benefits in relation to risks both in the short- and long-term:

> "Fire, as a critical natural process, will be integrated into land and resource management plans and activities on a landscape scale, and across agency boundaries. Response to wildland fire is based on ecological, social, and legal consequences of fire. The circumstances under which a fire occurs, and the likely consequences on firefighter and public safety and welfare, natural and cultural resources, and values to be protected dictate the appropriate management response to fire."

The Healthy Forest Restoration Act

The Healthy Forest Restoration Act (2003) directs agency personnel to reduce hazardous fuels in the wildland urban interface (WUI) and municipal watersheds and restoring fire adapted vegetation communities.

Kootenai National Forest Plan

The Kootenai National Forest Plan (KNFP) provides the overall direction of management activities on the Forest. Specific goals in the KNFP in relation to fire management are to use prescribed fire to emulate natural ecological processes, prevent excessive natural and activity fuel buildup, create habitat diversity for wildlife, reduce suppression costs and maintain ecosystems (page II-2). Objectives identified in the

KNFP state that the fire protection program will seek to minimize the number of acres lost to damaging wildfire and to provide for the safety of the public and personnel engaged in fire protection activities. The fuels management program intends to treat both activity fuels and natural vegetation to the degree needed to facilitate implementation of the fire protection program and other dependent activities of the KNFP (page II-11).

The analysis area contains Management Areas (MAs) 2, 3, 5, 6, 10, 11, 12, 13, 15, 16, 17, 18, 19, 24 and private land. KNFP direction, in regards to fire suppression strategy for the MAs in the project boundary, is for unplanned ignitions during critical fire season to normally be controlled. Critical fire season is defined in the KNFP when the Energy Release Component (ERC) exceeds 39 for the past four days and the Burning Index (BI) is 30 or greater, or the 1,000 hour time lag fuel moisture is below 16% (page VI-7). Only MAs 2 and 3 in the analysis area allow for a contain or confine strategy during the critical fire season but they are not large enough areas to be considered by decision makers. During the non-critical fire season, a contain and/or confine strategy may be used in the above MAs if an analysis of the time of year and expected fire behavior disclose no effect to the area or adjacent MAs, and it is more cost effective to do so.

Energy Release Component – A number related to the available energy (BTU) per unit area (ft^2) of the flaming front at the head of a fire. It evaluates the contribution of various fuel loadings represented mathematically in the National Fire Danger Rating fuel models. It is a good indicator of seasonal trends because it does not change dramatically from day to day unless precipitation is received (which affects fuel moistures).

Burning Index – An estimate of the potential difficulty of fire containment as it relates to the potential flame length at the head of a fire. Doubling the burning index indicates that twice the effort will be required to contain a fire in that fuel type as was previously required, providing all other parameters are held constant. BI is widely used to help determine staffing levels for initial attack resources.

All MAs in the analysis area except for MAs 13 and 24 encourage the use of prescribed fire (planned ignitions) as the primary tool for fuels management and/or to maintain or enhance wildlife habitat. The purpose of prescribed fire in MA 13, as identified in the KNFP, is to maintain old growth characteristics. MA 24, low productivity areas, does not usually allow the use of prescribed fire.

ANALYSIS AREA

The East Reservoir analysis area lies within the Koocanusa Physiographic Area. The East Reservoir analysis area is approximately 92,400 acres. National Forest System (NFS) lands consist of 78,546 acres, 4,032 acres are State of Montana Department of Natural Resource and Conservation (DNRC) lands, 7,672 acres are owned by Plum Creek Timber Company (PCTC), 802 acres are Corp of Engineer (COE) lands and 1,355 acres are in private ownership. The East Reservoir analysis area consists of five major drainages: Fivemile Creek (northern most), Warland Creek, Cripple Horse Creek, Canyon Creek and Dunn Creek (southern-most).

ANALYSIS METHODS

Vegetative Response Units (VRUs) as described in detail in the Vegetation Section of this document were used to describe existing vegetation characteristics and their relationship to disturbances and fire regimes, which help determine the desired future conditions of a given landscape. VRUs are more appropriate to use in a fire and fuels analysis than MAs because they are more tied to vegetation and disturbance processes.

Fire history for the East Reservoir analysis area was derived from records maintained in the GIS library. Records in the GIS library were derived from the Kootenai Fire History Atlas and fire records maintained at the national database in Kansas City.

Fire behavior modeling was accomplished with FlamMap (version 3.0) for the pretreatment landscape and

BehavePlus (version 5.0.5) for unit specific post treatment comparisons. FlamMap is a fire behavior mapping and analysis program that computes potential fire behavior characteristics (spread rate, flame length, crown fire activity, etc.) over an entire landscape for constant weather and fuel moisture conditions. It is designed to examine the spatial variability in fire behavior assuming that fuel moisture, wind speed and wind direction are held constant. This allows for a more direct comparison of different fuel treatments and their effects on fire behavior and fire movement (Stratton 2004). It does incorporate spatial variability in fuels and topography. FlamMap is more useful in determining how a fire might burn across a landscape rather than giving a fire perimeter or final fire size (Scott 2006). It does not simulate the effects of ember transport and spotting on overall fire growth (Scott 2006). Some literature states that FlamMap is known for under-predicting active crown fire as compared to other models and observed conditions (Stratton 2004, Scott 2006). This is mostly due to a poor understanding of crown fire modeling which is an area of research that is in its infancy (Stratton 2006).

FlamMap incorporates the following fire behavior models that have been scientifically validated and used by fire managers for many years (www.firemodels.org):

- Rothermel's 1972 surface fire model
- Van Wagner's 1977 crown fire initiation model
- Rothermel's 1991 crown fire spread model
- Nelson's 2000 dead fuel moisture model

The BehavePlus fire modeling system is a computer program that is based on mathematical models that describe wildland fire and the fire environment. It incorporates over 40 models and is best described by Heinsch and Andrews (2010). BehavePlus has been in use in various versions for fire management application that involves modeling fire behavior and effects, projecting the behavior of an ongoing fire, planning prescribed fire, assessing fuel hazard, and training (Andrews 2007). It was used in this analysis to model post-treatment fire behavior characteristics at the stand level.

20-ft Wind- is the wind measured 20 feet above the average top of the dominant vegetation. It is usually a combination of general and local winds.

Mid-flame Wind- the wind measured at ½ of the flame height. It is almost always lighter than the 20-ft wind speed.
All wind directions are the direction the wind is coming from.

A 20 mph 20-ft wind blowing upslope was used for both models. This equates to a mid-flame wind speed of 2-12 mph depending on stand height and stand density (affects sheltering from the wind). Since wind is extremely variable it cannot be accurately forecasted across the entire analysis area; thus, it is more important that a constant 20-ft wind speed be used for equal comparison of pre and post-treatment fire behavior.

Fuel moistures were developed for each fuel model. In general, low fuel moistures were used to represent drought summer conditions: 1 hour = 3-6 percent, 10-hour = 4-6 percent, 100-hour = 7-10 percent, Live Herbaceous = 60-90 percent, Live Woody 90-120 percent. The live fuel moisture content represents fuels that are 1/3rd to 2/3rd cured. This is very typical of live fuel moisture conditions within the analysis area in August for native species. Generally, lower fuel moistures were used for more open stands and higher fuel moistures were used for denser, moist site stands.

Dead Fuel Size Classes
1-hour fuels: 0 to ¼ inch diameter
10-hour fuels: ¼ to 1 inch diameter
100-hour fuels: 1 to 3 inches diameter
1000-hour fuels: 3 to 8 inches diameter

1-hr and 10-hr fuels are the primary carrier of most fires and the biggest concern for fire spread. 100-hr and 1000-hr fuels are good indicators of drought and add significantly to fire intensity, severity, and resistance to control.

AFFECTED ENVIRONMENT

Fire History

There have been approximately 285 fires recorded in the East Reservoir analysis area since the early 1900s. Most of the fires have been caused by lightning but a significant portion of the fires occurring from early 1900s until about 1930 were human-caused due to active timber harvesting, homesteading and poor fire prevention controls. After the 1930s, human-caused fires account for less than 20% of the fires in the analysis area.

Over 22 large fires have been documented in the analysis area. In general, the large fires ranged in size from 50-1,000 acres and occurred primarily on the south, southeast and southwest aspects. The first large fire on record occurred during 1872 and burned a significant portion along the eastern boundary of the analysis area (1872 was a significant fire year for the Northern Rockies). Large fire activity remained high from 1910 thru the 1920s, with 15 of the 22 large fires occurring during this period. The next documented fire to burn any significant amount of acres was the Dry Fork Fire of 1988 (approx. 15,000 acres). The most recent large fires to occur in the analysis area were the 1994 S.F. of Cripple Horse Creek (approx. 600 acres) and the Warland Fire of 2000 (approx. 50 acres).

Historic Versus Present Fire Regimes

The East Reservoir analysis area would have historically exhibited low, mixed and stand-replacing fire severities across the landscape. Table 3.72 uses Vegetation Response Units (VRU), as described in detail in the Vegetation Section, to classify historical fire regimes and the potential number of fire cycles missed. Missed fire cycles are largely attributed to fire suppression. Other causes include logging, grazing and land conversion to agriculture or housing developments.

Table 3.72 - Historical Fire Regimes, Potential Missed Return Intervals by VRU

VRU (% of AREA)	HISTORICAL FIRE REGIME* by ASPECT	POTENTIAL MISSED RETURN INTERVALS
1 (1%)	All- I	1-10
2 (23%	South - I	1-6
	North - III	1-6
3 (22%)	South - III	1-3
	North, valley bottoms - IV	0-2
4 (10%)	South- III	1-2
	North, valley bottoms - IV	0-1
5 (1%)	South- IV	0-2
	North, valley bottoms - V	None likely
7 (29%) and 9 (13%)	South- III	0-2
	North - IV	0-1
	Valley bottoms and rounded ridge tops - V	None likely

*Fire Regime I- return intervals of 0-35 years, low severity
Fire Regime III- return intervals of 35-100+ years, mixed severity
Fire Regime IV- return intervals of 35-100+ years, stand replacement severity
Fire Regime V- return intervals of 200+ years, stand replacement severity

The greatest departure from historical conditions is occurring mostly in VRUs 1, 2, 3 and to a lesser extent in VRU 4S, due to the number of missed fire return intervals due to suppression. According to Peterson et al. (2005), deviation from historical fire regimes caused by fire suppression has been most impactive to drier forests dominated by ponderosa pine and Douglas-fir. In these forest types, fires of low to mixed severity would have controlled regeneration of shade-tolerant tree species (Arno and Allison-Bunnell 2002) and promoted fire-tolerant species such as ponderosa pine, western larch and larger diameter Douglas-fir. Today, these dry forest types in the analysis area have an accumulation of understory fuels and vegetation, increased ladder fuels, fewer large trees and an increased potential for crown fires (Agee 1993, Arno and Brown 1991). This increased potential for surface fires to develop into

crown fires is because the understory ladder fuels lower the effective canopy base height and the overstory trees are denser, allowing for crown fire initiation and spread. Scott and Reinhardt (2001) define canopy base height as the lowest height above ground at which there is significant canopy fuel to propagate fire vertically through the canopy. Put more simply, it means having enough ladder fuels to allow a surface fire to transition into a crown fire.

Crown fires are considered the main threat to ecological and human environment values and they are one of the biggest challenges of fire management (Graham et al. 2004). Fire managers recognize three different types of crown fires. ***Passive crown fires*** kill individual trees or small groups of trees. Passive crown fires are often referred to as "torching." ***Active crown fires*** are continuous. They burn the entire tree canopy but they are dependent on heat from surface fires for continued spread. ***Independent crown fires*** also burn the entire tree canopy but they are independent of surface fires. Independent crown fires, which are rare, only occur in the most extreme situations and are poorly understood. Passive and active crown fires are the main concern for the analysis area because of the current conditions of the stands proposed for treatments (dense, high coarse fuel loads, lots of ladder fuels).

Fuel Condition

The material referred to as "fuels" are those portions of plants that are available to be consumed by fire. This includes both live and dead material. The amount and size of fuels that contribute to fire spread and intensity vary by time of year and weather conditions. During late summer, when many plants have finished their seasonal growth and the lack of precipitation (perhaps as a result of extended drought) combined with hot weather, much of the live and dead fuel is available for consumption by fire.

Conversely, during the spring when most plants are growing vigorously and moisture is abundant, available fuels are limited to the most flammable dead fuels on the driest sites. During the fall season the increase in rainfall as well as the change to shorter days and cooler weather limits the availability of fuels. Across these seasonal changes in fuel availability there is a range of possible outcomes should a fire occur. While it is not possible to predict when a fire will occur it is true that most lightning fires do occur during July and August. Fire season is usually halted by an episode of rainy weather that traditionally occurs between the third week of August and the third week of September. The exceptional years when this rain does not occur will see the fire season extending perhaps as late as mid-October.

Fuel models are used by fire specialists to predict fire behavior and characterize the amount of fuels available to burn during a surface fire. A fuel model is chosen by the primary carrier of the fire (e.g. grass, brush, timber litter, slash) and its fuel characteristics (e.g. fuel loading, surface area to volume ratio, fuel depth, etc.). In some cases a fuel model is chosen because it accurately reflects the expected fire behavior even though it does not fit the visible description of the stand or area. Fuel models are simple tools to help fire managers realistically estimate fire behavior.

Rothermel (1983) has a detailed discussion on fuel models and how they are used to predict the spread and intensity of forest and range fires.

Fuel models, canopy base heights, canopy bulk densities, crown cover and stand heights for the East Reservoir analysis area were developed from LANDFIRE (see box to the right) and then verified with ground reconnaissance and/or aerial photos and adjusted if needed. The fuel models contained within the project boundary are described below by Scott and Burgan (2005). Since the fuel models within the project boundary are numerous, this report will briefly describe the most common fuel models

LANDFIRE (Landscape Fire and Resource Management Planning Tools Project) is an interagency vegetation, fire, and fuel characteristics mapping project. It is a shared project between the Dept. of Interior and Forest Service wildland fire management programs. LANDFIRE is producing a comprehensive, consistent, scientifically credible suite of spatial data layers for the entire United States and covers all land ownership.
For more information on LANDFIRE visit http://www.landfire.gov/index.php

currently existing in the analysis area. A detailed map of all the fuel models across the analysis area is contained within the project file.

Fuel Model GR2 (102 Low load, dry climate grass): Primary carrier of fire is grass, small amounts of fine dead fuel may be present. This is the primary fuel model on open, south aspects where overstory vegetation is sparse.

Fuel Model GS2 (122 Moderate load, dry climate grass-shrub): The primary carrier of fire is grass and shrubs combined. Shrubs are 1 to 3 feet high and grass load is moderate. This fuel model can also represent a younger regeneration stand that has had past fuel treatment and a grass understory. This is the most abundant fuel model in the analysis area because it does represent grass-shrub lands and most of the past regeneration harvest.

Fuel Model TU1 (161 Low load, dry climate timber-grass-shrub): The primary carrier of fire is a low load of grass and/or shrubs with timber litter. TU1 is commonly used to replace Fire Behavior Fuel Model 8 from the original 13 fuel models as described by Anderson (1982). This fuel model usually has a very low load of surface fuels in the understory and fire behavior is usually minimal. The addition of ladder fuels and/or a high density overstory (high crown bulk density) can cause this fuel model to exhibit a crown fire. It is the third most abundant fuel model in the analysis area.

Fuel Model TU5 (165 Very high load, dry climate timber-shrub): The primary carrier of fire is heavy forest litter with a shrub or small tree understory. This fuel model is the second most dominate fuel model in the project boundary. It replaces Fire Behavior Fuel Model 10 from the original 13 fuel models. TU5 best represents stands with an overstory and heavy component of ladder fuels and/or a high load of dead and downed surface fuels. It is very common to expect a crown fire with this fuel model.

Fuel Model TL3 (183 Moderate load conifer litter): The primary carrier of fire is a moderate load of conifer litter and a light load of coarse fuels. It is similar to Fire Behavior Model 8 from the original 13 fuel models. TL3 best represents closed canopy stands with very little surface fuels.

Fuel Model TL4 (184 Small downed logs): The primary carrier of fire is a moderate load of fine litter and coarse fuels. Includes small diameter downed logs. TL4 represents stands that have started to unravel and include conifer litter and coarse woody fuels. It is the fourth most abundant fuel model in the analysis area.

Fuel Model TL8 (188 Long needle litter): The primary carrier of fire is a moderate load of long-needle pine litter. It may include a small amount of herbaceous fuels. This fuel model tends to occur in stand with a heavy component of ponderosa pine without an accumulation of coarse fuels.

The following fuel models would be present in some of the post-treatment units along with some of the fuel models identified previously:

Fuel Model TL5 (185 High load conifer litter): The primary carrier of fire is a high load conifer litter and light slash or mortality fuel. TL5 is similar to TL4 except it has an even higher load of coarse fuels and would exhibit higher fire behavior if all else were equal. It can be used to represent precommercial thinning slash after the red needles have fallen off.

Fuel Model SB1 (201 Low load activity fuel): The primary carrier of fire is light dead and downed activity fuel. Fine fuel load is 10-20 tons/acre, weighted towards fuels in the 1 to 3 inch diameter class. Fuel bed depth is less than 1 foot. SB1 represents a lighter load of post-harvest activity fuels that have not been treated by piling or prescribed fire.

Fuel Model SB2 (202 Moderate load activity fuel or low load blowdown): The primary carrier of fire is moderate dead and downed activity fuel or light blowdown. Fine fuel load is 7 to 12 tons/acre, evenly distributed across 0-0.25, 0.25-1 and 1-3 inch diameter classes. Fuel bed depth is about 1 foot**.** Blowdown is scattered, with many trees still standing. This fuel model will only exist in the analysis area if harvest activity fuels are not treated or to represent the red needle stage of precommercial thinning slash.

Wildland Urban Intermix (WUI)

The East Reservoir analysis area has many homes scattered throughout the area in what has been labeled a Wildland Urban Intermix. The Intermix Community exists where structures are scattered throughout a wildland area. There is no clear line of demarcation and wildland fuels are continuous outside of and within the developed area. The development density, in the intermix, ranges from structures very close together to one structure per 40 acres or more. In the East Reservoir analysis area, the largest concentration of homes is in Warland Creek. Homes also exist in Fivemile Creek, Dunn Creek, between Boundary and Canyon Creek, and between Canyon Creek and Dunn Creek. The Koocanusa Marina is located on leased NFS land and is located on Lake Koocanusa near the mouth of Cripple Horse Creek. Numerous proposals for additional access to private property are also occurring at this time and would eventually mean additional homes in the analysis area. Other miscellaneous structures such as historical sites or developed recreation sites also exist within the planning area. There have been some treatments to the hazardous fuels on Forest Service (FS) land adjacent to private property, but most of the land has not been treated recently. Areas immediately adjacent to private property that have not had recent hazardous fuel reduction treatments would be high priority areas for treatment.

All of the LANDFIRE data used for fire behavior modeling on NFS lands can also be acquired for other ownerships including private. The potential fire behavior modeling maps included in the Fire/Fuels project file includes expected fire behavior for all ownerships. The caveat with this expected fire behavior is that some of the data used as inputs into the fire models could not be ground verified for non-NFS lands.

ENVIRONMENTAL CONSEQUENCES

ALTERNATIVE 1 (No-Action)

Direct and Indirect Effects

Under Alternative 1 there would be no new proposed treatments. Natural processes would continue and accumulation of forest debris would increase natural fuel loadings. Many of the forested stands in the analysis area would remain overstocked and ladder fuels would continue to fill-in and crowd the understory. The drier forest stands would continue to lose vigor due to competition from a dense understory of shade tolerant species. This understory would serve as ladder fuels that would permit a surface fire to expand into the canopy of overstory trees. This could result in the mortality of many of the existing overstory trees that would have otherwise survived a surface fire of lower intensity.

The cooler and more moist sites would continue to decline. Additional mortality from insects and disease in these stands would lead to even higher fuel loading over time. Timber harvest would not be used to reduce crown densities and ladder fuels. Existing surface fuels would not be treated and would remain a hazard. Fire suppression would continue in the analysis area, as directed by the KNFP.

Because there would be no new fuel treatments to reduce the fire hazard in the analysis area, the potential for high-severity wildland fires would continue and be more likely than under the action alternatives. Any fire start inside the analysis area or start outside and moving into the analysis area would likely be more expensive, difficult and dangerous to suppress. Development of private lands would continue, increasing the complexity and expense of fire suppression.

Fire modeling indicates that there is at least 24,000 acres at risk of crown fire under the existing conditions and modeled weather scenario. These areas would also exhibit flame lengths and rates of spread that would require indirect suppression tactics utilizing mechanized equipment and aviation resources. As time progresses and stand conditions continue to deteriorate in the analysis area due to insects, disease, wind and snow, the fire hazard would continue to increase. Eventually, conditions would arise and another fire such as the 1988 Dry Fork Fire would occur.

Cumulative Effects

Cumulatively, fire suppression and timber management have had and would continue to have the most effect on fire regimes and fuels in the analysis area. Table 3.2 in Chapter 3 of this document shows past timber sale activities for the analysis area. Past harvest activities on NFS land that were followed up with fuel reduction activities, such as piling and burning or underburning, are still providing a slowing effect on fire spread. The most effective treatments with the greatest longevity for reducing fire behavior are regeneration harvest followed by broadcast burning.

Map 17 shows past burning in the East Reservoir analysis area. Broadcast burning as shown on this map is associated with regeneration harvest. Although regeneration harvest followed by broadcast burning did not mimic all of the ecological processes that occur during a mixed or stand replacing wildfire it was effective at reducing fuels and maintaining an individual stand in a mixed or stand-replacing fire regime. Underburning, on the map, is associated with intermediate harvest or wildlife burning. These typically occurred in areas within Fire Regimes I or III. In most cases, timber harvest or noncommercial slashing of ladder fuels eliminated the ladder fuels and burning was done to reduce fuels and improve wildlife habitat and/or browse. This type of treatment was effective at maintaining or returning individual or multiple stands to a low or mixed severity fire regime. In general, underburning has a much shorter lifespan on treatment longevity because the lower severity of the burning consumes less fuels, keeps most of the overstory in place and stimulates the growth and vigor of fire adapted native plants allowing for surface fuels to accumulate.

In 2010, Forestwide Fuels unit 589 (170 acres) was slashed in preparation to be underburned as part of the 2001 Forestwide Fuels Reduction and Wildlife Habitat Enhancement EA. An additional three units were also slashed in 2011 under the same EA. This included: FWF 545 (Gopher Hill, 265 acres), FWF 536 (Warland Peak, 195 acres) and FWF 53403 (Warland Peak, 450 acres). All these units are scheduled to be underburned between 2013 and 2015. As of the spring of 2013, a partial burn for 170 acres had occurred in FWF 545. The rest of the slashed units still have potential to exhibit passive and active crown fire. Once underburning has occurred, these units would be restored back to a low to mixed severity fire regime.

Firewood cutting is also expected to continue in the analysis area. Cumulatively, this has been effective at decreasing hazardous fuel loads within 200 feet of many of the open roads.

ALTERNATIVES 2 and 3

Direct and Indirect Effects

The purpose and need specific to the fire and fuels section of the East Reservoir Project is to reduce hazardous fuels adjacent to private property and across the landscape while reintroducing fire to the ecosystem. In order to meet this purpose and need, the action alternatives are designed to apply the principles of a fire-resilient forest as defined in Table 3.73. Reintroduction of fire to the ecosystem would be accomplished through the use of prescribed fire and natural fire as allowed on a limited basis by the current KNFP.

Table 3.73 - Principles of Fire-Resilient Forests (Agee and Skinner 2005)

OBJECTIVE	EFFECT	ADVANTAGE	COMMENTS
Reduce surface and ladder fuels	Reduces potential flame length	Fire control easier, less torching	Surface disturbance less with fire than other techniques
Increase canopy base height	Requires longer flame length to ignite tree crowns	Less torching	Opens understory, may allow surface wind to increase
Decrease crown density	Makes independent crown fire less probable	Reduces crown fire propagation	Surface wind may increase, surface fuels may be drier
Increase proportion of mature fire-resilient tree species	Thicker bark, taller crowns, higher canopy base height	Increases survivability of trees	Removing smaller trees is sometimes difficult and costly

Under the treatment alternatives, the existing fuel models were converted to post-treatment fuels models

for each unit. Table 3.74 includes some of the most abundant stand characteristics by treatment type.

Table 3.74 – Pre- and Post-Treatment Stand Characteristics Used for Fire Behavior Modeling

	REGENERATION HARVEST		IMPROVEMENT HARVEST		FUEL REDUCTION ONLY		UNITS
	PRE-TREATMENT	POST TREATMENT	PRE-TREATMENT	POST TREATMENT	PRE-TREATMENT	POST TREATMENT	
Fuel Model	TU1(161), TU5(165), TL4(184), TL8(188)	TU1(161), TL3(183), TL4(184), TL8(188)	TU1(161), TU5(165), TL4(184), TL8(188)	TU1 (161), TL3 (183), TL4 (184), TL8 (188)	GR2(102), GS2(122), TU1(161), TU5(165), TL4(184), TL8(188)	GR2(102), GS2(122), TU1(161), TL4(184), TL5(185), TL8(188)	Fuel Model Number
Canopy Bulk Density*	0.10-0.290	0.020-0.030	0.080-0.20	0.040-0.10	0.020-0.290	0.020-0.220	Kg/m^3
Canopy Base Height**	1-10	20-30	1-10	10-30	1-10	6-15	feet
Canopy Cover	40-60	10-20	40-60	30-40	40-60	30-50	Percent
Crown Fire Potential	Yes	No	Yes	No	Yes	Limited to passive crown fire	

* Canopy Bulk Density is the mass of available canopy fuel per unit of canopy volume (Scott and Reinhardt 2001).
**Canopy Base Height is the lowest height above the ground at which there is a sufficient amount of canopy fuel to propagate fire vertically into the canopy. It is an effective value that incorporates ladder fuels such as shrubs and understory trees (Scott and Reinhardt 2001).

Under the action alternatives, none of the proposed harvest units are expected to be able to initiate or carry a crown fire because canopy base heights would be raised and crown bulk densities would be low enough that they would not sustain a crown fire after treatments are completed. Units for fuels and fuels and wildlife objectives would still exhibit limited crown fire potential. They are not designed to reduce or thin overstory trees that would further reduce canopy bulk densities. Because surface fuels and ladder fuels would be reduced, the crown fire potential should be limited to passive crown fires (single and/or group tree torching).

Peterson et al. (2005) suggest there is strong support in the scientific literature and case studies that fuel treatments reduce the probability of crown fire. This has been supported as recent as 2005 with the Camp 32 fire on the Rexford Ranger District of the KNF. However, it is very important to recognize that without treatment of slash created by harvest activities and thinning, it is possible that wildfire severity could increase (Omi et al. 2006).

The post-treatment areas would result in low to moderate surface fire conditions and would be unlikely to initiate or sustain a crown fire. Expected flame lengths would be less than four feet and the fire is expected to be a surface fire which would be more conducive to fire suppression activities. These two criteria are the thresholds of fire control for ground-based suppression personnel directly attacking the fire. Also, these conditions would substantially reduce the potential for long range and short range spotting from firebrands, which are associated with high fire intensities, torching, crowning and fire whirls (Rothermel 1983). Fires exhibiting long range spotting pose some of the greatest threats to firefighter and public safety because they are extremely difficult to control.

None of the alternatives can influence the time and place where ignitions may occur. Wildland fire is a natural,

Residence Time- The time, in seconds, required for the flaming front of a fire to pass a stationary point at the surface of the fuel. The total length of time the flaming front of the fire occupies one point.

Resistance to Control- The relative difficulty of constructing and holding a control line as affected by resistance to line construction and by fire behavior. http://www.nwcg.gov/pms/pubs/glossary

ongoing process whose time and location can never be precisely predicted by fire behavior science. There would still be untreated areas of high fuel accumulations that could lead to high-intensity fires. Blowdown, insect and disease mortality, and other causes of fuel accumulation would likely continue in the analysis area. However, treated stands would help reduce fire effects. Omi et al. (2006), found treatments that include thinning followed by slash treatment were the most impressive in reducing fire intensity and severity and can last up to a decade in mixed-conifer sites. Beyond this time, maintenance fuel reduction treatments may be needed. These periods of effectiveness could be extended by future thinning with simultaneous fuel treatments.

Under all action alternatives, activity fuels and natural fuels would be present for a time before they are treated. This would likely be short-lived but it would be a high hazard. High burn severity would be expected if a wildfire were to occur before fuel treatments (underburning, grapple piling, masticating) are completed. Untreated fuels would be similar to a slash-blowdown fuel model SB1 or SB2. Given the same weather scenario and fuel moistures of the previous model runs, flame lengths of 8-13 feet and rates of spread of 30-50 chains/hour could be expected within the proposed units. In addition, heavy surface fuel loading would allow long residence time and a high resistance to control.

Commercial thinning, which is a type of intermediate harvest, is proposed in both action alternatives. The intent is to improve tree vigor, increase tree spacing, increase fire and insect resiliency, favor desirable species and reduce ladder fuels. Due to the younger age and size class of these stands, prescribed fire is not desired at this time because it could cause unacceptable levels of mortality from burning and increase the risk of attack by insects such as the Mountain Pine Beetle. Whole tree yarding would be utilized to minimize any increase in activity fuels. As soon as a commercially thinned stand is not at risk from unacceptable levels of mortality, prescribed fire should be used to further reduce hazardous fuels and to reintroduce fire to the landscape as appropriate. This would generally be within 15 years of the harvest treatment. Since prescribed fire may not be used immediately after harvest activities, an increase in surface fuels is expected in these stands. This would likely cause an increase in fire behavior but it is expected to remain a surface fire because ladder fuels would be reduced (raising canopy base heights) and crowns spacing would be increased (reducing canopy bulk density).

Precommercial thinning is also proposed in all of the action alternatives. Precommercial thinning would definitely cause a short-term increase in expected fire behavior in the thinned stands. The undesired trees are thinned and then lopped to reduce fuel heights but they are left on site to decompose. Most young stands proposed to be precommercial thinned in the analysis area can be characterized by a fuel model TU1 (161). Given similar fuel moisture and weather condition as described previously under “Analysis Methods”, an unthinned stand would exhibit flame lengths of 2-3 feet and a rate of spread of 3-7 chains per hour. After thinning has occurred and the needles on the slash have turned red, the fuel model would be represented by a SB2 (202- Moderate load activity fuel). Expected fire behavior would increase significantly to flame lengths of 7-10 feet and a rate of spread of 17-40 chains per hour. This condition would only occur while the red needles are still on the slash. Experience has shown this red needle stage to last 1-3 years after thinning. Once the red needles have fallen off and the fuels start to become more compacted from winter snow, the fuel model will shift to a TL5 (185). Expected fire behavior would include flame lengths of 2-4 feet and a rate of spread of 5-12 chains per hour. This condition would likely exist 2-5 years after thinning has occurred. Stands treated with daylight thinning around desirable species such as western white pine, tend to exhibit pockets of fuel concentrations versus the continuous fuels of a fully precommercial thinned stand. Stands which are daylight thinned will have the same pre and post treatment fuel models as other precommercially thinned stands, but the post-treatment fuel model will be in smaller concentrations. Since the daylight thinned fuels are not as continuous and more sheltered and shaded from the leave trees the expected fire behavior will likely be isolated and less severe versus stands with complete precommercial thinning.

As part of the East Reservoir Project, the KNF is also analyzing proposed treatments on U.S. Army Corps of Engineers (COE) land east of the Koocanusa Reservoir and the Kootenai River. The COE would be responsible for selecting their preferred alternative and documenting that decision. If one of the action alternatives is chosen by the COE, it would complement the FS land in a landscape approach to reducing hazardous fuels and reintroducing fire to the ecosystem.

An indirect effect of the proposed treatments in each action alternative is the potential to increase surface winds (Albini and Baughman 1979) and more drying of both live and dead surface fuels (Pollet and Omi 2002). This effect would be more impactive in the regeneration harvests than other treatments due to the level of overstory removed. These potentially drier and windier conditions are factored into the post-treatment fire behavior modeling. Most fire managers believe these conditions are offset by the reduction or elimination of crown fires in the post-treatment stands. These same conditions that allow for more drying also allow for more moist conditions during diurnal weather patterns (night time), after precipitation, and seasonal variation (spring and fall). The more open stand conditions after treatment also allow for more effective delivery of aerial retardant or water during wildfire suppression operations.

Another indirect effect of the proposed treatments is their impact on adjacent non-treated stands. Omni and others (2006) suggest that fuel treatment effects may extend beyond the treated area. This would most likely occur on the downwind side of a treated area.

All action alternatives propose numerous fuel reduction activities immediately adjacent to private property in order to meet the purpose and need of this project. Besides reducing fuels on NFS lands the treatments would likely enhance treatments on private property adjacent to NFS lands or benefit them as described previously. It is important to note that the most important factors of a home's ignitability during wildland fires depend on the characteristics of the home and its immediate surroundings. For this reason, it is imperative that landowners do their part in making their homes firewise. More information for landowners can be found at http://www.firewise.org/.

Cohen (2000a) addresses home ignitibility, or the potential for a home to ignite, in the wildland urban intermix. Cohen concludes that homes most often ignite via one of two processes, direct flame contact with the structure and lofted firebrands landing on receptive fuel such as a house. The Structure Ignition Assessment Model (SIAM) developed by Cohen (1995) and results from the International Crown Fire Modeling Experiment generally concur that a flaming front at a distance of 130 feet or more from a structure does not deliver sufficient heat energy to ignite the exterior of a home. This recommendation is based on preventing home ignitions from radiant heat, not protecting firefighters or the homeowner who may be present (in a safe location) as the fire passes.

In some cases this project proposes treatments on federal land that are contained within the home ignition zone of private landowners because of their close proximity to federal land. Radiant heat from high intensity wildfires could cause homes to ignite or cause damage if they are within the home ignition zone. Proposed treatments for this project in the home ignition zones or farther out are designed to reduce a wildland fire's intensity so that it remains a surface fire and does not develop into a crown fire. A crown fire would loft more firebrands into the air than a surface fire due to the amount and type of fuel being consumed. A crown fire would likely be more intense, thus producing more wind and convective heating. These forces alone or combined would carry firebrands greater distances. Cohen's analysis (modeling, experiments, case studies) did not explicitly address firebrand ignitions but he does recognize that firebrand ignitions can originate from distances of ½ mile or more (Cohen 2000a).

The previously-cited research exclusively addresses home ignitibility. Not addressed in the research are some of the other issues and problems faced by resource managers, fire professionals and residents when considering fire in the WUI. When fire enters the WUI, there remains the potential for loss of life,

property and other values even if homes have been made fire safe. When fire enters areas adjacent to private land, there is a high probability that firefighting resources would be deployed due to social and political pressures. Numerous treatment units are proposed that will improve ingress and egress routes for firefighters and the public during a wildfire event.

Because of the problems and complexities associated with the Intermix Community, resource managers and fire managers find it desirable to exclude, to the extent possible, wildland fire from these areas, and prefer to use prescribed fire to manage fuels; however, sociopolitical constraints may preclude or limit its implementation (Kalabokidis and Omi 1998, DellaSalla et al. 1995).

With the potential for more flexibility in the use of wildland fire under the new proposed Kootenai Forest Management Plan (not currently in effect), treatments like those proposed in all action alternatives would allow fire managers and decision makers more options. If adequate fuel reduction activities have occurred in or near values at risk, such as private property, then a decision maker may be more comfortable utilizing other options rather than full fire control.

Fuel treatments are proposed in Alternative 2 for areas designated as old growth. These would occur in dryland old growth such as south aspects of VRU2 and VRU3. Treatments are designed to reduce ladder fuels via a combination of slashing and prescribed burning. By reducing ladder fuels and surface fuels the treatments are expected to maintain or enhance some of the dryland old growth attributes and help ensure the survivability of the old, large diameter trees in these individual stands. The overall goal is to work towards returning these stands to their appropriate fire regime and increase fire resiliency.

Lastly, Alternatives 2 and 3 include the storage and decommissioning of roads and the addition of newly constructed permanent roads. Alternative 2 includes the storage of 16 miles of road and the decommissioning of 15.49 miles (includes undetermined roads). Under Alternative 2, 9.25 miles of new road will be constructed. Alternatives 3 includes 17.62 miles of road storage, 12.41 miles of decommissioning (includes undetermined roads), and 8.06 miles of new, permanent roads. Road access is important for a quick initial attack response; thus, road storage and decommissioning is rarely beneficial from a fire suppression standpoint. The roads identified for storage or decommissioning in these alternatives are not vital to wildfire suppression resources. Most of the roads proposed for storage or decommissioning are not maintained enough for engine access. Due to yearlong or seasonal closures they have become overgrown with vegetation or damaged due to a lack of maintenance. The majority of the roads are short spurs less than ½ mile in length or longer roads that are within ¼ mile and run parallel to other roads that would not be changed. None of the roads proposed for storage or decommissioning in the action alternatives provide sole access to ridgetops nor are they immediately adjacent to private property.

ALTERNATIVE 2

Direct and Indirect Effects

Alternative 2 would implement various vegetation treatments types on about 26,895 acres of the East Reservoir analysis area. Intermediate harvests including commercial thinning would occur on 6,316 acres and are designed to reduce ladder fuels, crown fuels, surface fuels and favor fire resilient tree species. Regeneration harvests are proposed on 2,529 acres and they are designed to trend vegetation towards more fire resilient species such as western larch, ponderosa pine and western white pine while also reducing ladder fuels, crown fuels and surface fuels. Regeneration harvest would occur in stands where intermediate harvest is not feasible due to poor quality trees and undesirable overstory tree species.

Fuel reduction units (Fuels (F) and Fuels and Wildlife (FW) units) would account for about 11,427 acres of treatment under Alternative 2. These proposed treatments are designed to reduce surface and ladder fuels through a combination of slashing small diameter understory trees (less than 6” DBH) and/or utilizing prescribed fire (underburning or pile burning). The units identified in Table 2.4 of Chapter 2 as

Mechanical Fuel Treatment could include machine piling or machine mastication to reduce ladder fuels prior to burning. In addition to reducing fuels and reintroducing fire, the FW units (10,049 acres) are intended to improve wildlife habitat and browse and maintain or enhance old growth characteristics.

Precommercial thinning is proposed on 5,775 acres. This treatment is intended to reduce tree density and improve the growing conditions of the remaining trees by reducing competition for light and nutrients. These treatments respond to the need to maintain the vigor and long-term productivity of forest stands. Thinning would also address ecosystem restoration objectives of restoring fire resilient species, restoring stand density to conditions consistent with historic disturbance regimes, favoring species that are most resistant to insect and disease infestation for specific site conditions, and generally improve stand health. The long-term effect is a stand that is more resilient to fire. In addition, 1,060 acres of white pine daylight thinning is proposed to feature this species where it exists.

Alternative 2 includes the use of prescribed fire on about 18,011 acres of NFS lands. This includes about 3,840 acres of pile burning and 14,171 acres of underburning. Approximately 2,744 acres of the underburning is associated with timber harvest units. The rest of the underburning is associated with fuel reduction units and fuels and wildlife habitat enhancement units.

This alternative includes 261 acres of intermediate harvest with prescribed burning and 137 acres of fuel reduction units with prescribed burning on COE lands. The intent of these treatments units is the same as those described previously for NFS lands.

Alternative 2 proposes multiple regeneration harvests that exceed 40 acres in size. These units were proposed to try to implement treatments that would have been more commensurate to historical patch sizes while also favoring more fire resilient species. They are proposed on more moist sites that would have typically experienced mixed to stand replacing fire severity at a scale of hundreds to thousands of acres in size. Additionally, Units 147, 148, 149 and 150 in Upper Fivemile Creek and Unit 170 in Warland Creek were designed to tie in with past regeneration harvests to simulate a fire that would have burned from the creek bottom to the ridge top due to continuous fuels and favorable topography. Treatments of this scale are also more likely to disrupt large fire growth and spread and assist in the efficacy of suppression efforts when a fire occurs in these areas. Fire modeling indicates these areas are at risk of experiencing stand-replacing crown fire behavior if left untreated. In addition to the benefits described previously, Unit 362 near Hornet Ridge (Dunn Creek) was partially designed to provide a fuel break immediately adjacent to a major power transmission line. The other regeneration harvest units exceeding 40 acres were not specifically designed with fire and fuels as the primary purpose; thus, they do not have as significant of a level of benefit to this resource but they will assist in reducing fuels, restoring fire to the landscape, and restoring fire resilient tree species.

ALTERNATIVE 3

Alternative 3 was designed to meet all standards and guidelines of the current KNFP. In order to meet these criteria, fuel treatments in old growth, lynx analysis units and areas that would negatively impact other sensitive, threatened or endangered fauna were eliminated from this alternative. In addition, further on the ground reconnaissance caused some units to be dropped and others to be added as described in Chapter 2. No regeneration harvest over 40 acres are proposed under this alternative.

Fuel reduction activities specific to Alternative 3 include:

- Intermediate harvest on 5,881 acres (including commercial thinning);
- Regeneration harvest on 1,901 acres;
- Fuel reduction units without timber harvest on 1,309 acres;
- Fuels and wildlife units totaling 10,049 acres;
- Precommercial thinning on 5,563 acres;

- Prescribed burning on 17,205 acres (2,457 acres of pile burning, 3,390 acres of underburning with timber harvest, and 11,358 acres of fuels and wildlife burning);
- 421 acres of treatment on COE lands (261 acres of intermediate harvest with underburning, 137 of fuel reduction activities with underburning, and 23 acres of grapple piling and burning).

All the treatments described under fuel reduction activities have the same objectives and direct and indirect effects as those described previously under Alternative 2.

Notable differences include a reduction in the proposed treatment acres and the elimination of treatments in dryland old growth. These areas dropped would continue to exhibit crown fire potential. Old growth units dropped from this proposal would continue to see an increase in surface and ladder fuels. Fire return intervals would continue to be missed, causing a trend away from historical fire regimes. When a wildfire does occur, it is more likely to cause excessive mortality in the old, large diameter trees common in old growth stands. In addition, this alternative eliminates the daylight thinning in white pine which has seen a significant reduction in abundance due to many decades of white pine blister rust. Since the short-term impact of precommercial thinning is an increase in expected fire behavior, this would not occur on 1,060 acres under Alternative 3. The long-term benefit of daylighting white pine is an increase in fire resiliency of the thinned stands due to the increase in tree spacing and a preference to leave this fire dependent, seral species.

ALTERNATIVES 1, 2 and 3

Cumulative Effects

The cumulative effects under the Alternative 1 (no-action) also apply to the action alternatives. The major difference is that the action alternatives, in combination with past harvest activities and fuel treatments, would provide for a more significant reduction in expected fire behavior and fire movement by addressing landscape level fuel treatments. The combination of location and juxtaposition of past and proposed treatments would be more effective at reducing the potential of a high severity wildfire from having negative impacts to the analysis area. Again it must be reiterated that this is based on the understanding that natural and activity fuels will be adequately reduced to lower fire severity and intensity.

In order to maintain the treated areas for effectiveness, maintenance treatments would be required. Treatments such as precommercial thinning, reduction of surface ladder fuel accumulations, and thinning overstory crowns as they begin to close-in and provide enough canopy fuels to sustain a crown fire would be needed. Maintenance treatments are not likely to be warranted for another decade or more depending on the type and extent of the initial treatments.

Summary of Analysis

From a fire and fuels management perspective, Alternative 1 would not meet the purpose and need of the project. Alternatives 2 and 3 reduce fuels, trend the vegetation towards fire resiliency, decrease expected fire behavior at the stand and landscape level, and enhance wildlife habitat and browse. Both action alternatives trend the East Reservoir analysis area towards the desired future conditions but Alternative 2 does this on the greatest number of acres.

CONSISTENCY with the FOREST PLAN and OTHER MANAGEMENT DIRECTION

Alternative 1 is not likely to meet the following direction in the KNFP:

> …to use prescribed fire to simulate natural ecological processes, prevent excessive natural and activity fuel buildup, create habitat diversity for wildlife, reduce suppression costs, and maintain ecosystems (page II-2).
>
> …the fire protection program will seek to minimize the number of acres lost to damaging

> wildfire and to provide for the safety of the public and personnel engaged in fire protection activities. The fuels management program intends to treat both activity fuels and natural vegetation to the degree needed to facilitate implementation of the fire protection program and other dependent activities of…

Alternatives 2 and 3 would be consistent with the fire and fuels management direction in the KNFP as long as natural and activity fuels are properly treated.

PTES PLANTS INTRODUCTION

The activities proposed under the East Reservoir project (tree removal, road decommissioning and storage, temporary and permanent road construction, road repair and BMPs, fuel treatments; slashing, piling and burning, road management, noxious weed control, recreational proposals) have the potential to effect proposed, threatened, endangered and sensitive (PTES) plant populations. These activities are described in detail in Chapter 2 of this DEIS

The purpose of this analysis is to:

1) Determine if the alternatives will adversely affect any of the PTES plant species that have potential to occur in the analysis area, and if so, list design features to be implemented to reduce potential effects. The analysis area is the East Reservoir project area.
2) Insure that the alternatives do not contribute to the loss of viability of any sensitive plant species or cause a trend toward federal listing;
3) Comply with USDA Forest Service Region 1 policy to insure that sensitive plant species receive full consideration in the decision-making process;
4) Comply with the Endangered Species Act.

This analysis considers the short- and long-term effects of the proposed action on:

- Existing and potential habitat;
- The welfare of existing plants.

REGULATORY FRAMEWORK

Endangered Species Act

The Endangered Species Act (ESA) of 1973 declares, "…all Federal departments and agencies shall seek to conserve endangered species and threatened species and shall utilize their authorities in furtherance of the purposes of this Act." Under the Act, Federal agencies must consult with the Secretary of Interior whenever an action authorized by such agency is likely to affect a species listed as threatened or endangered.

Although no proposed, threatened or endangered plant species are known to occur on the Kootenai National Forest (KNF) two plant species listed as threatened are suspected to occur.

National Forest Management Act

The National Forest Management Act (36 CFR 219.19) directs that the Forest Service (FS) must maintain viable populations of all native and desired non-native wildlife, fish and plant species in habitats distributed throughout their geographic range on National Forest System (NFS) Lands.

Agency Direction

In addition Forest Service Manual 2670.5 section 19 defines **sensitive** species as "those plants and animal species identified by a Regional Forester for which population viability is a concern, as evidenced by:

1. Significant current or predicted downward trends in population numbers or density; or
2. Significant current or predicted downward trends in habitat capability that would reduce a species' existing distribution.

Effects to these **sensitive** species must be analyzed.

The Kootenai National Forest Plan (KNFP) (USDA 1987) addresses sensitive species under its forest-wide management direction. In its goals it states that we will "determine the status of Sensitive species and provide for their environmental needs as necessary to prevent them from becoming Threatened and Endangered" (KNFP p. II-1). It goes on to say that we will maintain diverse age classes of vegetation for viable populations of all existing native species. The KNFP

also supports the protection and maintenance of important riparian zone features, marshes, and water bodies, where sensitive plants often exist.

ANALYSIS METHODS

The following steps were taken to complete this analysis for PTES plants:

1. The assessment of sensitive plants and sensitive plant habitat followed the methods outlined for the KNF by Leavell and Triepke (1995). Suitable habitats for each sensitive species known or suspected of occurring on the KNF have been identified by consultation with sensitive plant field guides (USDA 1992) and published and unpublished literature on sensitive plants (Lesica and Shelly 1992; Vanderhorst 1996, 1997) information from the Montana Natural Heritage website (http://nhp.nris.state.mt.us/plants/guidebook.asp) as well as through extensive field experience. Probability of occurrence (Leavell and Triepke 1995) of sensitive species was estimated, including both historic and existing location information. Rare plant inventories were conducted subsequent to these assessments (USDA 1998). These took into consideration all rare plants and rare habitats in addition to sensitive species. They took place in addition to other past and concurrent surveys of sensitive plants in and around the analysis area (Vanderhorst 1996, 1997; R. Ferriel, pers. comm.). The species included in this assessment are those with a moderate to high probability of occurrence in the analysis area. The probability analyses took into consideration the following factors:

- Past disturbance;
- Locations of known populations - District records, past surveys and the Montana Natural Heritage Program database were scanned to determine species already known to exist in the analysis area. These populations are included on the analysis map.
- Ecological requirements of the individual species (*e.g.*, elevation, potential vegetation, landtype, lithology, shade and moisture regimes).

Areas proposed for treatment were reviewed for places with moderate to high potential for providing habitat for PTES plant species.

2. Field surveys were completed for most proposed activity areas with emphasis on areas with moderate to high potential to provide habitat for PTES plants. In general, these areas are streams, wetlands, and riparian zones, mesic coniferous forest with a component of mature western red cedar, moist cliffs and talus slopes, dry meadows, park-like ponderosa pine forest, and dry south facing rocky areas. Unique landscape features have more potential to provide habitat for PTES plants than more common landscape features, so these are emphasized during surveys.

3. This analysis was completed using the maps, surveys completed to date, literature, experts, and personal knowledge about the requirements of each suspected plant species of concern. Plant surveys have been performed in this area for nearly 20 years.

Assessment Area and Time Frame

The East Reservoir analysis area is the context for the present analysis (see map in map section).

Current conditions will be considered against an historical reference period. Reference conditions give resource managers an idea of the environments that native plant species have adapted to (Morgan et al. 1994). As described by Federal Planning Regulations (CFR 219.20) and the KNF (USDA 1995), the reference period used with this analysis is based on the period extending back approximately 2,500 years before present, when climate and environmental conditions more or less stabilized. Forest processes have been affected accordingly, contributing to characteristic patterns of forest structure, composition, and habitat abundance and spatial distribution.

Project implementation should occur over the next five to ten years (except in the case of the no-action alternative).

AFFECTED ENVIRONMENT/EXISTING CONDITION

The habitat requirements for many sensitive plant species are often narrowly defined. When this is the case, decisions as to the probability of occurrence and the potential sites to survey are easily and confidently determined. Some sensitive plant species have wider ecological amplitudes and their potential extends through a variety of habitats.

Overall Description of the Analysis Area

Please see chapter one for description of analysis area.

Habitat Descriptions of Proposed Activity Areas

Within the East Reservoir analysis area are five recognized habitats with the potential to support sensitive plant species:

Aquatic Plant Species Guild

This guild occurs generally in littoral (< 2 meters) zones of vernal pools, small ponds and lakes, usually at lower elevations. *Psilocarphus brevissimus* (dwarf wooly heads) also occurs in drying mud of ponds and other vernally wet soil. Other species of this guild are found at varying depths in the quiet shallow water of ponds, lakes, marshes and/or slow-moving rivers; some, such as *Bidens beckii* (water marigold) may occur in deeper littoral to limnetic (> 2 meters) zones of these water bodies.

No treatments are proposed near any of the small ponds that occur in the East Reservoir analysis area. Most of these wet areas occur along Cripple Horse Creek and the upper reaches of that drainage. There are also some small ponds in the Dunn Creek area. No treatment areas are close enough to have any impact on this type of aquatic habitat so these areas were not surveyed.

Peatland Plant Species Guild

Many peatland species of interest are generally secure, and are common, when their entire worldwide range is considered (Chadde et al. 1998). However, species of this guild are narrowly restricted to one or more peatland types, and peatlands themselves are rare in the analysis area. There are no activities close to these habitats and they are in fact very rare in the East Reservoir planning area. There were no surveys conducted in this type and there would be no impact to species associated with peatlands.

Deciduous Riparian Plant Species Guild

This guild is associated with streams and their related floodplains that have regular flooding and deposition of sediments. Habitats include streams that have *Populus trichocarpa* (black cottonwood), riparian shrub (willow, dogwood, birch, alder, huckleberry, etc.), and shrub/herbaceous communities along them. Gentle gradient riffle/pool streams typically are sinuous and have exposed stream bars along some part of their reach.

Steeper step/pool streams, typically associated with conifers in the overstory, do not have well developed floodplains, and because of their steep slopes, sediments are rarely deposited adjacent to them. As a result, these streams lack the germination surfaces and also the full sunlight that some species require for either germination or vegetative establishment. The plant species in this group are thus most often found in lower-gradient settings. These species also generally require moist (or saturated) soil conditions throughout the growing season. In some cases, shade or partial shade (such as along ecotonal margins) is an important habitat component.

Collema curtisporum (short-spored jelly lichen) occur on twigs and bark of deciduous trees such as *Populus trichocarpa* (black cottonwood) and *Alnus rubra* (red alder). There is riparian habitat in the East Reservoir analysis area and tree harvest and road construction has the potential to affect species associated with this habitat.

Wet and Moist Forest Plant Species Guild

Wet forest guild species are found in wet, generally riparian, often mid- to late-successional western

redcedar and western hemlock forests generally at less than 4,000 feet. Certain habitat types within these systems, including *Thuja plicata*/*Oplopanax horridum* (cedar/devil's club), *Thuja plicata*/ *Athyrium filix-femina* (cedar/ladyfern), *Thuja plicata*/*Adiantum aleuticum* (cedar/maidenhair fern), *Tsuga heterophylla*/*Gymnocarpium dryopteris* (western hemlock/oakfern) and *Thuja plicata*/ *Gymnocarpium dryopteris* (cedar/oakfern), have a high potential to support rare plants. Rare ancient cedar groves that occur in this habitat guild often support a high diversity of rare plant species.

Moist forest guild species are found in more mesic *Thuja plicata* (western redcedar) and *Tsuga heterophylla* (western hemlock) forests, generally in mid- to late-successional stages below 4,800 feet. Most rare plants of this guild occur in *Thuja plicata/Clintonia uniflora* (western redcedar/queencup beadlily), *Tsuga heterophylla/Clintonia uniflora* (western hemlock/queencup beadlily), *Thuja plicata*/*Asara caudatum* (western redcedar/wild ginger) and *Tsuga heterophylla/Asara caudatum* (western hemlock/wild ginger) habitat types. A few species can also be found in moist *Abies grandis*/*Asarum caudatum* (grand fir/ginger) and *Abies grandis*/*Clintonia uniflora* (grand fir/queencup beadlily) habitat types. Certain members of the wet forest guild can also be found in these more mesic upland forests.

Most rare plants of this species group prefer closed-canopy conditions and undisturbed mineral soils. Many also appear to depend on well-developed soil mycorrhizae (symbiotic relationships between the root systems of some vascular plants and soil fungi). Some vascular plants, lichens and bryophytes in this species group occupy decaying logs, wet rock or dry rock substrates in the above plant communities. Several lichens are epiphytic (i.e. growing on tree trunks, branches or twigs), while others grow on mossy rock or downed wood.

There is a population of northern beechfern, *Phegopteris connectilis* in the Davis Mountain area. Surveys did not identify any other populations within or adjacent to activity areas.

Dry Forest Plant Species Guild

This species group encompasses the dry forest plant habitat guild, which includes dry, open sites in *Pinus ponderosa* (ponderosa pine), *Pseudotsuga menziesii/Physocarpus malvaceus* (Douglas-fir/ninebark), *P. menziesii/Calamagrostis* rubescens-*Arctostaphylos uva-ursi* (Douglas-fir/pinegrass-kinnikinnick) and *P. menziesii/Festuca idahoensis* (Douglas-fir/Idaho fescue) or */Elytrigia spicata* (bluebunch wheatgrass) communities, generally below 4,500 feet.

Non-lethal fires in these habitats historically occurred at intervals as short as 25 years or less; these frequent low-severity fires helped to maintain grasslands, maintain open forest structures and enhance regeneration of ponderosa pine (Smith and Fischer 1997). Mixed-severity and stand-replacing fires occurred where fire return intervals were longer (Smith and Fischer 1997).

There are two known sensitive plant species within the East Reservoir analysis area. Western pearlflower, *Heterocodon rariflorum* is found in the Warland area and Taper-tipped onion, *Allium acuminatum*, is found in the Fivemile, Warland and Cripple Horse drainages on the open dry sites.

Cold and Forested Subalpine Plant Species Guild

The cold forest guild includes the more productive and mesic phases of *Abies lasiocarpa*/*Menziesia ferruginea* (subalpine fir/menziesia) and *Abies lasiocarpa/Xerophyllum tenax* (subalpine fir/beargrass) community types, mostly above 4,800 feet; however, they can occur below 4,800 feet in cold, north-facing drainages. This includes cold riparian areas that can extend well below 4,000 feet and are dominated by cold and wet *Abies lasiocarpa/Calamagrostis canadensis* (subalpine fir/bluejoint reedgrass) and *Abies lasiocarpa/Streptopus amplexifolius* (subalpine fir/twisted stalk) habitat types. The subalpine guild includes the following higher elevation plant communities:

Lycopodium dendroideum (groundpine) occurs in the cold forest guild in cold air drainages, and is associated with subalpine fir forests at lower elevations. It has not been found in the planning zone at the higher elevations usually associated with this species group.

Habitat types in this species group historically experienced stand-replacing fire at widely varying intervals from 50 to 200 years (Smith and Fischer 1997). Nonlethal fires historically occurred more frequently, with fire-free intervals as short as 30 years (Smith and Fischer 1997).

There is little of this habitat in the East Reservoir analysis area but a few units in the Davis Mountain area are proposed for treatment. Surveys in this area did not identify any of the species that occur in this habitat.

POTENTIAL SPECIES

Threatened, Endangered and Proposed Plant Species

Currently, two species in Montana, water howellia (*Howellia aquatilis*) and Spalding's catchfly *(Silene spaldingii*) are federally listed as threatened. Only *Silene spaldingii* is suspected to occur on the KNF, but have not been found on KNF lands. The term 'threatened species' means any species that is likely to become an endangered species within the foreseeable future throughout all or a significant portion of its range.

Table 3.75 summarizes findings for threatened and endangered plant species. Table 3.75A displays the findings for the Sensitive plant species.

Table 3.75 - Threatened and Endangered Species Findings

SPECIES	HABITAT	CONCLUSION	JUSTIFICATION
Howellia aquatilis (Water howellia)	Ephemeral glacial ponds and abandoned river oxbows below 4,500 ft.	**No Impact**	*Not known in the PA or found during project surveys
Silene spaldingii Spalding's catchfly	Remnant Palouse Prairie and canyon grassland habitat	**No Impact**	*Not known in the PA or found during project surveys.

Table 3.75A - Sensitive Plant Species of the KNF and Status in the East Reservoir Analysis Area

COMMON NAME	SCIENTIFIC NAME	STATUS	POTENTIAL/ FOOTNOTE	*HABITAT GUILD
Taper-tipped onion	*Allium acuminatum*	Known	Known	**D**
Round-leaved orchis	*Amerorchis rotundifolia*	Suspected	Low	M
Water marigold	*Bidens beckii*	Not Suspected	NS2	A
Deer fern	*Blechnum spicant*	Suspected	Very Low	M
Upswept moonwort	*Botrychium ascendens*	Suspected	High	M
Wavy moonwort	*Botrychium crenulatum*	Suspected	High	M
Western moonwort	*Botrychium hesperium*	Suspected	Low	M
Peculiar moonwort	*Botrychium paradoxum*	Suspected	Low	M
Stalked moonwort	*Botrychium pedunculosum*	Suspected	Low	M
Watershield	*Brasenia schreberi*	Not Suspected	NS2	A
Big-leaf sedge	*Carex amplifolia*	Suspected	Low	M
Creeping sedge	*Carex chordorrhiza*	Not Suspected	NS2	P
Prairie sedge	*Carex prairea*	Suspected	Low	M
Beaked sedge	*Carex rostrata*	Not suspected	NS2	A
Sheathed sedge	*Carex vaginata*	Not suspected	NS5	DR
Common clarkia	*Clarkia rhomboidea*	Suspected	Moderate	D
Sand Springbeauty	*Claytonia arenicola*	Suspected	Very Low	M
Lichen	*Collema curtisporum*	Suspected	Moderate	DR
Pink corydalis	*Corydalis sempervirens*	Suspected	Low	D

PROPOSED, THREATENED, ENDANGERED AND SENSITIVE PLANTS

COMMON NAME	SCIENTIFIC NAME	STATUS	POTENTIAL/ FOOTNOTE	*HABITAT GUILD
Clustered lady's-slipper	*Cypripedium fasciculatum*	Suspected	Moderate	D
Small yellow lady's-slipper	*Cypripedium parviflorum*	Suspected	Low	DR
Sparrow's egg lady's-slipper	*Cypripedium passerinum*	Suspected	Low	DR
English sundew	*Drosera anglica*	Not Suspected	NS2	P
Linear-leaved sundew	*Drosera linearis*	Not suspected	NS2	P,S
Crested shield fern	*Dryopteris cristata*	Not suspected	NS2	P
Giant helleborine	*Epipactis gigantea*	Not suspected	NS8	P
Slender cotton grass	*Eriophorum gracile*	Not Suspected	NS2	P
Green-keeled Cottongrass	*Eriophorum viridicarinatum***	Not suspected	NS2	P
Western boneset	*Eupatorium occidentale*	suspected	low	S
Hiker's gentian	*Gentianopsis simplex*	Not Suspected	NS2	A,DR
Mouse moss	*Grimmia brittoniae*	Not Suspected	NS3	D,M
Howell's gumweed	*Grindelia howellii*	Not suspected	NS8	D
Western pearlflower	*Heterocodon rariflorum*	Known	Known	D
**Water howellia	*Howellia aquatilis*	Not Suspected	NS2	A
Latah tule pea	*Lathyrus bijugatus*	Suspected	Low	D
Geyer's biscuit root	*Lomatium geyeri*	Suspected	Low	D
Bog club moss	*Lycopodiella inundata*	Not suspected	NS2	P
Prickly tree club moss	*Lycopodium dendroideum*	Suspected	Low	C,DR,M
Running Pine	*Lycopodium lagopus*	suspected	Low	M
Moss	*Meesia triquetra*	Not suspected	NS2	P
Stalked Leaved Monkeyflower	*Mimulus ampliatus*	Not suspected	NS4	M
Short-flowered Monkeyflower	*Mimulus breviflorus*	Suspected	Low	M
Bank Monkeyflower	*Mimulus clivocola*	suspected	Low	D
Old Man's Beard	*Nodobryoria subdivergens*	Not Suspected	NS7	S
Northern adder's-tongue	*Ophioglossum pusillum*	Not suspected	NS2	P
Northern beechfern	*Phegopteris connectilis*	Suspected	High	M
Whitebark Pine	*Pinus albicaulis*	Not suspected	NS7	S
Dwarf wooly heads	*Psilocarphus brevissimus*	Not suspected	NS8	A
Pod grass	*Scheuchzeria palustris*	Not suspected	NS2	P
Water bulrush	*Schoenplectus subterminalis*	Not suspected	NS2	A
Moss	*Scorpidium scorpioides*	Not suspected	NS2	P
**Spalding's catchfly	*Silene spaldingii*	Not Suspected	NS5	D
Tufted bulrush	*Trichiophorum cespitosum*	Not suspected	NS2	A,DR
Flat leaved bladderwort	*Utricularia intermedia*	Not suspected	NS2	A
Great-spurred Violet	*Viola selkirkii*	Suspected	Low	M

Footnotes: **NS2** - Not suspected due to lack of associated wetland habitat, floating moss mats, fens
NS3 - Not suspected due to lack of calcareous influence
NS4 - Not suspected due to lack of associated open habitat
NS5 - Not suspected due to lack of associated forest type
NS7 - Not suspected due to lack of subalpine or alpine habitat
NS8 - Not suspected/Has not been found on the KNF

High Potential = Habitat appears to be suitable and plant known from several occurrences on the KNF, or a known site is within one mile of analysis area boundary.

Moderate Potential = Habitat appears suitable and plant known on the KNF

Low Potential = Habitat appears to be suitable but plant is very rare on the KNF, or known occurrences on the forest are considerably distant or confined to specific geographic area.

Very Low Potential = Habitat appears suitable, but plant is not known to occur on the KNF.

Habitat Guilds: A=Aquatic, P=Peatland, DR=Deciduous Riparian, M=Moist Forest, D=Dry Forest, C=Cold Forested Subalpine, S=Subalpine Grassland

Sensitive species with low or no probability of occurrence in the project impact area will not be considered further in this analysis.

TABLE 3.76 – Known and Suspected Sensitive Plant Species in East Reservoir Analysis Area

COMMON NAME	SCIENTIFIC NAME	STATUS	POTENTIAL/FOOTNOTE
Taper-tipped Onion	*Allium acuminatum*	Known	Warland, 5-mile, Cripple
Upswept moonwort	*Botrychium ascendens*	Suspected	Moderate-High
Wavy moonwort	*Botrychium crenulatum*	Suspected	Moderate-High
Common clarkia	*Clarkia rhomboidea*	Suspected	Moderate
Clustered lady's-slipper	*Cypripedium fasciculatum*	***Suspected***	Moderate
Lichen	*Collema curtisporum*	Suspected	Moderate
Western pearl-flower	*Heterocodon rariflorum*	Known	Warland
Northern beechfern	*Phegopteris connectilis*	Suspected	Known in Davis

KNOWN SPECIES

***Allium* acuminatum:** This species was first discovered in 2011 during surveys for this project. There are extensive populations in Fivemile, Warland and Cripple Horse drainages on the southwest facing slopes in the dry types. Many of these areas are proposed for underburning.

Heterocodon rariflorum: The first known district population of western pearl-flower was located on the Libby District in June 2004. The site was in a dry, grassy-rocky opening located near the Koocanusa Reservoir. The plants were found growing in small depressions that provide a bit more shade and moisture than the surrounding vicinity. This type of micro-site can exist in many dry, grassy-rocky openings. Several more populations were observed in the Warland, Fivemile and Cripple Horse drainages during project surveys. These populations are found in areas proposed for underburning.

MODERATE-HIGH POTENTIAL

Populations of the Sensitive plant species *Botrychium ascenden,* and *B. crenulatum***,** have been found growing in roadsides across a variety of habitats. However, a few factors seem to be constant among all known roadside locations. All sites are in wetter habitats, as compared with open hillsides. Cedar, hemlock, subalpine fir and even spruce habitat types are very common at these sites. Also, shade is found consistently at all of these sites. Generally, there is shade in the mornings and early afternoons. This shade can be from vegetation growing along the roadside (alder, willow, etc.) or via the surrounding landforms. Plus, the slope of the road is never extreme; the actual location of the plants is generally in areas having slopes less than ten percent. And finally, the density of the ground cover is such that there are patches of exposed soil. There are a couple of occurrences north of the analysis area on the Fortine Ranger District.

These conditions can occur whenever a stream channel or a draw, crosses a road. Other situations where these conditions can be found are at roadside seeps (created by the cut-slope) or on any gentle stretch of road where shade and moisture conditions fall into the above parameters. No new populations were found during project surveys.

***Phegopteris connectilis* -** This species is typically found under older closed red cedar canopy in low gradient, braided riparian zones. The species has been found along a small meandering creek just outside of the project boundary in the Davis area. No populations of this species were found during project surveys.

MODERATE POTENTIAL

***Clarkia rhomboidea* -** This species has been found on the Cabinet and Three Rivers Districts of the KNF. It also has been found on dry open slopes on the Lolo Forest south of the analysis area. No populations of this species were found during project surveys. No populations have been found on the Libby District.

Cypridpedium fasciculatum - This species can be found in warm, dry mid-seral montane forests of grand fir and Douglas-fir. Elsewhere in its range it can be found in western red cedar habitats. No populations of this species have been found on the Libby District or in the East Reservoir analysis area.

ENVIRONMENTAL CONSEQUENCES

Design Features: refer to Table 2.34 in Chapter 2 of this DEIS for design feature regarding proposed, threatened, endangered and sensitive (PTES) plant populations.

ALTERNATIVE 1 (No-Action)

Direct and Indirect Effects

This alternative proposes no ground disturbing activity. The no-action alternative would have no direct or indirect effects to plants listed as known or suspected status in the preceding Table 3.73, since no activities would occur.

Cumulative Effects

The response of each of the PTES plant species to management activity varies by species, and in some cases, is not fully known. We do know that these rare plants and all the native vegetation of the KNF evolved with and are adapted to the climate, soils and natural processes that took place prior to settlement of this area by Europeans. Any management or lack of management that causes these natural processes to be altered may have a negative impact on native vegetation, including rare plants. An example of altered natural processes would be the removal of fire from the ecosystem. If Alternative 1 is selected and fire is continuously excluded from the analysis area, there could be a negative impact on PTES plant species due to an unnatural buildup of fuels, increased canopy closure with a resulting decrease in light to the forest floor, and a decrease in naturally occurring open meadows.

ALTERNATIVES 2 and 3

PLANT SPECIES in DECIDUOUS RIPARIAN HABITATS

Implementation of the action alternatives may impact individuals or habitat but willl not likely contribute to a trend toward federal listing or cause a loss of viability to the population or species for suspected species with moderate potential to occupy wetland, riparian or wet forest habitats (*Collemia curtisporum).*This species is a lichen found on cottonwood in moist riparian areas. Any activity that might affect cottonwood has the potential to affect this species although it was not found during surveys.

Key stressors affecting this species group include timber harvest (especially regeneration of late seral and old growth cedar and hemlock forests), prescribed fire, road and trail construction, and other activities that could impact populations either directly through loss of individuals or indirectly through canopy removal or ground disturbance that disrupts soil mycorrhizae. Air pollution and removal of large old trees may negatively affect lichens in this species group.

Stressors beyond FS control include short- and long-term climate change (which may increase the risk of desiccation due to increased and prolonged summer temperatures and/or drought conditions), and activities as described previously that occur or originate on other ownership lands. These are other stressors that may affect this species.

Direct Effects

No populations were discovered in the riparian habitats. These systems are protected by Inland Native Fish Strategy (INFS) and Riparian Habitat Conservation Act (RHCA) buffers in Alternatives 2 and 3. These required buffers are expected to protect potential sensitive plant habitat from direct effects of activities by restricting activities in riparian and wetland habitat. The retention of all cottonwood is prescribed for silvicultural prescriptions.

Proposed road storage may affect both the habitat in which these species occur and any potential habitat

for these species by causing subtle hydrologic changes. These activities are intended to restore more historic habitat conditions to riparian and wetland systems, and is expected to help offset negative effects to riparian and wetland habitat caused by previous road building.

Indirect Effects

- Management actions that alter hydrologic regimes.
- Alterations to riparian plant community succession through vegetation manipulation.
- Changes to natural disturbance regimes such as flooding.

Refer to the chapter on watershed concerns for areas where hydrologic regimes may be altered. Potential flooding in areas where trees are removed may kill some cottonwood but the harvest units should be spread out enough not to cause severe flooding.

There are no known populations of rare plants within any proposed treatment units, road locations or stream channels so it is anticipated that there would no effects to PTES plant populations.

Cumulative Effects

Some PTES plant species may have previously occupied suitable habitat in the analysis area. Past timber harvest, reforestation, road construction and recreational activities in the analysis area on lands of all ownership has likely had detrimental effects to potential habitat for some of the previously mentioned species to an unknown extent. Wetland and riparian habitat on private land would continue to be threatened by these activities. The INFISH and RHCA buffers applied to wetland and riparian areas in the East Reservoir analysis area would greatly reduce the potential for proposed activities to contribute to cumulative effects to the previously mentioned species or their habitat. These buffers are expected to help protect sensitive plant populations and potential habitat by minimizing direct and indirect effects to wetland and riparian habitat. Cumulative effects from project activities are not expected to threaten the presence or viability of riparian and wetland species within the analysis area.

SENSITIVE PLANTS in MOIST FOREST AREAS

Implementation of the action alternatives may impact individuals or habitat but will not likely contribute to a trend toward federal listing or cause a loss of viability to the population or species for suspected species with moderate potential to occupy roadsides or moist forest habitats (*Botrychium ascendens* (upswept moonwort), *Botrychium crenulatum* (wavy moonwort)).

Direct Effects

Road maintenance and use may directly affect plants or potential habitat of *Botrychium ascendens* and *Botrychium crenulatum* since they tend to occur along roads in moist habitat. Mechanical disturbance during road storage activities may injure or kill sensitive plants and alter potential habitat. Logging activities that disturb areas along roadsides can also injure or kill plants. There is a chance that these species could occur adjacent to riparian areas. These required buffers are expected to protect potential sensitive plant habitat from direct effects of activities by restricting activities adjacent to riparian habitat.

No plants were observed during project surveys and past survey so direct effects from project activities are not expected to threaten the presence or viability of these species within the analysis area.

Indirect Effects

The possible indirect effects relate only to potential habitat for sensitive species, since this species is not known to occupy the analysis area. Therefore, the East Reservoir project activities are not expected to threaten the presence or viability of this species within the analysis area.

Road maintenance and use during project activities may alter potential habitat of sensitive species, which

occupy roadsides. Road storage may reduce the availability of potential habitat for these species. Indirect effects of the East Reservoir project on potential habitat for these species is not expected to threaten the presence or viability of these species within the analysis area because the plants are secure in habitat in other locations and none were found in the area during surveys.

Cumulative Effects

Road building can mimic natural processes that provide opportunity (bare soil) for colonization by these sensitive species. Subsequent road maintenance activities can be beneficial or detrimental, depending on the nature and degree of disturbance. Disturbance from road building, maintenance and use on lands of all ownership in the East Reservoir analysis area has caused many acres to become infested with noxious weeds, reducing opportunity for sensitive species to colonize and inhabit roadsides.

Herbicide use for weed control could injure or kill roadside sensitive species, depending on the species and the herbicide used. Weed spread is an expected result of East Reservoir activities, and of all foreseeable activities on lands of all ownership, further compromising potential habitat for these species. The amount of potential habitat that would be affected cannot be predicted. Weed design features (described in Chapter 2) are expected to reduce, though not eliminate, the effects of additional weed infestation. Road storage activities may reduce the availability of potential habitat for these species. The degree to which the activities of the East Reservoir project would contribute to cumulative effects of weeds on potential habitat cannot be quantified. Cumulative effects of the East Reservoir project to potential habitat for these species are not expected to threaten their presence or viability within the analysis area. The plants are secure in their habitat in other locations and none were found during surveys for this project

Phegopteris connectilis

Phegopteris connectilis (northern beechfern), is found just outside the analysis area along low gradient braided stream. This type of habitat is fairly common in the Davis Mountain area of the project.

Direct Effects

Riparian areas were surveyed in units 317, 318 and 319 in the Davis mountain area and no plants were identified but the habitat is present and there is a high likelihood the plants could occur. These units have been designed with RHCAs that should reduce the potential for impact to unobserved northern beechfern populations.

Indirect Effects

Harvest activities have the potential to change hydrologic regimes in the low gradient areas. This plant seems adapted to small flooded and braided streams so if water flow is increased temporarily by harvesting it should not adversely impact habitat.

Cumulative Effects

These cumulative effects are similar to those described for species in deciduous riparian habitat. Implementation of the action alternatives may impact individuals or habitat but will not likely contribute to a trend toward federal listing or cause a loss of viability to this species or population.

SENSITIVE PLANTS in DRY FORESTS or OPEN AREAS (along RIDGES and in the FOREST)

The Proposed Action, (Alternative 2) and Alternative 3, may impact individuals or habitat but will not likely contribute to a trend toward federal listing or cause a loss of viability to the population or species for the sensitive plant listed in the table as suspected with a moderate potential to occupy dry forested or open habitat, (*Clarkia rhomboidea* (common clarkia) and *Cypripedium fasciculatum* (clustered lady's-slipper)). These species are not known to occur in the East Reservoir analysis area, and were not observed during sensitive plant surveys.

Direct Effects

Since this sensitive plant species is not known to occur in the analysis area, it is assumed there would be no direct effects to this species. If some plants were undetected they could possibly be affected by activities in the dry habitats.

There is over 12,000 acres of fuel treatment and burning and over 2,500 acres of improvement harvest in dry types. The use of prescribed burning for fuels reduction or site preparation for reforestation would influence potential sensitive plant habitat. In general, the sensitive plants that inhabit dry forest types are adapted to fire, and low intensity fire would increase habitat suitability for these plants. These activities have the potential to directly impact individuals and habitat for these species. Road construction and storage efforts in dry habitat could also impact individuals or habitat.

Indirect Effects

Indirect effects may influence potential habitat for sensitive species. Ground disturbance from harvest and road storage activities would remove vegetation and expose bare mineral soil. Several sensitive species are adapted to colonization of disturbed soil, but noxious weed species that now reside throughout the analysis area have the advantage. The possibility of weed migration into potential sensitive plant habitat would be increased, reducing opportunities and habitat suitability for sensitive species. Adherence to design features for noxious weeds in the East Reservoir analysis area (see Chapter 2) would be helpful in reducing indirect effects of weed encroachment, though would not preclude weed encroachment. Please refer to potential weed impacts described in regard to *Allium acuminatum* a rare plant that has been found on dry types in the analysis area.

These possible indirect effects relate only to potential habitat for sensitive species, since these species are not known to currently occupy the analysis area. Therefore, the East Reservoir project is not expected to threaten the presence or viability of these species within the analysis area.

Cumulative Effects

It is likely that timber harvest, reforestation and road construction activities in the analysis area on lands of all ownership have affected some sensitive plants and potential habitat. In some cases, these activities may have created disturbances reflecting natural processes that provide opportunity for colonization by sensitive species. Disturbance from activities on lands of all ownership in the East Reservoir analysis area has caused many acres to become infested with noxious weeds, reducing opportunities for sensitive species to colonize disturbed areas. Weed spread is an expected result of East Reservoir activities, and of all foreseeable activities on lands of all ownership, further compromising potential habitat for sensitive species. The amount of potential habitat that would be affected cannot be predicted. Weed design features (Chapter 2) are expected to reduce, though not eliminate, the effects of additional weed introduction. The extent of previous and future effects of weed invasion cannot be quantified, though is likely considerable. The degree to which the East Reservoir project would contribute to these effects is unknown.

Timber harvest and road construction is expected to continue to affect these plants and their habitat. Road construction proposed on FS lands in the East Reservoir analysis area is minimal, and not expected to contribute to cumulative effects to these plants. Road storage, proposed in all action alternatives, may also result in negative cumulative effects; but overall is expected to improve habitat suitability by reducing weed migration into potential habitat. Basal area and fuels reduction in dry forest habitats would help to restore more historic overstory conditions in potential habitat for sensitive plants that occupy dry forest types.

Heterocodon rariflorum

Direct Effects

Heterocodon rariflorum (western pearl flower) generally occurs in dry forests but is located in vernally moist seepages or rocky cliffs where there might be seasonal pooling of shallow water. This species was located within Fuel and Wildlife Units FW524, FW522, FW50602 and FW533 in the East Reservoir

analysis area One occurrence is in an old ditch on a dry open site in the Warland drainage and in vernally moist areas in Blue Sky Creek Area and Southern exposures in the Warland drainage. Moisture gathers in these areas in the spring and doesn't dry as quickly as adjacent sites. Both action alternatives (2 and 3) would have similar impacts to known populations. Direct impacts could occur during burning activities. Although effects of burning are unconfirmed there is a possibility that this plant would be unaffected or only temporarily affected since it has likely evolved with periodic disturbance caused burning. There is an additional 4,483 acres of fuel treatment and burning in the following units that are located in suspected habitat for this rare plant: FW502, FS503, FW53403, FW340, FW3402, FW51101, FW51102, FW51103, FW5111, FW5109 and FW540. This plant is also suspected to occur in harvest Units 18, 157 and 158. Logging could impact individuals during skidding operations but would not affect viability of the species since it also occurs in adjacent areas where only prescribed burning would occur.

Weed spraying of noxious weeds, if not done carefully, can kill other forbs such as this small plant.

Indirect Effects

There are currently several weed species in and adjacent to the plant location. Indirect effects would likely result from the introduction and spread of undesirable non-native species. Weed species are already abundant on many roads and on the dry land types in the analysis area. Ground disturbing activities from timber harvest, burning, as well as road storage activities would remove vegetation and expose bare mineral soil. Though many native species are adapted to colonizing disturbed soil, noxious weed species now residing throughout the analysis area have the advantage. Weed infestations are adjacent to almost every proposed activity area. The seed bank in native communities may already contain weed seeds that would take hold when conditions, such as soil disturbance, permit. Machinery is likely to be a primary vector, bringing weed seeds from infested roads or portions of units into native communities. Even revegetation along roads and skid trails would have effects to the native community, as nonnative, potentially invasive species can be introduced in seed mixes. Please see the discussion that addresses weed concerns for *Allium acuminatum* which is also found in all units where the pearl flower has been found.

Cumulative Effects

Additional activities in the area are likely to exacerbate negative effects to the rare plant habitat caused by past activities. In particular in the location of this population is the potential increase in ATV use when adjacent areas are logged and opened up next to a highly used recreational area. ATVs can spread weeds as well as trample plants. Implementation of the action alternatives may impact individuals or habitat but will not likely contribute to a trend toward federal listing or cause a loss of viability to this species or population because the plant is secure in its habitat in other locations. Current grazing and potential grazing in the Fivemile and Warland drainages has the potential to spread weeds. If cows graze on the dry open slopes, there is the potential for trampling damage and grazing of the rare plant. Typically, cows stay along the road and in the shadier, moister sites. Some grazing management can be used to reduce potential impact to the western pearl flower. Keeping cattle off the site is the best way to prevent damage.

Allium acuminatum

Direct Effects

This species is generally found on open dry types, which are quite common on the lower south and west facing slopes of the analysis area. The species is thought to be adapted to periodic fire since they occur in habitats that were subject to historic periodic burning every 10-20 years (Odegard 2011). This species had never been previously identified on the KNF. Several new locations of *Allium acuminatum* (taper-tipped onion) were located in the summer of 2012 during project plant surveys. This onion was located within Fuel and Wildlife Units FW50602, FW524, FW522, FW533, FW340, FW53401 and FW53402 and proposed harvest Unit 20 which is both in Alternative 2 and 3. There is an additional 5,566 acres of fuel treatment and burning in the following units that are located in suspected habitat for this rare onion: FW53403, FW502, FW503, FW51101, FW51102, FW51103, FW551103, FW5111, FW5109 and

FW540. Harvest Units 157,158, 18, 2B and 2D are also suspected habitat for taper-tipped onion. Plants were not found during field surveys but plants may have been missed. Skidding operations and weed infestation could impact plants and habitat in these units but should not affect overall viability since there are plants in adjacent burn only areas. All effects are similar for both action alternatives (2 and 3).

Burning can have the direct impact of killing the flowering portion of the plant. However, most onions can regenerate vegetatively from bulbs or by seeds sexually produced by pollination and fertilization (USDA FEIS, 2012). As stated previously, the burning is likely a disturbance that the plant is used to and may actually prepare a seed bed if burning occurs in the spring. Road building and timber harvesting can also directly impact plants and habitat. It appears that this species occurs primarily on high energy sites and doesn't thrive as well under a canopy cover. There are no new roads proposed in the onion habitat. There is some tree removal planned in some of the fuel units. There is a chance that the harvest may impact some individual plants.

ATV use has the potential to impact individual plants especially in FW533 which is located next to a heavily used recreational site.

Weed spraying of noxious weeds, if not done carefully, can kill other forbs such as this onion.

Indirect Effects

There are currently several weed species in and adjacent to the onion locations. *Centaurea maculosa, Hypericum perforatum, Potentilla recta, Bromus tectorum,* as well as others in the mustard family have been identified in the onion habitat. Indirect effects would likely result from the introduction and spread of undesirable non-native species. Weed species are already abundant on many roads and on the dry land types in the analysis area. Ground disturbing activities from timber harvest, burning, as well as road storage activities would remove vegetation and expose bare mineral soil. Though many native species are adapted to colonizing disturbed soil, noxious weed species now residing throughout the analysis area have the advantage. Weed infestations are adjacent to almost every proposed activity area. The seed bank in native communities may already contain weed seeds that would take hold when conditions, such as soil disturbance, permit. Machinery is likely to be a primary vector, bringing weed seeds from infested roads or portions of units into native communities.

In general, most rare plants are adapted to fire, tolerant of fire or indifferent to fire, especially in our fire disturbance driven areas in northwest Montana (Owen 2000). Since fire may be an important component for propagation of the onion, burning may be viewed as a positive impact to its habitat.

However, concern for weed spread requires a well-thought out plan to control weed spread along with the burning program. *Bromus tectorum* is especially able to take advantage of burned sites. It is a prolific invader and able to germinate in spring and fall and out-compete natives in the spring (Pellant 1996). A study on the effects of the spread of *Potentilla recta* on site north of the analysis area suggests that prescribed fire can have a positive effect of the spread and germination of weeds (Lesica and Martin 2003).

In an effort to address the concerns of weed spread the district would develop a decision matrix for treating all of the proposed burning treatments that addresses potential weed spread. Rice and Gauer (2008) found that a combination of herbicide treatments, in conjunction with the burning, could result in no net gain of noxious weeds. A well-thought out plan to limit weed spread and continue with the use of fire is the best strategy for these dryland habitats. Refer to the project file for the draft Decision Matrix for fuel treatment in the East Reservoir analysis area.

Cumulative Effects

Additional activities in the area are likely to exacerbate negative effects to the rare plant habitat caused by past activities. In particular, in the location of this population, is the potential increase in ATV use when adjacent areas are logged and opened up next to a highly used recreational area. ATVs can spread weeds as well as trample plants. Logging and continued road use and weed spraying in the East Reservoir area have the potential to cumulatively affect habitat and individual onion plants. Overall if management features are followed, the proposed action and the action alternatives may impact individuals or habitat but will not likely contribute to a trend toward federal listing or cause a loss of viability to the population. Current grazing and potential grazing in the Fivemile and Warland drainages has the potential to spread weeds. If cows graze on the dry open slopes there is the potential for trampling damage and grazing of the rare plant. Typically, cows stay along the road and in the shadier, moister sites. Some grazing management can be used to reduce potential impact to the taper tipped onion. Keeping cattle off the site is the best way to prevent damage

NATIVE PLANT COMMUNITIES

In general, the effects to other native plant communities are similar to the effects described for the sensitive plants described in this chapter. The Noxious Weed Section of the DEIS addresses the general concern and impacts of weed spread.

PROPOSED, THREATENED, ENDANGERED and SENSITIVE PLANT SPECIES BIOLOGICAL ASSESSMENT/EVALUATION

Consultation Requirements for Threatened and Endangered Species

In accordance with the Endangered Species Act, it's implementing regulations, and FSM 2671.4, the KNF is not required to initiate formal consultation with the FWS regarding the determination of no effects to the threatened water howellia and Spalding's catchfly; and is not required to request written concurrence from the FWS with respect to the determination of "no effect".

Table 3.77 summarizes the biological assessment/evaluation for the six plant species considered in this analysis.

Table 3.77 - Summary of Effects to Known and Suspected Sensitive Species

COMMON NAME	SCIENTIFIC NAME	CONCLUSION	RATIONALE
Taper-tipped onion	*Allium acuminatum*	May Impact**	Known
Upswept moonwort	*Botrychium ascendens*	May Impact**	MI 1
Wavy moonwort	*Botrychium crenulatum*	May Impact**	MI 1
Common clarkia	*Clarkia rhomboidea*	May Impact**	MI 2
Western pearl flower	*Heterocodon rariflorum*	May Impact**	Known
Northern beechfern	*Phegopteris connectilis*	May Impact**	MI 1
Clustered lady's-slipper	*Cypripedium fasciculatum*	May Impact**	MI 2
Lichen	*Collema curtisporum*	May Impact**	MI2

*****No Impact expected N1 no activities proposed in potential habitat N2 low potential for occurrence in analysis area
******May impact individuals or habitat, but will not likely contribute to a trend towards federal listing or cause loss of viability to the population or species.
MI 1 High potential for occurrence: Proposed activities may impact potential habitat or individuals not detected in surveys.
MI 2 Moderate potential for occurrence: Proposed activities may impact potential habitat or individuals not detected in surveys.

CONSISTENCY with the FOREST PLAN and other MANAGEMENT DIRECTION

This project is in compliance with FS policy on sensitive species (FSM 2670.32) and the Endangered Species Act relative to PTES plant species. The FS is mandated to maintain viable populations of all native and desirable non-native species under the National Forest Management Act. Clause R1-C6.251#, Protection of Habitat of Endangered Species, will be used in the timber sale contract to modify the action as necessary to protect PTES plant populations in the event that they are missed by field surveys and found after the timber sale contract is awarded.

Consultation Requirements for Threatened and Endangered Species
In accordance with the Endangered Species Act, it's implementing regulations, and FSM 2671.4, the KNF is not required to initiate formal consultation with the FWS regarding the determination of no effect to the threatened water howellia and Spalding's catchfly; and is not required to request written concurrence from FWS with respect to the determination of "no effect".

Need for Re-Assessment Based on Changed Conditions
The findings of this report are based on the best data and scientific information available at the time of preparation. This project underwent several changes throughout the field season so it was impractical to survey at that time. If new information reveals effects that may affect threatened, endangered, proposed or sensitive species, or their habitats, in a manner or to an extent not considered in this assessment; if the proposed actions are subsequently modified in a manner that causes an effect that was not considered in this assessment; if sensitive species are found to occupy activity areas, or if a new species is listed or habitat identified that may be affected by the actions, a revised biological assessment should be prepared.

WILDLIFE INTRODUCTION

The Kootenai National Forest (KNF) provides habitat for over 300 different species of wildlife (KIPZ Analysis of the Management Situation USDA Forest Service 2003b 49 59-64), many of which occur on the Libby Ranger District and within the Cripple Planning Subunit (PSU) (analysis area). The presence or absence of these wildlife species depends on the amount, distribution and quality of each animal's preferred habitat. In addition to habitat changes, many of these animals are impacted by hunting or trapping. Montana Fish, Wildlife & Parks (MFWP) regulates game animal populations. The Forest Service (FS) and MFWP work together to ensure that an appropriate balance is maintained between habitat capability and population numbers. The FS also works closely with the U.S. Fish & Wildlife Service (FWS) to assist in the recovery of animals listed under the Endangered Species Act (ESA). Proposed federal projects that have the potential to impact species protected by the ESA require consultation with the FWS.

For the purpose of this Environmental Impact Statement (EIS), a number of wildlife species were selected for detailed analysis. The species chosen represent a combination of fine filter (species specific) and coarse filter (management indicator species) analyses. The FWS requires that endangered, threatened and proposed species be included in an effects analysis. The Regional Forester designates sensitive species. Any effects to sensitive species present or potentially present in a project area must be disclosed. Management Indicator species (MIS) are identified in the Kootenai Forest Plan (1987 Appendix 12) and represent a particular habitat or habitat complex. Each MIS represents a group of species that share common habitat components required for sustained growth and successful reproduction. Other species that would not be affected by any of the alternatives are reviewed, but not discussed in detail. The wildlife portion of this chapter is divided into seven sections: old growth, snags, down woody debris, MIS, other species of interest, sensitive species, threatened and endangered species, and migratory birds.

The bounds of analysis for each species were determined using the viability analysis concepts described by Ruggiero et al. (1994). Species viability is tiered to the forest-wide conservation plan (Johnson 2004).

The wildlife analyses include the baseline conditions (created by all past management practices and natural events); direct, indirect and cumulative effects of the proposed actions; and cumulative effects of reasonably foreseeable projects (Chapter 3, pg.1 to 7). The analyses are based on a review of Forest and District records, a thorough review of the best relevant scientific information, a consideration of responsible opposing views, an acknowledgment of incomplete or unavailable information and recognition of relevant scientific uncertainty.

OLD GROWTH

Data Sources, Methods, Assumptions, Bounds of Analysis

Management and characteristics of old growth (OG) and stand attributes necessary for a stand to be considered old growth are discussed and summarized in the Kootenai National Forest Plan (KNFP Appendix 17 FP II-1 7 22 FP III-54); Green et al. (1992); Pfister et al. (2000); Kootenai Supplement No. 85 to FSM 2432.22 (1991); Castaneda (2004). That information is incorporated by reference. Data sources to identify old growth stands include District files and surveys, the KNF old growth GIS layer developed from stand-level old growth inventory that is aggregated and summarized at the Forest scale, and the Forest Inventory and Analysis (FIA) data that collects and reports data at the Forest scale.

Field verification of OG has occurred. Stands were inventoried using one of the procedures developed for use on the Libby Ranger District (Old Fisher River Old Growth Process Paper, USDA 2003a). This survey procedure, developed by Gary Altman (Altman 1990) and used from 1990 to 2000, rates the structural features of OG forests as defined in the KNFP (Appendix 17 KNF Integrated Plan 1987). Some more recent surveys use the KNF old growth protocol surveys. For the Cripple PSU, old growth acres were updated in 2003. Final acreages may be different if additional suitable replacement stands are found

during field reconnaissance for the East Reservoir Project. Forestwide acres displayed in Table 3.57 are as of April 2008.

The KNFP identified the pileated woodpecker as the MIS for old growth habitat (KNFP-Vol II Appendix 12-1). For effects to OG associated wildlife species, refer to the pileated woodpecker analysis in the MIS section of this document.

Criteria used, when applicable, to compare the alternative impacts on old growth include:
1) Acres of vertical structure removed. These are the acres of direct harvest in designated old growth. This includes both effective (OG) and replacement old growth (ROG).
2) Acres of harvest in undesignated effective old growth (OG).
3) Road length built adjacent or through designated old growth (in feet).
4) Number of proposed units adjacent to old growth.
5) Acres of edge effect in old growth.
6) Acres of interior habitat remaining in old growth.
7) Acres of additional old growth designated.
8) Acres treated to maintain old growth characteristics or trend toward old growth.
9) Percent of designated old growth (OG/ROG) in the PSU.

Current edge effects were determined by buffering existing regeneration harvest units (TSMRS activity codes 4100-4134) that are ≤ 30 years old and bordering OG stands by 300 feet (three tree heights- Russell et al. 2000 134; Harris 1984 110-111; Morrison et al. 1992 84; Province of BC 1995 App 1; Ripple et al. 1991 79). On the KNF, the average old growth tree height across OG types is 100 feet (KNF TSMRS). Effects of alternatives were determined by using the same buffer on proposed regeneration units that border old growth stands.

Direction for maintaining 10% old growth below 5,500 feet in each third order drainage or compartment, or combination thereof, or by planning subunit is contained in the KNFP (Appendix 17, FP II-1, 7, 22, FP III-54), Kootenai Supplement No. 85 to FSM 2432.22 (1991), and Castaneda (2004). That information is incorporated by reference. Old growth has been previously analyzed by timber compartment and OG compartment and this process is also described in USDA 2003a and USDA 2003b. Table 3.57 summarizes the designated and undesignated status of the OG and ROG acres within compartments located in the Cripple PSU and the KNF situation. The analysis boundary used for the displaying the East Reservoir project impacts and cumulative effects to old growth is the Cripple PSU, based on Castaneda (2004), while viability of the OG resource and its MIS species are analyzed at the Forest level. The temporal boundary for cumulative effects on OG ranges from approximately 100 to 300 years depending on vegetation response units (VRUs) and tree species (lodgepole pine versus spruce or larch etc.) present within those VRUs.

AFFECTED ENVIRONMENT/EXISTING CONDITION

Existing conditions are a result of historic timber harvest and wildfires. Timber harvest and fire history are discussed in the Cripple NFMA assessment (USDA 2010), and the vegetation section of the EIS. Existing old growth surveys within the Cripple PSU have identified approximately 9,262 acres of designated and undesignated old growth less than 5,500 feet in elevation.

See the old growth map (Map 10) in the map section of this document for location of old growth stands within the PSU. Of the 9,262 acres, designated/undesignated effective old growth totals 1,203 acres, and designated/ undesignated ROG totals 8,059 acres. Replacement is the minimum acres required to be designated to meet KNFP standards. Designated old growth stands in the analysis area generally support the habitat conditions described in “Old Growth Forest Types of the Northern Region” (Green et al. 1992, errata corrected 02/2005).

Table 3.78 - Old Growth Acres Under ≤5500 Feet Elevation NFS Lands in Cripple PSU and Forestwide

EXPRESSED as ACRES and (PERCENT)											
	TIMBER COMPARTMENT									PLANNING SUBUNIT	NATIONAL FOREST
	556	557	558	559	560	561	562	563	564	Cripple	Kootenai
Total NFS lands	7,083	13,073	8,064	9,492	14,083	4,596	7,643	8,879	5,409	78,607	1,869,222
Total NFS lands below 5,500 feet elevation	7,025	12,064	7,916	8,844	13,964	4,596	7,454	8,622	5,351	76,083	186,922
Minimum acreage designation required by KNFP	702	1,206	791	884	1,396	459	745	862	535	7,608	138,902
DESIGNATED OG											
Effective OG	187	285	37	106	108	221	197	47	0	1,192	138,902
Replacement OG	629	1,094	988	791	1,658	435	696	668	364	7,341	62,605
Total OG and ROG	816 (11.6)	1,379 (11.4)	1,025 (12.9)	897 (10.1)	1,766 (12.6)	656 (14.3)	893 (11.9)	715 (8.6)	364 (6.8)	8,533 (11.2)	221,065 (11.8%)
UNDESIGNATED EFFECTIVE OG AND ROG											
Effective OG	0	0	0	0	0	0	11	0	0	11	61,192 (3.3%)
Replacement OG	259	257	202	0	0	0	0	0	0	718	36,229 (1.9%)
TOTALS											
Total Designated and Undesignated DEFF	187	285	37	106	108	221	208	47	0	1,203	201,577 (10.8%)
Total Designated and undesignated ROG	888	1,351	1,190	791	1,658	435	696	668	364	8,059	97,717 (5.2%)
All OG <5,500 feet	1,075 (15.3)	1,636 13.6)	1,227 (15.5)	897 (10.0)	1,766 (12.6)	656 (14.3)	904 (12)	715 (8.3)	364 (6.9)	9,262 (12.1)	299,294 (16.0%)

NFS – National Forest Service **All numbers in ( ) are percentages %**

The 2011 Forest Plan Monitoring Report (FY2010, August 2011) indicates the KNF has 1,869,222 acres below 5,500 feet elevation (minus lakes and highways). Using the stand-level data, there are currently 201,577 acres or 10.8% of KNF acres below 5,500 feet that are OG (designated or undesignated). An additional 97,717 acres are replacement old growth (designated and undesignated). Forestwide, OG or ROG on the KNF totals 299,294 acres or 16.0% of acres below 5,500 feet based on the stand-level data.

As described in the Monitoring Report, the FIA data is summarized forestwide and does not measure old growth based on the criteria in the KNFP. The FIA data estimates effective OG forestwide at 9.0% of the Forest, with a 90% confidence interval of 7.2% to 10.9%. The acres of OG from the stand-level inventory are just within the confidence interval for the FIA data. FIA estimates for old growth cannot be used to determine whether or not the Forest is meeting the Forest Plan standard for OG. The FIA estimate is for all forest lands (not only lands <5,500 feet in elevation) and does not include lands managed as replacement old growth.

The estimate from FIA is helpful, however, in comparing to the old growth GIS layer used by the Forest for managing OG. Also, to account for changes from when the FIA data was collected (1993 to 1995), any plots with disturbance (e.g. wildfire) were excluded from consideration as OG. This is a conservative estimate, since some wildfires may not have affected OG characteristics and the FIA may underestimate the amount of old growth, since not all disturbances would necessarily result in a reduction of old growth.

In addition Kootenai Supplement (Supplement 85, 1991) to Forest Service Manual 2400 describes the validation process to be conducted on a compartment basis before the Forest conducts management activities that could affect old growth habitat. Validation, as defined in the Manual, is "on-the-ground verification." Field verification has and is occurring on the Libby Ranger District and this is felt to be a more accurate representation of the old growth available. The FY 2011Monitoring Report indicates the Forest is meeting its Forest Plan requirements for managing 10% of the forest as old growth habitat well distributed across KNF lands below 5,500 feet elevation.

The Cripple PSU totals 92,544 acres, with 90,226 acres below 5,500 feet (76,083 acres of NFS and 14,143 acres of other state or private lands). Old growth stands on Corporate timber land and State lands have been harvested, and the 9,262 acres of OG remaining on NFS lands <5,500 feet is approximately 10.3% of all lands <5,500 feet within the PSU, regardless of ownership. As shown in Table 3.57, across the KNF, the percent of NFS acres designated as an old-growth management area (MA13) is 11.8%. The present allocations within the Cripple PSU of 12.1% are above Forest Plan direction as clarified in FSM 2432.22. Over 5,500 feet within the Cripple PSU, 34 acres have been designated as OG (designated effective, replacement and unknown). Old growth stands in the analysis area are mainly composed of old larch, ponderosa pine and Douglas-fir, and other conifers. There are several areas of large contiguous old growth blocks in the PSU, as well as some isolated and fragmented old growth stands. Field verification of all stands identified as MA 13 within the Cripple PSU was completed (fall 2011).

Stands with OG character and least fragmentation in the analysis area have been allocated to MA 13 or other old growth MAs. Replacement old growth stands were designated to provide OG in the future within the PSU. Replacement old growth above the KNFP standard was identified to provide connectivity between effective OG stands, or to conserve areas with a component of OG micro-sites and evidence of ecological continuity. Those inventoried stands best meeting old growth definitions were allocated to old growth MAs. Old growth management area designations within the PSU have been delineated to conserve the best old growth attributes available; and to provide the best distribution, size, habitat type and quality of what is available. These old growth areas are composed of old growth stands that are physically connected to other old growth stands where possible, or are interconnected to adjacent old growth stands with connector stands composed of 100+ year old age classes where possible.

Block Size

There are a total of 8,533 acres designated (MA13) for OG management. These acres are in 98 blocks ranging from 1 to 431 acres in size. Fifty-two designated OG blocks are greater than 50 acres in size.

When undesignated OG and ROG stands are considered in conjunction with designated stands, there are a total of 9,296 acres (above and below 5500 feet) in block sizes ranging from 1 to 433 acres. Of these, 52 blocks (53%) are greater than 50 acres in size. The larger blocks provide interior habitat and connectivity within the areas of National Forest System (NFS) lands.

Stands smaller than 50 acres in size were designated to protect additional attributes unique to old growth where they exist in the PSU. They were designated based on recommendations in Morrison et al. (1992 85), where they state *"it is vital to recognize that in heavily fragmented landscapes, the last remaining patches of older or forested vegetation may play an important role. The patches may act as stepping stones for dispersal of many species associated with the specific environmental conditions throughout the landscape. Removal of such patches because they fail to meet criteria for size and provision of interior conditions may result in a network of dispersal for wildlife being severed in the landscape".* These stands are largely surrounded by multi-aged stands that provide corridor links to larger blocks of old growth.

Current block size of old growth is largely the result of past timber harvests and 100 years of wildfire suppression, leaving some areas with relatively small, isolated blocks of interior old growth and other areas with an abundance of old growth due to lack of access. In many areas, functional old growth stands are limited to drainage bottoms where logging activities were more restricted. Likewise, federal

regulations on regeneration opening size and proximity of openings resulted in un-natural square blocks of harvest areas. This practice in turn resulted in a reduction of large interior blocks of old growth and a checker-board effect of cover versus openings across the landscape.

Distribution
Table 3.79 shows the distribution of old growth (< 5500' elevation) by VRU. Old growth is well distributed across the vegetation types.

Table 3.79 - Old Growth (≤5500' elevation) Distribution by VRU NFS Lands in the Cripple PSU

VRU	HRV % OG \1	NFS LANDS VRU acres (%)	DESIGNATED OG acres (%)	UNDESIGNATED OLD GROWTH acres (%)	TOTAL OG \2 (UNDESIGNATED and DESIGNATED) acres (%)
1	10-70	832 (1.1)	58 (7.0)	0	58 (7.0)
2	20-50	18,322 (23.3)	2,780 (15.2)	384 (2.1)	3,164 (17.3)
3	15-40	17,491 (22.3)	1,826 (10.4)	146 (0.83)	1,972 (11.3)
4	10-40	8141 (10.4)	566 (7.0)	80 (0.98)	646 (8.0)
5	25-55	947 (1.2)	16 (1.7)	13 (1.4)	29 (3.1)
7	15-45	22,452 (28.6)	2,815 (12.5)	94 (0.42)	2,909 (13.0)
9	5-10	10,271 (13.1)	447 (4.4)	12 (0.12)	459 (4.5)

\1 USDA Forest Service 1999: stands > 150 years old \2 remaining 25 acres is VRU XX5 (water)

These designated OG stands represent the best distribution of old growth habitat that remains in the PSU (following KNFP direction), recognizing that these areas and their boundaries may change due to natural events such as windstorms, epidemic insect infestations and stand replacement fires.

Stand Structure
Old growth stand structure is described by Green et al. (1992 errata corrected 2005). That information is incorporated by reference. In summary, Green identifies three structural stages that are useful in describing old growth. They are late seral single story (e.g. ponderosa pine, Douglas-Fir, lodgepole pine sites); late seral multi-story (e.g. larch, western white pine) and near climax (e.g. cedar, grand fir, sub-alpine fir sites). Stands identified as OG contain one of these structure stages described by Green.

Disturbance
Within existing designated OG, there are approximately 30 miles of local roads. Of these, 1.4 miles are restricted seasonally, 11.9 miles are restricted yearlong, 10.4 miles are open yearlong, 4.9 miles are impassable; and there are approximately 37 miles of motorized trails. These roads/trails either bisect or are adjacent to old growth stands. Roads allow for potential access by firewood cutters to remove standing snags. There are 136 areas where existing regeneration units (stands < 30 years old) are adjacent to old growth. These units create an edge influence on about 1,744 acres of old growth.

ENVIRONMENTAL CONSEQUENCES/EFFECTS

Table 3.80 displays a comparison of effects to old growth habitat by alternative. These criteria are discussed under each alternative.

Table 3.80 - Summary of Measurement Criteria to Evaluate Effects to Old Growth Alt 1 = Existing Condition (by acres)

MEASUREMENT CRITERIA	ALT 1	ALT 2	ALT 3
Vertical structure removed in designated OG/ROG	25	137	0
Vertical structure removed in undesignated OG	N/A	43	0
Road length (feet) existing/built adjacent/through designated OG/ROG	158,400	+666	+666
Number of existing or proposed regeneration areas/units adjacent to old growth	136	+28	+23
Acres of edge influence in old growth	1,744	+250	+241

MEASUREMENT CRITERIA	ALT 1	ALT 2	ALT 3
Acres of interior habitat remaining in old growth remaining	7,518	7,268	7,277
Acres of additional old growth designated	0	0	0
Acres treated to maintain OG or trend stand toward OG (burning)	N/A	1,326	0
Percent of designated old growth in Sub-Unit (OG+ROG)	11.2	11.2	11.2

Management activities (including timber harvest, road construction, mining, etc.) have the potential to impact the function of old growth habitat or specific components of old growth, such as interior habitat and vertical structure. Activities may also allow noxious weed invasion.

Timber harvesting can affect adjacent OG stands by altering six microclimatic factors (solar radiation, soil temperature, soil moisture, air temperature, relative humidity and wind speed (Chen et al. 1995). Microclimatic changes lead to vegetative changes (e.g. species richness, diversity, structure, composition) (Russell and Jones 2001). Changes in vegetative conditions may lead to effects such as changes in wildlife species using the area, species abundance and higher predation (Askins 2000 pg.120) (see pileated woodpecker analysis). All these effects extend varying distances into the uncut stands depending on a number of variables (e.g. aspect, slope, elevation, wind speed and direction, etc.). While there is no single answer to how wide the area influenced by edge is (Chen et al. 1995), research (Harris1984; Russell et al. 2000; Morrison et al. 1992; Ripple et al. 1991; Province of BC 1995) has identified a three-tree height rule of thumb as the distance effects occur. Table 3.59 displays the acres of OG influenced by edge effects. The depth of influence is also related to time since harvest, with effects dissipating within 20 to 50 years, depending on the factor (Russell and Jones 2001; Ripple et al. 1991; Russell et al. 2000). In the Cripple PSU, average tree growth in regeneration units result in tree heights (20-50 feet) and densities (fully stocked stands) that reduce the depth of influence from edge effects after 30 years.

While changes in vegetation and wildlife use may occur on the acres influenced by edge, those acres remain functional old growth for some species. The old growth acres not impacted by edge effects provide interior habitat.

ALTERNATIVE 1 (No Action)

Direct and Indirect Effects

This alternative would have no direct effect on designated OG or associated plant and wildlife species (see pileated woodpecker discussion). The conditions for all nine measurement criteria (Table 3.59) would remain unchanged. No OG would be treated through timber harvest or prescribed burning. There would be no risks from these activities, such as soil compaction, weed introduction or modification of stand structure. All old growth areas would maintain their existing conditions, and continue to provide habitat for those species that utilize the area over the long-term. This analysis accounted for the possibility for snag removal in old growth, as well as other mature forest stands on all NFS roads, both open and restricted. Restricted roads are opened occasionally for personal firewood gathering (Table 3.61 in the Snag/Down Woody Debris Section – also applicable to Alternatives 2 and 3).

Opportunities to return fire into the drier types of old growth would still be taken under this alternative under other projects. These would assist in reducing the fuel loadings in these old growth types, increase forage on ungulate winter range, assist in the growth of retained trees, and create some large snags. Old growth stands left untreated under this alternative or by similar projects would be at greater risk of stand replacement in the event of wildfires and insect infestations.

ALTERNATIVES 2 and 3

Direct and Indirect Effects

Alternative 3 is similar to Alternative 1 in that no treatments of any kind are proposed in any category of old growth. Any changes to the composition and structure of old growth under Alternative 3 would be the result of natural processes such as insects, disease, or windstorms and wildfire.

While Alternative 2 would not result in a reduction of OG in any category, treatments are proposed in designated effective old growth (MA 13). All treatments are designed to maintain the large tree component of old growth but would temporarily remove varying amounts of the vertical structure. Management activities (removal of ladder fuels, prescribed fire) are proposed in 180 acres of effective dry-site old growth under Alternative 2. The purpose of these activities is to lessen the threat of stand removal by a wildfire and to maintain the integrity of the stand by lessening competition favoring large diameter trees. The outcome would be the maintenance of all old growth structure, function and health in the treated areas. This action alternative would better meet the purpose and need of this project than the No Action (Alternative 1) by treating more acres of habitat outside of existing projects.

Treatments are also proposed in designated replacement old growth (MA 13) under Alternative 2. Activities are designed to improve or preserve attributes that could develop additional old growth characteristics in the near future, as well as maintain the existing OG attributes in the treatment areas. Alternative 2 proposes 1,306 acres of ladder fuel reduction and prescribed fire in designated ROG. Presently, these stands lack enough large trees to be designated as effective old growth. Treatments would increase growth and vigor in the younger age-classes, which would enhance growth into the larger tree diameters.

Undesignated ROG would be managed by proposed activities under Alternative 2. Approximately 43 acres of undesignated old growth would be treated to physically remove (slashing) ladder fuels followed by prescribed burning in order to reduce fuel loadings and lessen the possibility of stand replacement fires on the boundary of private and state lands. This strategy would also assist in prolonging the overall health of these stands and retaining the large-diameter tree component for a longer period of time and contributing to long-term nesting, cavity building and thermal cover habitats for wildlife as described in the purpose and need for this project.

Both action alternatives propose treatments adjacent to designated and/or undesignated OG (a portion of the proposed unit is adjacent to one or more edges of the old growth stand). The effect on existing OG and the resulting interior acres of old growth from the nine proposed treatment areas can be found in Table 3.59. In general, seedtree harvest adjacent to just one edge of the old growth stands would subject the edge to drying and invasion by early successional plant species (Morrison et al. 1992).

New permanent and or temporary road construction/reconstruction is proposed under Alternative 2. Of the miles of road proposed, approximately 666 feet would intersect existing OG in the PSU. These roads can have similar effects to old growth and associated species, but to a smaller degree, as the edge effect from treatment units being placed next to old growth (see above). Additional effects to old growth are disclosed within the discussion of Snag Resources.

Alternative 2 proposes motorized trail access changes in that it converts approximately 37 miles of motorized trails to non-motorized and covert approximately 16 miles of seasonally or yearlong restricted roads into an intermittent stored status. Both of these actions would benefit any adjacent OG stands by making them less susceptible to firewood cutting. Contrarily, Alternatives 3 proposes to convert approximately 1.7 miles of seasonally restricted roads to intermittent stored service and approximately 13.5 miles of undetermined roads to NFS roads which allow legal use. Although this is a legal access change, any impact to adjacent OG stands has likely already occurred from illegal firewood gathering due to the easy topography of these lands along Koocanusa Reservoir. Additional impacts to any old growth in these areas are not anticipated.

Prescribed fire is proposed in designated or undesignated OG stands under Alternative 2. The effect on old growth (acres) was accounted for under the discussion of vertical structure. Expected effects include a temporary reduction in vertical structure including shrubs, reduction in down woody debris, snag loss and

snag creation, and slight alteration of microclimate (e.g. soil moisture, penetration of sunlight, change in herbaceous layer, etc.)

Ground disturbing activities, such as the proposed dispersed campground improvements (Fivemile, Yarnell) in or adjacent to old growth may result in noxious weed invasion. The project design should include measures to reduce this potential risk (e.g. washing equipment, weed spraying). These activities would not remove old growth attributes, such as snags, unless deemed unsafe to recreation users/campers.

The Army Corps of Engineer (COE) is proposing to harvest and or slash/burn approximately 421 acres on COE lands included in the PSU boundary. There are no NFS old growth stands adjacent to any COE activities so no impacts to this resource, such as edge effect, are anticipated.

Summary of Direct/Indirect Effects of Action Alternatives on Existing Condition
Alternative 2 proposes treatments in various OG designations. Briefly, these include slashing to remove ladder fuels and prescribed burning to reduce fuel loadings. Some road building adjacent or through designated old growth is also proposed.

Cumulative Effects
Summary of the Existing Condition
Existing old growth conditions have been cumulatively created by past management actions including fire suppression, forest user activities, as well as natural events, such as fire, windstorms and insect infestations. Increased edge from adjacent regeneration units and wildfires is one quantifiable example (Table 3.59). Other cumulative impacts to OG resources include a decrease in interior (secure) habitat, loss of vertical and horizontal structure in some stands while other stands have over-accumulated structure due to years of wildfire suppression. All of these effects alter the way wildlife utilize forests classified as old growth. Snags, another important element of old growth, have also been altered in their presence across the landscape. Roads opened for firewood cutting result in some continuing level of snag removal from the old growth stands, while wildfires in old growth create an abundance of snags in localized areas, thus resulting in somewhat of an imbalance of snag distribution.

Effects of Current and Reasonably Foreseeable Actions
All activities identified to occur within the analysis area that have the potential to affect this resource are discussed.

Vegetation Management and Fuels Reduction Activities
There is 25 acres planned for underburning within the East Reservoir analysis area which initiated under the treatment of FWF (Forestwide Fuels) Unit 589. These 25 acres are within designated old growth and would alter the understory as described under direct effects for action alternatives.

Cumulatively, the proposed activities (timber harvest, prescribed fire, ground fuel reduction) in designated and undesignated old growth would not reduce the amount and distribution of OG below KNFP requirements. However, due to cumulative edge effects (Table 3.59) there may be reduced old growth quality for some plant and animal species, such as resulting in less interior habitat and more edge where predation is more likely to occur or where noxious weed invasions are more likely to become established. However, given the level of impact and the quantity of OG in the PSU, this effect should be minimal and would diminish in approximately 50 years (Russell and Jones 2001; Ripple et al. 1991; Russell et al. 2000). Private lands in the Cripple PSU were assumed to not provide any OG, based on past harvest practices.

The action alternatives, in combination with other current and reasonably foreseeable actions including tree planting, precommercial thinning (760 ac), Christmas tree cutting, bough collection and pine cone collecting would maintain the designated management level of OG by avoidance. In the instance where

existing OG is burned or blown down, ROG would be designated to account for this loss.

Livestock Grazing
Cattle grazing (Fivemile and Warland Allotments) would not result in a change of OG habitat, snags or down woody debris in the PSU, as it does not involve the harvest of trees, dead or alive. Grazing cattle predominantly move along road systems and within past harvest units where an abundance of forage can be found.

Noxious Weed Treatment
Noxious weed management would result in no loss or change in snags and down woody debris because weed treatments primarily focus on the herbaceous layer along roads and in previously disturbed areas. Typically, approximately 200 acres are treated within the PSU on an annual basis.

Fire Suppression
In the event of a wildfire, construction of firelines, helispots and safety zones could potentially result in impacts to OG habitat. Conversely, wildfire suppression also serves to preserve existing OG habitat. Suppression activities are typically subject to input from District Resource Advisors, and protection of special habitats, including OG, is considered. However, if cumulative effects to old growth habitat result in the habitat no longer functioning as old growth, additional old growth habitat would be designated.

Road Management/Use Activities
Road management actions such as road maintenance and administrative use associated with permit administration, data collection and monitoring of NFS lands are not likely to affect OG and other specialized habitats (e.g. snags, down woody debris) because they generally do not result in vegetation removal. These activities include the Koocanusa Marina re-paving project (0.9 miles) to occur in the summer or fall of 2013. The standing tree and snag component would only be affected if considered a hazard to road users. These activities would not result in any change to the quantity of old growth, thus no adverse cumulative effects would be expected.

Recreation Maintenance
Routine maintenance of trails and developed and dispersed recreation sites would not contribute to the cumulative impact on OG because maintenance of these facilities do not typically involve removal of old growth elements such as large trees or snags unless deemed to be a safety hazard to forest users. In this situation, the removal of a tree or snag is considered negligible.

Special Uses
There are areas previously impacted by special use permits such as mineral material sites (pits quarries, borrow, roadsides), water developments, utility corridors, private land access routes, outfitter/guide trails/camps and COE monitoring stations, that would continue to be present and utilized. Ground disturbance on resources such as old growth have been included under the existing condition and would have no additional impacts. Any expansion of existing gravel pits would be analyzed for potential impacts on old growth at that time.

The Koocanusa Marina plans to expand its camping site system and increase its septic capabilities beginning in 2012 through 2013. These expansions fall within the acreage for which it is already permitted and would not involve the removal or alteration of designated old growth stands.

Public Use
Firewood gathering would continue to remove some snags from OG along open road corridors and these acres were previously accounted for as part of the existing condition. Other forest use activities such as mushroom and berry picking, camping, hunting, Christmas tree cutting, bough collection, etc. have little to no measurable impact on old growth because they are largely non-consumptive or rapidly re-established and would not contribute to the cumulative effect on this resource.

Private Property

Private activities such as land clearing, home construction, livestock grazing, etc. are likely to continue on those private lands within the PSU. Therefore there would likely be a decrease in dry-site old growth within the PSU, but outside of NFS lands.

Other Lands

The state of Montana is proposing to regenerate 198 acres and build approximately 0.84 miles of road in T31N, R29W, Section 12. However, these proposed actions are not adjacent to any mapped old growth type on NFS lands and therefore would have no edge effect on old growth stands.

Summary of Cumulative Effects

As previously stated, fire suppression over the last century has altered stands historically maintained by fire disturbance. The affected stands have developed fuel loading and ladder fuels that are uncharacteristic for some sites. These conditions would continue to develop until a natural disturbance occurs. Potential natural disturbances (wildfire, insect or disease epidemics, wind) could reduce OG characteristics or completely remove an area of old growth under extreme conditions. Likewise, there is the potential for human-caused fires initiating on private lands to move on to adjacent NFS lands and remove OG that has not been, at least partially, managed either by prescribed burning and/or removal of ladder fuels. In either case, if the large tree component of old growth is removed then replacement old growth would need to be designated.

The most recent Forestwide old growth analysis concludes that at least 10% of the KNF below 5,500 feet elevation is designated for old growth management. The proposed activities would not affect the 10% standard for old growth at either the PSU or Forest scale.

REGULATORY CONSISTENCY

Kootenai National Forest Plan

All alternatives are consistent with KNFP direction to maintain a minimum of 10% OG below 5,500 feet in elevation in each third order drainage or compartment, or a combination of compartments (Kootenai Supplement No 85; supplement to FSM 2432.22). Based on April 26th, 2004 direction (Castaneda 2004), old growth will be analyzed at the PSU scale. After implementation of the action alternatives, the Cripple PSU would have 11.2% designated old growth below 5,500 feet elevation. In addition, 729 acres of undesignated old growth would remain. The most recent Forestwide assessment as documented in the Forest Plan Monitoring and Evaluation Report (USDA Forest Service 2011) shows that the KNF has 11.8% old growth designated (includes both effective and replacement). The KNFP established that maintaining 10% of old growth habitat is sufficient to support viable populations of old-growth dependent species (Vol 1 II-1 7; III-54; Vol 2 A17).

***MA 13 Recreation Standards*:** All alternatives comply with these standards. A forest closure order exists to off-highway vehicles that restricts them to established roads and trails therefore limiting their effect on old growth.

***MA 13 Wildlife and Fish Standards*:** All alternatives comply with these standards, which are largely passive and favor natural processes. Also refer to grizzly bear analysis.

***MA 13 Range Standards*:** All alternatives comply. Due to the lack of available forage in old growth stands, use by grazing cattle is negligible.

***MA 13 Timber Standards*:** All alternatives comply with Standards 1 and 3. Unauthorized firewood cutting could impact snags located in OG habitat, and this effect is taken into consideration in the cavity habitat analysis and accounted for under the existing condition.

***MA 13 Facilities Standards*:** All alternatives comply with Standards 2 and 3. All alternatives would continue to restrict motorized access on local roads where closures exist.

MA 13 Fire Standards: Planned ignitions. The proposed slashing and burning is consistent for all alternatives. The KNFP (Vol 1 III-56) states that planned ignitions are acceptable to maintain old growth characteristics (e.g. old growth ponderosa pine).

National Forest Management Act
The project complies with the 2012 National Forest System Land and Resource Management Planning rule of March 27, 2013, by meeting KNF Land Management Plan direction for old growth.

SNAGS

Data Sources, Methods, Assumptions, Bounds of Analysis
Thomas (1979 pg.72-75) was used to determine the percent of the potential population level (PPL) to maintain primary cavity excavator populations (snag level % times % of area with that snag level). The general analysis process was based on the field data and applied as a worst case scenario. Old growth stands provide 100% snag level (SL) as do untreated forest stands (Tincher 1998). Partial cut stands provide at least 60% SL (Johnson and Lamb 1999). Regeneration units provide 0-80% SL. The percent varies mostly by period of harvest (pre- vs. post-KNFP 1987). Units harvested prior to the KNFP and those planned pre-1987 but harvested through 1992 basically provide no cavity habitat structures (Johnson and Lamb 1999). Post-1987 KNFP, (1993-2002) harvest units provide at least 40% SL (USDA Forest Service 2003b). Roads provide 0% SL. Roads account for 4 acres/mile (average 33 feet wide times 5,280 feet per mile divided by 43,560 square feet per acre). There is no difference in snag density adjacent to open versus closed roads (Bate and Wisdom 2004).

For this project, OG stands and stands with multi-story, low or high risk pole timber (MLRD, MHRP), multi-story low and high risk saw timber (MLRS, MHRS), and saw timber (SAWT) were categorized as forested stands that provide 100% snag level. All other stands, whether partially treated or regenerated were given a conservative average snag capability level of 20% whether or not the stands were treated prior to or after the 1987 KNFP. Additionally, the forest acres within 100 feet of any road were given a 0% snag level in order to adjust for the loss of snags along roads over time. A one hundred foot zone along roads was chosen based on field observations and conversations with firewood cutters, which is adequate given that many firewood cutters do not pull snags uphill nor do they winch trees much farther than 100 feet from a solid road surface.

The KNFP recommends applying minimum cavity excavator PPL on a drainage or compartment basis at the following levels: maintain at least 40% of the PPL throughout commercial forest lands, and maintain at least 60% of the PPL in riparian areas (KNFP 1987). These recommended percentages equate to snag levels of approximately 0.9 snags per acre for the 40% PPL, and 1.35 snags per acre for the 60% PPL. Due to the need to provide a continuous supply of snags over time, there is also a need to designate green trees as snag replacements. Usually two replacements are needed for every snag needed (USDA Forest Service 1987 A 16-11). This results in the general recommendation of 1-2 snags and 2-4 snag replacements per acre or a total of 3-6 per acre. The KNFP riparian standards, as amended by the Inland Native Fish Strategy (INFS) (USDA Forest Service 1995b), provide adequate snags and replacement trees to meet the riparian 60% SL standard. Therefore, the following analysis focuses on the general forest standard of 40% PPL.

Newer science (e.g. Bull et al. 1997), since the 1987 KNFP, has been incorporated into the Northern Region Snag Protocol (USDA Forest Service 2000). This protocol used the FIA data for 1988 to 1995 to estimate snag numbers by VRU cluster. The protocol further recommends Forests use local data to fine tune the protocol and recommended snag management levels. The Interior Columbia Basin Ecosystem Management Plan (ICBEMP DEIS Appendix 12) (USDA et al. 2000b) also provides new data on snags. Like the R1 Snag protocol, the ICBEMP document recognizes the need to use local data to fine tune recommended snag management levels. The KNF has established optional snag management levels based on local data (Johnson 2005). These snag levels are greater than the KNFP snag standards. These recommendations were considered in this analysis as part of the design criteria for snag retention in proposed treatment units.

The pileated woodpecker is the MIS for snags (KNFP App 12) (MIS section). The KNFP assumption is that effects of a proposed action on MIS can be correlated to effects on other species with similar habitat requirements. As habitat for MIS species is being maintained, it is assumed that sufficient habitat, such as snags and other snag associated species are also being maintained.

The effect indicators for snag and down wood habitat are: 1) percent of the maximum population potential by PSU; 2) acres treated that reduce snag and down wood levels.

The analysis boundary for project impacts (direct, indirect, cumulative) on snags is the Cripple PSU. This size is sufficient to cover home range sizes of species associated with snag and down wood habitat structure. Effects on the viability of MIS pileated woodpecker are evaluated at the Forest scale.

AFFECTED ENVIRONMENT/EXISTING CONDITION

Historically, within VRUs 1 and 2, Douglas-fir and ponderosa pine snags and live culls provided a majority of the cavity habitat, with fire resistant ponderosa pine providing most of the large (>19" dbh) snags and live culls. VRU 3 has a higher component of larch snags and culls, which provide an important feature for primary excavators and secondary cavity nesters. The more moist VRUs (5 and 7) also have a component of larch snags in the early and late seral forest condition, with cedar and grand-fir also providing cavity habitat. The number of snags per acre (>10"dbh) likely approached 5-10 snags per acre within all VRUs.

Table 3.81 - Snag Capability/Recommendations by VRU

VRU-CLIMATIC MODIFIER	ACRES/PERCENT OF PSU in each VRU	TOTAL SNAGS/ACRE at 100% CAPABILITY and RECOMMENDED NUMBERS	RECOMMENDED # SNAGS >20" DBH at 100% CAPABILITY to RETAIN
1 - warm &dry	832 ac/<1.1%	4	1
2 - mod. warm& dry	18,322 ac/23.3%	6	2
3 - mod. warm & mod. dry	17,491 ac/22.3%	8	2
4 - mod. warm & moist	8,141 ac/10.4%	7	2
5 - mod. cool & moist	947 ac/1.2%	9	3
6 - mod. cool & wet	0 ac/0%	8	4
7 - cool & moist	22,452 ac/28.6%	12	2
8 - cool & wet	0 ac/0%	12	1
9 - cool & mod. dry	10,271 ac/13.1%	12	All available

Snags, broken-top live trees, live cull trees and down logs are used by a great variety of wildlife species for nesting, denning, perching, roosting, feeding and shelter. On the KNF, 42 species of birds, 14 species of mammals, and several species of amphibians are recognized as largely dependent on cavity habitat (snags and down wood). Table 3.82 summarizes the existing cavity habitat potential on NFS lands in the Cripple PSU based on the criteria given previously.

The current SL within the Cripple PSU is 67.9% (Table 3.82). In other words, 67.9% of the area should be able to naturally produce 100% of the snags necessary for associated species, and these snags would be distributed across the landscape based on VRUs (as demonstrated by percentage of the PSU in Table 3.81. This level exceeds (better than) the KNFP standard of 40% in general forest habitat and 60% in riparian habitat (USDA Forest Service, 1987a, II-22; USDA Forest Service, 1987b, A16-3), indicating that existing snag habitat is maintaining viable populations of cavity-dependent species. The current capability rating takes into consideration the number of acres altered by man via timber harvest and firewood cutting as described under the written assumptions (Table 3.82). The actual procedure and capability matrix, as calculated in Arc Map GIS, is located in the Wildlife Section of the Project File.

Table 3.82 - Existing Population Potential on All Lands in the Cripple PSU

HABITAT COMPONENT	ACRES	% OF SUBUNIT	TOTAL SNAGS/ACRE[1]	SNAG LEVEL (%)	POPULATION POTENTIAL[2]
OG & MLRP, MHRP, MLRS, MHRS, SAWT	58,262	63.0	2.25	100[3,4]	63.0
Treated Forest Areas Ranging from Clearcuts to Thinned Stands (average 20% capability)	22,605	24.5	<1.0	20[3]	4.9
Roads & Buffer (24.5 acres/mile at 100 foot buffer for 471 miles)	11,540	12.5	0[4]	0[3]	0
Total PSU	92,407	100	- -	- -	67.9

[1] Value in parenthesis is based on Thomas 1979 Table 18 (pg 72) and include all snags ≥ 10" dbh. This number is needed to achieve the Snag Level value in parenthesis in the next column.
[2] Percent of sub-unit (expressed as decimal) times snag level percent = proportionate population potential for each component. Sum of proportionate population potentials from all components equals the PSU potential. (Thomas 1979 72-73)
[3] Managed snag level percent based on averaging areas treated prior to and following 1987 FP.
[4] Based on field observations; conversations with firewood cutters

MLRP = multi-story low risk pole timber **MHRP** = multi-story high risk pole **MLRS** = multi-story low risk sawtimber; **MHRS** = multi-story high risk sawtimber **SAWT** = sawtimber **POLE** = pole timber **IMST** = immature sawtimber

ENVIRONMENTAL CONSEQUENCES

In the PSU, all action alternatives would provide at least 40% snag levels following management activities. PPLs would be cumulatively reduced by 0.1 to 7.9% in the PSU depending on alternative (Table 3.83).

Table 3.83 - Cavity Excavator Potential Population Level (%) by Alternative Based on KNFP Standards

	EXISTING CONDITION	ALT 1 (NO-ACTION)	ALT 2	ALT 3
PPL in PSU (%) Change in PPL (%)	67.9%	67.8% (-0.1%)	60.0% (-7.9%)	61.0% (-6.9%)
Cumulative Acres Treated that Reduce Snag Level	34,145	34,347	43,301**	42,001**

(*) Value in parenthesis is percent change (+/-) due to alternative. Change in No Action reflects cumulative effects of other known or reasonably foreseeable actions, though not enough to change PPL.
(**) Some treatment acres fall within previously treated stands were not duplicated and already assigned a snag capability level of 0.2 or 20%.

ALTERNATIVE 1 (No-Action)

Direct and Indirect Effects

Under Alternative 1, no activities would be proposed, so no direct effect to snags is expected. However, there could be some additional snag loss or creation due to cumulative activities from foreseeable projects. These acres are disclosed in Table 3.83 and listed under the section discussing foreseeable activities under cumulative effects. Wildlife use of cavity habitat would continue at current levels. The addition or loss of snags would be dependent on other factors, such as firewood cutting, which has already been accounted for (100 ft. from all system roads), and wind events, natural attrition or wildfire. The level of impact from these factors cannot be calculated due to the high uncertainty in predicting occurrence and intensity levels.

Effects Common to Alternatives 2 and 3

Management activities that could reduce snags in riparian areas are restricted by Riparian Habitat Conservation Area (RHCA) standards and guidelines (USDA Forest Service 1995b). For the proposed activities, this would result meeting the riparian standard for snag levels (60%).

Regeneration harvest would result in a long-term (50-100 years), site-specific reduction in suitable cavity habitat for species (e.g. pileated woodpeckers) that do not utilize open areas for nesting. In the long-term, the green trees retained in regeneration units would provide nesting habitat as the new forest develops into a mature stand comprised of snag producing agents.

Underburning and excavator piling are treatments proposed to reduce existing fuels and/or harvest-generated slash. Underburning has the potential to reduce cavity habitat because standing snags can burn up or the bases can burn through, causing them to fall over. Down logs are sometimes partially or wholly consumed by fire. At the same time, underburning also has the potential to create new snags if a green residual tree is killed by fire. The loss or gain of cavity habitat varies widely, and depends on conditions (e.g. weather, fuel loads, fuel moisture) present when units are underburned. Excavator piling and burning would have less potential for loss or gain of cavity habitat because the burn treatment would be concentrated in pile areas, and piles would generally be located away from snags and leave trees. Similar results and effects on snags can be expected on proposed COE lands contained within the analysis area.

ALTERNATIVES 2 and 3

Direct and Indirect Effects

Implementation of the action alternatives would have direct effects on snag habitat. Table 3.84 summarizes those project activities that would change snag levels. Also see Table 3.82 for the changes in PPL by alternative.

Table 3.84 - Acres of Project Activities that Cumulatively Impact Snag Level

ACTIVITY	ALT 1[1]	ALT 2	ALT 3
Regeneration Harvest	198	3456	2802
Partial Cutting	0	5649	4945
New Road Construction (miles)	0.84	9.3	8.1
Prescribed Fire[2]	935	11,848	11,358

[1] the acres in Alternative 1 are the cumulative effects from other reasonably foreseeable projects. They can be added to the acres in the action alternatives to see cumulative effect acres
[2] Acres treated with prescribed fire may increase and/or decrease snag levels and were not accounted for in capability calculations.
[3] Includes lands managed by Army COE.

Regeneration harvest in Alternatives 2 and 3 would reduce snag availability specific to the unit areas, and use would change from those species requiring snags with nearby live tree cover (e.g. pileated woodpeckers) to those that would use snags in open sites (e.g. bluebirds, northern flickers, flycatchers). Regeneration harvest can potentially impact long-term cavity habitat, since fewer trees are left on site to be recruited as snags or snag replacements.

Commercial thinning in Alternatives 2 and 3 would retain higher levels of existing snags than regeneration units, and green replacement trees would be more readily available for future habitat. Limited timber harvest is proposed in MA 10 however, the resulting snag capability level within this MA designation would remain high at least 93% and still well above KNFP standards (40% general; 60% riparian).

In the long-term, the proposed improvement harvests identified in the action alternatives are expected to provide for the continuity of large-diameter ponderosa pine and Douglas-fir. This in turn provides a long-term benefit to cavity-dependent species, as over time they would become snags. Commercial thinning would follow a basal area reduction prescription. A majority of the ponderosa pine-Douglas-fir stands would retain larger and older trees in the overstory to maintain vertical structure and provide future replacement snags. The prescription would result in the removal of small diameter (less than 7" dbh) snags and whips in the understory, which would likely be removed or toppled during logging operations. On units planned for skyline yarding, snags are expected to be lost due to OSHA safety standards. This may also occur on tractor yarding units, depending on snag condition, location and size in relation to skid trails and falling personnel. These losses have been accounted for in the conservative estimate (20% average amongst units harvested prior to and after 1987 KNFP) of the snag capability of treated stand (Tables 3.82 and 3.83). Adequate live trees of larger sizes would be available to provide habitat features

needed by snag dependent wildlife in the future.

The subsequent proposed prescribed underburning would reduce the small-diameter Douglas-fir encroachment, and any trees that may be killed during the burning would result in the creation of snags. Additionally, fire may facilitate decay in surviving trees by providing an entry point for fungi, which increases the likelihood that the trees would be used by cavity excavators (Smith et al. 2000).

Site preparation burning and prescribed fire on non-harvest units may result in some fire-killed trees and subsequent new snag feeding/nesting sites. Within proposed harvest units, retention of snags greater than 10" dbh would contribute to meeting KNFP standards for this resource.

There are typically no snags available within precommercial thin units, especially those stands initiated prior to 1992 so reduction of snags is not a concern within these units.

Alternative 2 proposes motorized trail access changes in that it converts approximately 37 miles of motorized trails to non-motorized, covert approximately 16 miles of seasonally or yearlong restricted roads into an intermittent stored status and decommission 5.93 miles of road. These actions would benefit any adjacent snags by making them less susceptible to firewood cutting. Contrarily, Alternative 3 proposes to keep approximately 9.7 miles of trails as motorized for ATV use. Both action alternatives convert approximately 1.7 miles of seasonally restricted roads and approximately 13.5 miles of undetermined roads to NFS roads which allow legal use. Although this is a legal access change, any impact to snags has likely already occurred from illegal firewood gathering due to the easy topography of these lands along Koocanusa Reservoir. Additional impacts to any old growth in these areas are not anticipated.

The proposed dispersed camping areas would have negligible direct effects on the snag resource because these areas are maintained as natural as possible. Only those snags determined to be a threat to users and campers would be removed. Indirectly, forest users would likely fell and burn some snags as campfire wood but would likely only impact a one to two hundred foot perimeter around the sites based on typical firewood gathering. The potential for tree or snag due to the creation of permanent or temporary roads has already been accounted for in the effects of road systems (Table 3.82) on snag capability in that any areas 100 feet from any road are considered to have a zero capability to produce snags.

The Army COE is proposing to harvest and or slash/burn approximately 421 acres on Corp lands included in the PSU boundary. The impacts on snags from these activities would be similar to those described previously and were included in the snag capability results found in Table 3.82.

Summary of Direct/Indirect Effects of Action Alternatives on Existing Condition
Direct effects of the action alternatives would reduce (ranging from 0.1 to 7.9%) the number of snags available to wildlife within stands treated by timber harvest. Conversely, the associated fuel treatments and periodical prescribed burns would indirectly create snags for years following timber harvests. Although small, isolated pockets lacking in snags may occur as a result of the action alternatives, overall, management actions would not have a major impact on snags across the landscape and would maintain a viable snag level of 40% or greater as directed by the KNFP.

Cumulative Effects
Summary of the Existing Condition
In conjunction with naturally occurring events such as insect infestations, windstorms and wildfires, fire suppression and certain logging practices have changed the amount and distribution of snags across the landscape (USDA Forest Service 2000). Likewise, firewood cutting, a commonplace impact and one that is difficult to measure, has contributed cumulatively to the existing condition of the current snag resource. All of these influences on the snag resource can be expected to continue to varying degrees in years to come and would contribute both positively and negatively to the resource in that snags are both created

and removed. Table 3.82 displays estimated snag levels for the existing condition based on what is known about past occurrences.

Effects of Current and Reasonably Foreseeable Actions
All activities identified to occur within the analysis area that have the potential to affect this resource within the next 10 to 20 years are discussed in the following paragraphs.

Vegetation Management and Fuels Reduction Activities
There are four Forestwide Fuel units (FWF 545 for 265 ac, FWF 536 for 195ac, FWF 52403 for 450ac, FWF 589 for 25ac) that were initiated (slashed) under the corresponding EA. The subsequent burning for these units would occur between 2013 and 2014, will likely remove and create snags therefore their impact is considered negligible. All of these acres are reflected in Table 3.84.

The action alternatives, in combination with other current and reasonably foreseeable vegetation related actions including tree planting, precommercial thinning, Christmas tree cutting, wreath bough collection, character wood collection (log furniture), and blowdown salvaging would maintain the existing level of snags by avoidance with the exception of small snags possibly lost to character wood (furniture) gatherers. Most snags removed for furniture however are small diameter trees (<10" DBH) unsuitable for most cavity nesters and this impact is considered negligible.

Livestock Grazing
Cattle grazing (Fivemile and Warland Allotments) would not result in a change of, snags or down woody debris in the PSU, as it does not involve the harvest of trees, dead or alive.

Noxious Weed Treatment
Noxious weed management would result in no loss or change in snags and down woody debris because weed treatments primarily focus on the herbaceous layer along roads and in previously disturbed areas. Typically, approximately 200 acres are treated within the PSU on an annual basis.

Fire Suppression
Fire suppression activities including the construction of firelines, helispots and safety zones could potentially result in impacts to specialized habitats (e.g. old growth, snags, down woody debris). The amount and timing of such a loss cannot be predicted; however, the number of snags created by a wildfire would far exceed those lost during fire suppression efforts. Suppression activities are typically subject to input from District Resource Advisors, and protection of specialized habitats, including snags, is considered.

Road Management/Use Activities
Road management actions such as road maintenance and administrative use associated with permit administration, data collection and monitoring of NFS lands are not likely to affect specialized habitats (e.g. snags, down woody debris) because they generally do not result in vegetation removal. These activities include the Koocanusa Marina re-paving project (0.9 miles) to occur in the summer or fall of 2013. The snag component would only be affected if considered a hazard to road users. These activities would not result in any change to the snag component, thus no adverse cumulative effects would be expected.

Recreation Maintenance
Routine maintenance of trails and developed and dispersed recreation sites could involve the harvest of snags or green replacement trees that pose a hazard to users. However, the scale of the impact would be small and not measurable as a cumulative effect to snag levels or associated species.

Special Uses
There are areas previously impacted by special use permits such as mineral material sites (pits quarries, borrow, roadsides), water developments, utility corridors, private land access routes, outfitter/guide

trails/camps and COE monitoring stations, that would continue to be present and utilized. Ground disturbance on resources such as snags have been included under the existing condition and would have no additional impacts. Any expansion of existing gravel pits would be analyzed for potential impacts on snags at that time.

The Koocanusa Marina plans to expand its camping site system and increase its septic capabilities beginning in 2012 through 2013. These expansions fall within the acreage for which it is already permitted but could result in the loss of individual snags due to public safety concerns.

Public Use
Firewood gathering would continue to remove some snags from the open road corridors and these acres were previously accounted for as part of the existing condition. Other public uses such as wildlife viewing, berry picking, camping, snowmobiling, etc. have negligible impacts on the snag resource. Most campers utilize down wood for campfires in lieu of felling additional dead wood so this impact would also be negligible.

Private Property
Private activities such as land clearing, home construction, livestock grazing, etc. are likely to continue on those private lands within the PSU. Therefore there would likely be a decrease in dry-site snags within the PSU, but outside of NFS lands.

Other Lands
The state of Montana is proposing to regenerate 198 acres and build approximately 0.84 miles of road in T31N, R29W, Section 12. These activities will likely result in snag loss and were considered under the No-Action Alternative 1 (Table 3.84).

Summary of Cumulative Effects
Cumulatively, with all lands considered, and all other reasonably foreseeable actions on private and state lands considered, sufficient cavity habitat would remain in the Cripple PSU (Table 3.83).

When other activities including the harvest on private, state and federal lands discussed under Alternative 1, and all past, present and reasonably foreseeable activities are considered, habitat on federal lands is considered sufficient to provide cavity habitat to cavity-dependent species. After implementation of Alternative 1 and the reasonably foreseeable FS projects, the primary cavity excavator PPL on NFS lands is estimated to remain at approximately 67.8%. After implementation of Alternatives 2 or 3 and the reasonably foreseeable projects, the primary cavity excavator PPL on NFS lands would decrease from 67.9% to 60.0 or 61.0% respectively. This level of snag habitat is still expected to provide for an associated species population level above 40%, which is thought to be the minimum needed to maintain self-sustaining populations of snag-dependent wildlife (Thomas 1979 pg.72).

The 2007 KNFP Monitoring Report (USDA Forest Service 2008) documents results for the past 19 years, and indicates the KNF is providing sufficient cavity habitat at the drainage or compartment, as well as the Forest scale.

REGULATORY CONSISTENCY

All proposed units in Alternatives 1, 2 and 3 maintain at least 40% snag level. No alternative causes the Cripple PSU overall PPL to drop below the general forest 40% or riparian 60% primary cavity excavator potential population level. This is consistent with Forest Plan standards.

KNFP cavity habitat standard (40% PPL) in MAs 15 and 16 is met by maintaining at snag capability of at least 64.5% under all alternatives.
KNFP cavity habitat standard in MA 10 is met by maintaining a snag capability of at least 93% under all alternatives. Alternatives 2and 3 would not require a project-specific amendment to suspend the requirement to retain all existing cavity habitat in MA 10. All treatment units would be managed to meet the 40% minimum snag level.

DOWN WOOD HABITAT

Data Sources, Methods, Assumptions, Bounds of Analysis

Down wood habitat is woody material derived from tree limbs, boles and roots in various stages of decay (Graham et al. 1994), and performs many physical, chemical and biological functions in forest ecosystems. Coarse down wood habitat is generally defined as any down wood material larger than 3 inches in diameter. The minimum piece size to qualify as a down "log" is 8 feet long with a large-end diameter of six inches or more (Bull et al. 1997). The ecological processes and functions of down wood material are discussed in many research papers (e.g. Bull et al.1997; Graham et al. 1994; Maser et al. 1984). These are incorporated by reference.

The analysis boundary for project direct effects is the treatment units. Cumulative effects are analyzed at the PSU scale because the home range of several resident wildlife species with associations to down wood habitat extend further than the typical treatment unit.

AFFECTED ENVIRONMENT/EXISTING CONDITION

The KNFP suggests that sufficient amounts of large down wood material be retained on site for wildlife habitat needs, nutrient release back into the soil and site protection for timber stand regeneration. The current KNFP direction (USDA Forest Service 1987 A16-6) is to meet timber/silviculture Guideline #9, which is to leave logs greater than 12" diameter scattered throughout harvest units (a few pieces per acre). Five to 15 tons per acre is recommended depending on the associated VRU.

The project is designed to meet Guideline #9. Reserve trees are provided to assure future down wood habitat.

ENVIRONMENTAL CONSEQUENCES

ALTERNATIVE 1 (No Action)

Direct and Indirect Effects

In the short-term, this alternative would not change the current condition or availability of coarse woody debris within the PSU. With the lack of wildfires in concert with continued fire suppression, these forest stands could accumulate down woody debris beyond what would be expected under natural conditions in a given VRU.

Effects Common to Alternatives 2and 3

Direct and Indirect Effects

The proposed Forest Fuel and Wildlife habitat enhancement units (10,049 ac) would retain adequate down wood. Spring burning prescriptions and conditions should allow for the maintenance of larger pieces of organic matter on the forest floor. Fall burning may increase the risk of large woody consumption by fire, but fire-killed snags would be recruited over time.

In proposed timber harvest units under the action alternatives, implementing recommended down wood material guidelines under all alternatives is expected to ensure the maintenance of adequate habitat. Implementation of KNFP snag guidelines would maintain some cavity habitat and subsequent down wood habitat recruitment to the forest floor over the next several decades. Application of these guidelines in all harvest units would ensure distribution of down wood material across the landscape. Any snag felled due to OSHA standards would be required to remain on site. The forest guideline to leave 5-15 tons/acre of 12"+ diameter down wood is met.

Generally, all action alternatives have the potential to reduce down woody resources over several thousand acres under a variety of management actions (Tables 2.14 and 2.23). Any acres treated with timber harvest should meet KNFP guidelines/recommendations for retention of down woody debris. The many acres treated with prescribed fire should maintain a minimum of 5 to 10 tons of down woody debris

per acre, depending on the VRU, for soils nutrient recycling. Site preparation methods are similar between the action alternatives (see Chapter 2 for the differences in acres between alternatives). Grapple piling of logging slash can more easily separate fine fuels from coarse wood material thereby assisting in maintaining the large wood component in treatment units. Charred coarse wood material with checks and cracks does not substantially interfere with the decomposition or function of this material.

There are typically few snags and subsequent down wood available within precommercial thin units, especially those stands initiated prior to 1992, so reduction of down wood is not a concern within these units.

Alternative 2 proposes motorized trail access changes in that it converts approximately 37 miles of motorized trails to non-motorized and covert approximately 16 miles of seasonally or yearlong restricted roads into an intermittent stored status. Both of these actions would benefit any adjacent snags by making them less susceptible to firewood cutting. Contrarily, Alternative 3 proposes to keep approximately 9.7 miles of trails as motorized for ATV use. Both action alternatives convert approximately 1.7 miles of seasonally restricted roads and approximately 13.5 miles of undetermined roads to NFS roads which allow legal use. Although this is a legal access change, any impact to snags has likely already occurred from illegal firewood gathering due to the easy topography of these lands along Koocanusa Reservoir. Additional impacts to any old growth in these areas are not anticipated.

The proposed dispersed camping areas improvements would have negligible effects on the snag resource because these areas are maintained as natural as possible. Only those snags determined to be a threat to users and campers would be removed.

Any potential for tree or snag loss and subsequent down wood due to the creation of permanent or temporary roads has already been accounted for in the effects of road systems (Table 3.82) on snag capability in that any areas 100 feet from any road are considered to have a zero capability to produce snags.

The Army COE is proposing to harvest and or slash/burn approximately 421 acres on Corp lands included in the PSU boundary. The impacts on snags and subsequent down wood from these activities would be similar to those described above and were included in the snag capability results found in Table 3.82.

Cumulative Effects

Summary of the Existing Condition

In conjunction with naturally occurring events such as insect infestations, windstorms and wildfires, fire suppression and certain logging practices have changed the amount and distribution of the down wood component across the landscape (USDA Forest Service 2000). Likewise, firewood cutting, a commonplace impact and one that is difficult to measure, contributes cumulatively to the existing condition of the current down woody debris resource. All of these influences on the down woody resource can be expected to continue to varying degrees in years to come and would contribute both positively and negatively to the resource in that down woody debris would be both created and removed.

Effects of Current and Reasonably Foreseeable Actions

All activities identified to occur within the analysis area that have the potential to affect this resource within the next 10 to 20 years are discussed in the following paragraphs.

Vegetation Management and Fuels Reduction Activities

There are four Forestwide Fuel units (FWF 545 for 265 ac, FWF 536 for 195ac, FWF 52403 for 450ac, FWF 589 for 25ac) that were initiated (slashed) under the corresponding EA. The subsequent burning for these units would occur between 2012 and 2014, will likely remove and create down wood (new snag creation) therefore their impact is considered negligible.

The action alternatives, in combination with other current and reasonably foreseeable vegetation related

actions including tree planting, precommercial thinning, Christmas tree cutting, wreath bough collection, character wood collection (log furniture), and blowdown salvaging would maintain the existing level of snags, and subsequent down wood, by avoidance with the exception of small quantities possibly lost to character wood (furniture) gatherers. Most wood removed for furniture however are small diameter trees (<10" DBH) unsuitable for most cavity nesting or hollow log rest areas. This impact is considered negligible.

Livestock Grazing
Cattle grazing (Fivemile and Warland Allotments) would not result in a change of old growth habitat, snags or down woody debris in the PSU, as it does not involve the harvest of trees, dead or alive.

Noxious Weed Treatment
Noxious weed management would result in no loss or change in snags and down woody debris because weed treatments primarily focus on the herbaceous layer along roads and in previously disturbed areas. Typically, approximately 200 acres are treated within the PSU on an annual basis.

Fire Suppression
Fire suppression activities including the construction of firelines, helispots and safety zones could potentially result in impacts to specialized habitats (e.g. old growth, snags, down woody debris). The amount and timing of such a loss cannot be predicted; however, the number of snags and down wood created by a wildfire would far exceed those lost during fire suppression efforts. Suppression activities are typically subject to input from District Resource Advisors, and protection of specialized habitats, including dead standing and down wood, is considered.

Road Management/Use Activities
Road management actions such as road maintenance and administrative use associated with permit administration, data collection and monitoring of NFS lands are not likely to affect specialized habitats (e.g. snags, down woody debris) because they generally do not result in vegetation removal. These activities include the Koocanusa Marina re-paving project (0.9 miles) to occur in the summer or fall of 2013. The snag component would only be affected if considered a hazard to road users. It is likely however, that any or most down wood within the permitted area of the Marina would be lost to campers for campfires. Given the number of acres (70 ac) under permit versus the size of the PSU (>90,000), this impact is considered negligible.

Recreation Maintenance
Routine maintenance of trails and developed and dispersed recreation sites could involve the harvest of snags or down wood that pose a hazard to users. However, the scale of the impact would be small and not measurable as a cumulative effect to snag/down wood levels or associated species.

Special Uses
There are areas previously impacted by special use permits such as mineral material sites (pits quarries, borrow, roadsides), water developments, utility corridors, private land access routes, outfitter/guide trails/camps and COE monitoring stations, that would continue to be present and utilized. Ground disturbance on resources such as snags have been included under the existing condition and would have no additional impacts. Any expansion of existing gravel pits would be analyzed for potential impacts on snags at that time.

The Koocanusa Marina plans to expand its camping site system and increase its septic capabilities beginning in 2012 through 2013. These expansions fall within the acreage for which it is already permitted but could result in the loss of individual snags, and subsequent down wood, due to public safety concerns. It is likely however, that any or most down wood within the permitted area of the Marina would be lost to campers for campfires. Given the number of acres (70 ac) under permit versus the size of the PSU (>90,000), this impact is considered negligible.

Public Use

Firewood gathering would continue to remove some snags/down wood from the open road corridors and these acres were previously accounted for as part of the existing condition. Other public uses such as wildlife viewing, berry picking, camping, snowmobiling, etc. have negligible impacts on this resource due to scope.

Private Property
Private activities such as land clearing, home construction, livestock grazing, etc. are likely to continue on those private lands within the PSU. Therefore there would likely be a decrease in dry-site snags and associated down wood within the PSU, but outside of NFS lands.

Other Lands
The state of Montana is proposing to regenerate 198 acres and build approximately 0.84 miles of road in T31N, R29W, Section 12. These activities would likely result in snag and subsequent down wood loss and were considered under the no-action Alternative 1 under the snag analysis (Table 3.84).

Summary of Cumulative Effects
Cumulatively, with all lands considered, and all other reasonably foreseeable actions on private and state lands considered as described previously, sufficient down woody debris would remain in the Cripple PSU.

The 2007 KNFP Monitoring Report (USDA Forest Service 2008) documents results for the past 19 years may be the best indicator that standing dead and down habitat is being retained via management guidelines and recommendations.

REGULATORY CONSISTENCY

There are no goals or standards for downed woody debris in the KNFP. It does contain the goal to: “Maintain diverse age classes of vegetation for viable populations of all existing native, vertebrate, wildlife species.... (FP Vol 1 II-1 Goal #7)”. The KNFP provides guidelines in Appendix 16, Cavity Habitat Management (FP Vol 2 App 16 6 - Guideline #9). All alternatives are consistent with the KNFP, as a wide range of successional habitats, and associated amounts of downed wood would be available.

MANAGEMENT INDICATOR SPECIES

REGULATORY FRAMEWORK

Federal laws and direction applicable to Management Indicator Species (MIS) include the National Forest Management Act (NFMA 1976) and Forest Service Manual (FSM) 2620. The NFMA specifies that the NFS be managed to provide for diversity of plant and animal communities to meet multiple-use objectives. The “specific land area” (scale) for providing diversity is established in the framework as the area covered by a Forest Plan (36 CFR 219.3). The regulations also say that Forests “must ensure well distributed habitat” to provide for viable populations of native and desired non-native plants and vertebrate species (36 CFR 219.19). The NFMA defines a viable population as "... one which has the estimated numbers and distribution of reproductive individuals to insure its continued existence and is well distributed in the planning area." Under the implementation regulations, the Forest is considered the planning area.

Other Federal resource laws that provide impetus for managing for viable wildlife populations on public land includes the National Wilderness Preservation Act (1964), the National Environmental Policy Act (1969) and the Endangered Species Act (1973). Information from the landscape assessments conducted in the Columbia River Basin was also reviewed.

The Kootenai Forest Plan (KNFP) (1987 Appendix 12) identifies MIS (Table 3.85). The FP states “the maintenance of viable populations of existing native and desirable non-native vertebrate species, as monitored through indicator species, will be attained through the maintenance of a diversity of plant communities and habitats.” (FP II-22)

The analysis considers how the action provides for diversity of plant and animal communities based on the suitability and capability of the specific land area in order to meet overall multiple use objectives, and within the multiple use objectives of a land management plan adopted 16 USC 1604 (g)(3)(B).

Wildlife habitat guidelines and objectives to help maintain species viability on the KNF are outlined in the FP on pages II-22-23. The current list of MIS species for the KNF is displayed in Table 3.85.

Table 3.85 - Management Indicator Species

SPECIES	HABITAT REPRESENTED	COMMENTS
Grizzly Bear (*Ursus arctos*)	General Forest	See T&E Section
Gray Wolf (*Canis lupus*)	General Forest	See Sensitive Species Section
Bald Eagle (*Haliaeetus leucocephalus*)	Rivers and Lakes	See Sensitive Species Section
Peregrine Falcon (*Falco peregrinus*)	Cliffs	Suitable habitat questionable, no known aerie present, No further analysis required
Elk (*Cervus elaphus*)	General Forest	Serves as MIS for Cripple Subunit
Whitetail Deer (*Odocoileus virginianus*)	General Forest	Represented by Elk
Mountain Goat (*Oreamnos americanus*)	Alpine	No alpine habitat in project area. Mtn. goats not found in project area. Project will have no impact on mtn. goats. No further analysis required.
Pileated Woodpecker (*Dryocopus pileatus*)	Snags, Old Growth	Also see old growth and snag sections

The KNFP identified a number of wildlife species that find optimum breeding and feeding habitat in old growth. The pileated woodpecker is an inhabitant of old growth habitat and a management indicator species (MIS) for old growth habitat on the KNF.

Elk and whitetail deer are two MIS species that represent similar habitat. Summerfield (1991) recommends determining which big game species will be featured in a particular area, since species winter requirements differ. Based on FP direction, the biological potential of the area, state wildlife management objectives, public comments during scoping and the information contained within the Kootenai Conservation Plan (Johnson 2004 Appendix H); an emphasis species was identified for this report.

As a general rule the following process was used to determine the featured species. In the Conservation Plan, the KNF and MFWP Elk Task Force established management emphasis designations for elk by PSU (Ibid: Appendix H Attachment B page H-12 and 2600 letter of 5-16-1997). In PSUs with high emphasis for elk, elk will be the emphasis MIS in the report. For PSUs where elk are a low emphasis, whitetail deer will be the indicator for general forest habitat in the report. For PSUs where elk are moderate emphasis, the project biologist will designate the general forest indicator, based on site-specific information about elk and deer use in the PSU. The Cripple PSU is moderate emphasis for elk and the elk has been chosen to be the general forest indicator in the analysis because of its higher interest to the public as a game mammal.

ELK

Data Sources, Methods, Assumptions, Bounds of Analysis

Elk are one of the indicator species for general forest habitat condition. The East Reservoir project area is located in the Cripple PSU, which is identified as an area where elk are managed equally with the white-tailed deer, another general forest indicator species (KNF MFWP Elk Task Force 1997).

Elk population ecology, biology, habitat description and relationships identified by research are described in Murie (1979) and Toweill and Thomas (2002). That information is incorporated by reference. Elk population and harvest data come primarily from MFWP data. Additional information used is from recent District wildlife observation records and Forest historical data (NRIS Wildlife). The analysis area

boundary for project impacts to individuals and their habitat is the Cripple PSU. The boundaries for determining population trend and viability are the MFWP elk hunting districts #101, 102, 103, 120, 122 (Salish EMU) and the Kootenai National Forest, respectively.

The effects analysis is based on direction provided in the KNFP (1987) as amended and Coordinating Elk and Timber Management (MFWP 1985). Additional guidance is provided by Defining Elk Security: The Hillis Paradigm (1991). Potential effects to elk habitat are identified by analyzing four effects indicators: cover/forage ratio, habitat effectiveness, security and key habitat components.

***Cover/Forage Ratio*:** Cover/forage ratio portrays the percentage of area that meets elk requirements for cover and forage. Cover provides protection from weather, predators and humans. Two different types of cover have been recognized. Hiding cover is defined as vegetation capable of hiding 90% of an elk from the view of a human at 200 feet. Thermal cover is a stand of conifers that are 40 feet tall with 70% crown closure. Forage areas are those natural or man-made areas that do not qualify as cover (hiding or thermal) (Thomas 1979, pp. 109, 114, 116). Recently, elk use of thermal cover and foraging areas has been reexamined and this research indicates that providing thermal cover is not a suitable solution for inadequate forage conditions (Cook et al. 1998).

The KNFP (1987) recommends a cover/forage ratio of 30/70% for elk winter range (measured on the combined acres in MA 10 and 11 lands). Summerfield (1991) recommends cover to be 60% on winter and summer range (measured on all MAs, not winter range, e.g. MAs 12, 15, 16, etc.). On elk winter range, the cover should be at least 40% thermal cover (Ibid). Summer range cover may be in any combination of hiding and thermal cover (Ibid). The KNFP (1987) also identifies the general maximum size for an opening as 40 acres. Summerfield (1991) recommends that the opening size standard be the same as the standard for grizzly bear (a maximum of 600 feet to cover from any point inside an opening).

Current landscape conditions as related to opening size and fuel loads are noticeably out of their historical ranges where wildfires have not occurred in recent years. These conditions can be largely attributed to successful wildfire suppression and man-made opening size limitations of federal regulations and KNFP direction. This disturbance conditions, or lack thereof, are present across most VRUs, but most noticeable in the drier type VRUs, like VRU 2.

Cover/Forage ratio (C/F) for summer range (combined MAs 15, 16, 17 acres) in the PSU, C/F ratio for winter range in the PSU, the percent thermal cover on winter range, and the number of regeneration harvest units greater than 40 acres in size at the PSU scale are the measures for effects.

***Habitat Effectiveness*:** The habitat effectiveness (HE) of an area refers to the percentage of habitat that is usable by elk outside of the hunting season that does not contain open roads. Numerous studies have shown that there is a strong negative correlation between elk use of an area and the density of open roads, even if those roads are only lightly traveled (Frederick 1991).

The KNFP calls for an open road density (ORD) in MA 12 (Big Game Summer Range and Timber) of 0.75 mi/mi^2. This translates into a habitat effectiveness value of 68% (Lyon 1984). In MAs 15, 16, 17 and 18, the KNFP ORD standard is $\leq$ 3.0 mi/mi^2, which equates to 38% habitat effectiveness.

The percent HE for the PSU, ORD for MA12, and ORD for the combined MA 15, 16, 17 and 18 lands in the PSU are the measures for effects.

***Security*:** Security areas are defined as areas that are larger than 250 contiguous acres in size and more than one half mile from an open road (Hillis et al. 1991). These areas offer elk refuge through reduced vulnerability during the hunting season and can greatly influence the age structure and composition of a herd.

The KNFP has no standard for security. A panel of state and federal wildlife biologists convened in 1996

and produced, "Integrating Kootenai National Forest Plan and Fish, Wildlife & Parks Elk Management Plan Final Task Force Report (Johnson 2004 Appendix H-B). This document identified security as an important component in elk habitat and that the Hillis et al. (1991) method would be used to calculate it. This method recommends a minimum of 30% of an elk's fall use area be maintained as security habitat. Since elk use in the fall could be any place within a PSU, the 30% minimum is measured against the PSU NFS acres. Appendix H-B (Johnson 2004 p H-12) also provides the elk management emphasis level by PSU, as well as definitions for security levels (H-B-13).

The percent security in the PSU will be the measure for effects.

***Key Habitat Components*:** Wallows, wet meadows and bogs will be avoided when constructing roads (KNFP 1987; III-44 49). When these areas are located they will be mapped and managed as riparian areas.

The number of features potentially impacted by the project will be the measure for effects.

AFFECTED ENVIRONMENT/EXISTING CONDITION

The Cripple PSU is located in elk hunting districts #101, 102, 103, 120, 122 (Salish Elk Management Unit or EMU). The population in the Salish EMU is stable (MFWP 2004 p 66) based on numbers of elk taken during hunting seasons and counted at local hunter check stations. Currently, the summer cover/forage ratio is approximately 75/25%, winter range cover is 90/10%, habitat effectiveness is approximately 70% within MA 12 and 49% within MAs 15 and 16, and approximately 28.1% of the PSU is secure habitat (Table 3.86). The PSU is managed with a moderate emphasis for elk (Johnson 2004 App H-B p H-12) with sign (tracks, droppings) found throughout the PSU. The number of known or suspected wallows in the PSU is one, however, this habitat will continue to be documented if found during field visits to the PSU.

ENVIRONMENTAL CONSEQUENCES

ALTERNATIVE 1 (No-Action)

Direct and Indirect Effects

Cover/Forage Ratio

Under Alternative 1 (no-action) the C/F ratio would remain unchanged, in the short-term. However, as trees and shrubs continue to grow and mature, the number of acres of productive foraging habitat would decline. As trees continue to encroach upon forage openings and tree canopies close, the quality of forage and number of acres producing forage would also decline therefore not supporting the purpose and need described in Chapter 1 to maintain and improve wildlife habitat. The increased tree density and continuous fuel profile from the ground up to the main canopy puts the area at risk of severe wildfire (See Fuels Section for additional information). If severe wildfires occur, it is likely that forage habitat would be greater than 600 feet from cover, making it less likely to be used by elk.

ALTERNATIVES 2 AND 3

Direct and Indirect Effects

Cover/Forage Ratio

Each action alternative includes prescribed burning (see Alternative Descriptions, Ch. 2), which would occur primarily on south and west slopes that make up big game winter range. Burning would improve the palatability and enhance the quality of the forage produced on these acres which helps meet the purpose and need for managing wildlife habitat.

Cover/Forage ratios on winter range would shift toward the KNFP standard because of timber harvest in MAs 10 and 11 (Table 3.86). Alternatives 2 and 3 result in similar changes to the cover/forage on winter range, harvesting 3,276 acres and 3,060 acres, respectively. Summer range C/F ratio would become 66/34 (Table 3.86) under Alternative 2, which is the largest change in this ratio. Alternative 3 would change the

C/F ratio to 68/32.

For timber regeneration harvest in Montana, the maximum cut is defined as 40 acres (36 CFR Part 219.27 (d)(2)). Action Alternative 2 includes units that would result in openings greater than 40 acres (Units 147-150; 73T; 188; 75; 80; and 40). This strategy may result in openings that may not be fully utilized by elk as foraging areas, however, creating these openings reduces over edge effect and fragmentation that would occur with greater number of openings of lesser acreage. Additionally, stringers and groups of trees would be left within the units to provide screening and minimize the effect of the openings when possible. There may be short-term disturbances within identified big game travel corridors due to project related activities. Timber management in RHCAs would follow INFS guidelines and the state of Montana Streamside Management Zone (SMZ) law, ensuring the maintenance of travel corridors within riparian zones. Vegetated corridors facilitating movements in elevation would be maintained (see Cover/Forage maps in the Project File).

Unit 62 (seedtree prescription) was designed for various wildlife species like elk and other large bodied mammals, to maximize forage potential within summer habitat while maintaining a 600 feet to cover standard of the 1987 KNFP. This strategy allows elk to utilize both forage opportunities along the unit's edge and interior without the need to venture to far from forest cover. The shape of the unit mimics naturally created openings and contributes to the juxtaposition of forage and cover for the species.

The Army COE is proposing to harvest and or slash/burn approximately 421 acres on Corp lands included in the PSU boundary. These acres are included with the cover effects from harvest activities on NFS lands.

ALTERNATIVE 1 (No-Action)
Direct and Indirect Effects
Open Road Density and Habitat Effectiveness
Open Road Densities (ORDs) (3.86) and Habitat Effectiveness for MA 12 and MAs 15-18 would remain unchanged at 70% and 49% respectively, under Alternative 1.

ALTERNATIVES 2 AND 3
Direct and Indirect Effects
Open Road Density and Habitat Effectiveness
Alternative 2 would decrease the ORD within MA 12 (Table 3.86). Therefore, habitat effectiveness would be better than the existing condition (Table 3.86) due to the closing of 37 miles of motorized trails. The trail closings result in an increase in big game security discussed later in this document. All roads utilized to facilitate management activities would remain closed to the general public, therefore, not affecting the ORD. This alternative also converts approximately 16 miles of yearlong or seasonally restricted roads to stored status. Although these additional miles do not contribute to Hillis secure habitat, they do add quality to the value of existing secure habitat by making areas less accessible to humans during the hunting season.

Alternative 3 slightly increase the ORD within MA 12 (Table 3.86) due to the creation of a motorized trail loop in the Boundary Mountain area and an access change for the #4904 trailhead. These access proposals would result in a MA 12 habitat effectiveness of xx% as compared to the existing level of 70%.

Table 3.86 shows the PSU ORD in MAs 12 and 15-18. All alternatives are well below the Forest Plan standard of $\leq$3.0 mi/mi^2.
ALTERNATIVE 1 (No-Action)
Direct and Indirect Effects
Security
Secure habitat for elk would remain unchanged (28.1% of the PSU) under Alternative 1.

ALTERNATIVES 2 AND 3
Direct and Indirect Effects
Security
Although no roads needed to implement management activities would be open to the general public and therefore not affecting elk security during the hunting season, temporary displacement of elk or species avoidance during harvest activities may occur. Avoidance by elk or displacement from local areas would be temporary and extend only through the life of the project. Secure displacement habitat exists to the north and east of the PSU. Access to secure habitat would be maintained throughout the life of the project. Upon completion of all activities related to this analysis, big game security in the PSU would increase by 6.9% to 35% under Alternative 2 due to the reduction of 37 miles of motorized trails. This calculation includes the access change/creation of 1.6 (Alt 3) to 1.8 (Alt 2) miles of new open road which are largely located within the influence zone (½ mile) of existing open roads. The overall decrease in motorized roads or trails results in a security value, according to Hillis et al, better than KNFP standards. Also refer to discussion of ungulate cover, previously.

ALTERNATIVE 1 (No-Action)
Direct and Indirect Effects
Special Habitat Features
Under Alternative 1, no wetland acres would be impacted since no timber harvest would occur within the Streamside Management Zone of any wetlands.

ALTERNATIVES 2 AND 3
Direct and Indirect Effects
Special Habitat Features
Impacts to special habitat features, by alternative, are summarized in Table 3.86. Due to implementation of specific design criteria to buffer these features, and/or the timing restrictions on management activities, potential displacement of elk using these features is not likely to occur.

Table 3.86 displays the direct, indirect and cumulative effects to elk habitat in the Cripple PSU by alternative.

Table 3.86 - Elk Habitat Components by Alternative

HABITAT COMPONENT	ALT 1	ALT 2	ALT 3
PSU Cover/Forage Ratio Summer Range (guide 60/40) (non-winter range MAs 12, 15, 16, etc.)	D,I = 0/0 CE = 75/25	D,I = -9/+9 CE = 66/34	D,I = -7/+7 CE = 68/32
PSU Cover/Forage Ratio Winter Range (MA 10 &11) (guide 60/40)	D,I = 0/0 CE = 90/10	D,I = -25% CE = 65/35	D,I = -23.5% CE = 66/34
Thermal Cover % Winter range (MA 10 & 11) (guide ≥ 40%)	D,I = 0/0 CE = 58.5%	D,I = -15.0% CE = 43.5%	D,I = -14.8% CE = 43.7%
PSU Security Cover % (guide ≥30%)	D,I = 0.0% CE = 28.1%	D,I = +6.9% CE = 35%	D,I = +5.3% CE = 33.4%
MA 12 Effectiveness (%) (guide ≥68%) – during/after	D,I = 0 CE =70%	D,I = +8 CE =78%	D,I = +4 CE =74%
MA 15/16 Effectiveness (%) (guide ≥38%)	D,I = 0 CE = 49%	D,I = +5% CE = 54%	D,I = +2% CE = 51%
MA 12 ORD (mi/mi^2) during implementation/ following implementation (std. ≤ 0.75)	D,I = 0 CE = 0.73	D,I = -.17 CE = 0.56	D,I = -.09 CE = 0.64
PSU Open Road Density (mi/mi^2) (MA 15,16) (std. ≤3.0)	D,I = 0 CE = 1.8	D,I = -.23 CE = 1.57	D,I = +.06 CE = 1.86
# Openings > 40 acres - all summer range including MA 12* (not NFMA regeneration harvest standard)	D,I = 0 CE = 73	D,I = 10 CE = 83	D,I = 0 CE = 73
# Special Habitat Features impacted (if known) [1]	D,I = 1	D,I = 1	D,I = 1

HABITAT COMPONENT	ALT 1	ALT 2	ALT 3
	CE = 1	CE = 1	CE = 1
# Movement Areas Affected in MA 12 and other summer MAs	D,I = 0 CE = 14	D,I = +14 CE = 28	D,I = +19 CE = 33

D = Direct Effect I = Indirect Effect CE = Cumulative Effect

[1] Project design includes requirement to buffer special habitat features if found during project layout.

*Created since 1986, considers 600 feet to cover thus combining units closer than 600 feet in adjacency that will result in openings greater than 40 acres and calculated in ArcGIS.

**Unit 62 (regeneration cut) acres exceed 40; however, no point in this unit within MA 12 exceeds 600 feet from cover.

Summary of Direct/Indirect Effects of Action Alternatives on Existing Condition

In summary, each of the action alternatives proposes activity in big game habitat. Alternatives 2 and 3 begin the process of shifting the cover/forage ratio toward one more suitable for elk with no reduction in security. Some short-term displacement of big game may occur when harvest occurs in movement corridors or as localized disturbance occurs during the life of the project.

The management activities and resulting changes in habitat conditions disclosed previously are likely to result in short-term displacement effects on elk. For example, an estimated 25 miles of road may be utilized for timber hauling at any given time, although localized within the PSU. These hauling routes would result in approximately 8,000 acres being potentially unavailable to species like elk due to disturbance. Elk numbers are not expected to change dramatically, however, with increased forage availability and maintained security levels the population could show a slight increase.

Cumulative Effects

Summary of the Existing Condition

Briefly, forest management practices and other human activities (e.g. hunting, wood consumption, motorized recreation) have had influential cumulative impacts on elk and other big-game security, as well as measurable fluctuations in cover to forage ratios. While natural events, such as wildfires, can result in dramatic and immediate changes to big-game cover, and would continue to do so, it is the indirect effects of forest management that has likely had the greatest impact to big-game habitat in the form of road construction and associated uses. Use of these roads, whether for logging, recreation or hunting, decrease elk and other big-game security (increasing vulnerability or risk of mortality), decrease habitat availability via temporary displacement, and can increase stress levels of resident species. The formulation and adherence to KNFP standards for open and total road densities has been and will continue to be an important tool to mitigate the associated cumulative impacts to elk and other big-game. The current conditions of various elk habitat components are displayed in Table 3.86.

Contrarily, forest management has also contributed positively to elk and big-game habitat. Logging and prescribed burning have worked successfully to cycle forest cover through the many periods of succession. These vegetation treatments have been especially important given the many years of wildfire suppression activities, thus controlling wildfires that would have naturally kept a percentage of the forest in early successional stages that provided the primary foraging element of big-game habitat. Continued implementation of the wildfire use strategy utilized to help determine the agency's reaction to wildfires is expected to play an increasing role in future management of elk and big-game habitat in concert with vegetation management.

EFFECTS of CURRENT and REASONABLY FORESEEABLE ACTIONS

Vegetation Management and Fuels Reduction Activities

There are four Forestwide Fuel units (FWF 545 for 265 ac, FWF 536 for 195ac, FWF 52403 for 450ac, FWF 589 for 25ac) that were initiated (slashed) under the corresponding EA. The subsequent burning for these units would occur between 2012 and 2014 and may kill individual green trees within these units on the drier end of the burning prescription. This loss however, should be minimal and not result in measurable impacts to large ungulate cover.

Neighboring Fortine Ranger District, to the east of the analysis area, has six vegetation projects that may be active concurrently with treatments proposed under this project. These projects total 3,360 acres and include: Davis Be Good (124 ac); Trego (673 ac); S. Meadow Fuels (280 ac); N. Meadow Fuels (2095 ac); Little Feet (178 ac) and Elk Twins (10 ac). Large roaming species like elk, bears, lynx, etc. are more likely to be disturbed by these neighboring activities due to the typical sizes of their home ranges. Area elk may temporarily avoid (hours to days) these areas while activities are occurring. Although these areas may cumulatively add to disturbance on elk, there are approximately 26,000 acres within the analysis area that are available for the species as secure habitat.

The action alternatives, in combination with other current and reasonably foreseeable vegetation related actions including tree planting, precommercial thinning, Christmas tree cutting, wreath bough collection, character wood collection (log furniture) and blowdown salvaging (Pg. 3-5) would have minimal impacts on elk cover due to their limited spatial scope and minimal removal of vegetation. They may cause elk to temporarily (hours) avoid an area until the human activity has ceased however approximately 28% or approximately 26,000 acres of the analysis area is in secure habitat.

Livestock Grazing
Although grazing allotment(s) cover several thousand acres of the PSU, competition between cattle and resident ungulates for forage is not expected to be an issue. Domestic cattle typically utilize forage areas readily available along roadsides and recently harvested areas that have more gentle slopes whereas resident ungulates are more widespread across the landscape. There are four grazing allotments in the Cripple PSU including Fivemile, Warland, Cripple Horse and Canyon Creek. The latter two allotments (Cripple Horse, Canyon Creek) are slated for closure through the Forest Planning process. Warland has been inactive for five years, however now has renewed interest from a local rancher to run 22 cow/calf pair. Cripple Horse and Canyon Creek have been inactive for over 10 years allowing for full recuperation. Fivemile is an active allotment that supports 17 cow/calf pair with a grazing season of June 1 thru October 15. Much of the grazing is on private land owned by the permit holder along Fivemile Creek and upland areas adjacent to Blue Sky Road #6271

Noxious Weed Treatment
Weed treatment activities would not lead to any adverse effects on elk or their habitat because treatment of weeds would actually benefit forage species important to elk and other big game species (USDA Forest Service 1997, 30). Typically, approximately 200 acres are treated within the PSU on an annual basis.

Fire Suppression
In the event of a wildfire, construction of firelines, helispots and safety zones could potentially result in displacing elk and other big game from site specific areas until the event is contained. Upon completion of wildfire suppression activities, rehabilitation of these same areas can create micro-foraging areas since these sites are seeded for soil stabilization. Suppression activities are typically subject to input from District Resource Advisors, and protection of specialized habitats, including wallows, is considered.

Road Management/Use Activities
Road management actions such as road maintenance and administrative use associated with permit administration, data collection and monitoring of NFS lands are not likely to affect specialized habitats (e.g. wallows) because they generally do not result in vegetation removal. Elk and other large ungulates will typically simply avoid the disturbance area until human activities terminate, which usually comprises of a few hours. These activities include the Koocanusa Marina re-paving project (0.9 miles) to occur in the summer or fall of 2013. This action would not result in a loss of cover because the road already exists. Although water restoration projects may temporarily displace elk and other wildlife from a localized area, they typically benefit wildlife in the long-term by increasing security, providing pulses of foraging when seeded, or by simply stabilizing soils where certain habitat components can remain available (see Water and Transportation Sections).

Recreation Maintenance

Actions such as road, trail, campground maintenance and administrative use associated with permit administration, data collection and monitoring of NFS lands are not likely to measurably affect elk and other big game species. These species will typically simply avoid the disturbance area until human activities terminate, which usually comprises of a few hours.

Special Uses
There are areas previously impacted by special use permits such as mineral material sites (pits quarries, borrow, roadsides), water developments, utility corridors, private land access routes, and outfitter/guide trails/camps, COE monitoring stations, that will continue to be present and utilized. The ground disturbance on resources such as elk winter range, habitat effectiveness and cover, etc. have been included under the existing condition and would have no additional impacts. Any expansion of existing gravel pits would be analyzed for potential impacts on elk at that time.

The Koocanusa Marina plans to expand its camping site system and increase its septic capabilities beginning in 2012 through 2013. These expansions fall within the acreage for which it is already permitted but would add to the cumulative impact from human activities and their effects on elk.

Public Use
Other public uses such as wildlife viewing, berry picking, firewood gathering, camping, snowmobiling, etc. have negligible impacts on elk given their limited scope (time and space). Infra-structure, such as roads and campgrounds, that facilitate these activities have already been accounted for under the existing condition.

Private Property
Private activities such as land clearing, home construction, livestock grazing, etc. are likely to continue on those private lands within the PSU. Therefore, there would likely be a slight impact on elk cover and security, especially on winter range where most privately owned acres occur. For road construction on private lands, an estimated four acres per mile of cover can be expected to be lost. For home construction, garage, parking, lawn, an estimated 1-2 acres of cover can be estimated to be lost per resident. Because the acres are estimates and unknown, they are not reflected in Table 3.86.

Other Lands
The state of Montana is proposing to regenerate 198 acres and build approximately 0.84 miles (3.4 ac) of road in T31N, R29W, Section 12. These activities would likely result in cover loss and would cumulatively add to those disclosed impacts on NFS and COE lands under the action alternatives.

Summary of Cumulative Effects
Timber sales and other management projects, such as salvaging, road work, precommercial thins and fuels reductions, listed previously may have temporary effects on elk and other big game. These effects may include avoidance of activity areas, increase in vulnerability during the hunting season, raised stress levels and short-term displacement from key habitats, like foraging areas or wallows. Although these effects may occur, they are not expected to result in lower elk populations due to the utilization of seasonal design criteria, such as avoidance of the calving season. Contrarily, vegetation management activities can have beneficial effects, once management activities cease, by providing additional and/or reconditioned areas of big game foraging. Other forest activities such as hiking and berry picking are thought to have minimal impacts to elk, typically resulting in temporary (hours) avoidance of an area.

The temporal occurrence of forest uses such as summer activities (camping, hiking, berry picking) versus fall (hunting, firewood cutting) or winter (skiing, snowmobiling) activities, and the scheduling of management actions to avoid key time periods (spring calving and nesting) when wildlife may be more sensitive to human disturbances, allow for the avoidance of measurable cumulative impacts to elk and other species. There may be some situations where isolated or localized cumulative effects may occur, due to an overlap of forest activities, but these situations are typically short in duration, and do not persist through the lifecycle of any one species, either temporally or spatially.

REGULATORY CONSISTENCY

Forest Plan

All alternatives meet KNFP direction for big game species (FP Vol 1 II-1 #12) by maintaining appropriate amounts and quality of suitable habitat in order to maintain species viability.

All alternatives, with their associated Regional Forester approval for the over 40 acre unit request, are consistent with the KNFP (1987) by meeting KNFP or best science habitat parameters which in turn maintain available and suitable habitat.

National Forest Management Act

The project complies with the 2012 National Forest System Land and Resource Management Planning rule of March 27, 2013, by meeting KNF Land Management Plan direction for big game habitats.

State Elk Plan

The PSU is located in Elk Hunting Districts #101, 102, 103, 120, 122 (Salish EMU), identified in the MFWP Statewide Elk Management Plan. The proposed project is consistent with that document by maintaining viable populations of resident elk for hunting based on Forest Plan monitoring (USDA 2008).

Summary MIS Statement for Elk (General Forest)

Based on the analysis for elk and the other general forest habitat indicators and the KNF Conservation Plan (Johnson 2004), habitat for general forest species should provide sufficient quality and quantity of the diverse age classes of vegetation needed for viable populations. Since sufficient general forest habitat is available, the populations of species using that habitat should remain viable. According to Item C-2 of the 2008 KNFP Monitoring and Evaluation Report (FY 2007), "the aerial survey data on elk numbers show an increase since the last five year report (FY 2002). The numbers of elk observed during surveys increased from 1,778 in 2002 to 1,951 in 2007, with incremental increases each of the last five years. The average number of calves per 100 cows remained about the same, going from 31 (2002) to 28 (2007). Elk populations increased through 1990 or 1991 and then had a gradual decrease until 1997. The downward trend appears to have reversed from the previous five year reporting period (1998-2002)." This upward trend is indicative of a viable population although still below the fifth decade goal of 7,700 elk of the 1987 FP. This estimate is considered very conservative given many elk would not be seen via aerial flights only.

PILEATED WOODPECKER

Data Sources, Methods, Assumptions, Bounds of Analysis

Pileated woodpecker (PWP) population ecology, biology, habitat description and relationships identified by research for the northern Rocky Mountains are described in McClelland & McClelland (1999), McClelland (1979 1977), McClelland et al. (1979), and Warren (1990). Research conducted in the Pacific and Inland Northwest is described in Bull and Holthausen (1993), Bull et al. (1992), Bull (1987 1980 1975), Bull and Meslow (1977), Mellen et al. (1992), Mellen (1987), Thomas (1979), Mannan (1977), and Jackman (1974). This information is incorporated by reference.

Pileated woodpecker occurrence data comes from recent District wildlife observation records, the Region One Landbird Monitoring Program (Avian Science Center, Univ. of Montana), and Forest historical data (NRIS Wildlife). The PWP is the indicator species for old growth and snag habitat on the KNF. Habitat for this species was modeled using all designated and undesignated old growth habitat and old growth replacement habitat, which has currently been mapped for the Kootenai National Forest.

Effects Indicators

The potential population index (PPI) for PWPs on the KNF has been calculated and. based on the

assumption that all currently mapped effective and replacement old growth habitat (both designated and undesignated) is providing suitable habitat to support nesting territories. This assumption also includes the premise that all suitable habitat is spatially distributed across the landscape in a pattern that can be incorporated into individual nesting territories. The procedure was based on territory sizes of PWPs as described in research by McClelland (1977) for northwest Montana, and Thomas (1979) and Bull and Holthausen (1993) for northeast Oregon. For the PPI analysis on the KNF replacement old growth habitat was defined as habitat that had some old growth characteristics, but did not meet the KNFP definition of old growth or the definition found in Green et al. (1992).

Effective old growth habitat was modeled as supporting one nesting pair per 600 acres, with replacement old growth habitat supporting one nesting pair per 1,000 acres. The difference in territory size is based on research that suggests that higher quality habitat can support a breeding pair with fewer acres (McClelland 1977; Bull and Holthausen 1993). Also, allowing for larger territory sizes when habitat becomes fragmented appears reasonable, as territory sizes up to 2,600 acres have been reported for western Oregon (Mellen et al. 1992). Of course, there are numerous and complex interrelated factors that influence the actual size of the home range territory (McClelland 1977).

Project impacts are evaluated based on impacts to important attributes of pileated woodpecker habitat, primarily impacts to designated and undesignated old growth habitat. Specific features of old growth stands evaluated for project impacts include preferred nest tree species and size, down logs (both size and quantity), basal area (BA), and canopy closure (CC).

The overall assessment of habitat quality also accounts for potential negative factors discussed in the OG habitat analysis that relate to patch size and connectivity, and include fragmentation, edge effect and lack of interior habitat. Risk to firewood cutting is also evaluated. Other stands (not designated as OG) may have one or more important attributes of old growth forests, or perhaps provide for connectivity and interior habitat. These stands were also reviewed as part of this analysis.

The analysis boundary for project impacts and cumulative effects to individuals and their habitat is the Cripple PSU based on the known territory size for this species. The boundary for determining trend or viability is the Kootenai National Forest.

AFFECTED ENVIRONMENT/EXISTING CONDITION

The modeled minimum PPI for the pileated woodpecker on the KNF is 425 nesting or breeding pairs. This is within the calculated historic range of variation for the minimum potential population index of 335 to 554 breeding pairs (Johnson 1999).

A detailed summary of OG habitat for the Cripple PSU is displayed in the Old Growth Section of this document. This summary indicates that approximately 1,203 acres of effective OG habitat (both designated and undesignated), and about 8,059 acres of replacement habitat (both designated and undesignated) exist within the PSU. Existing PWP nesting territories would likely encompass a significant portion of this old growth habitat. Based solely on the quantity of old growth habitat available, the Cripple PSU could support about nine nesting territories (PPI) based on using 1,000 acres per territory given the condition of the old growth available.

Breeding bird point count surveys have been conducted on the KNF since 1994. In this program, transects consisting of multiple bird monitoring points are set up within a wide range of habitats distributed geographically across the KNF. This survey technique is not specifically designed to census woodpecker species, although all migratory and resident bird species detected by specialists trained in bird identification are recorded at each point on each transect. The rate of detection can vary greatly from year to year, especially for a wide-ranging species like the pileated woodpecker, that may or may not be

anywhere near a given point on a given day. During the 1994-2002 period, the PWP was tallied 184 times at the 2,638 individual points surveyed (USFS 2003).

There are numerous snags in the Cripple PSU with sign of pileated woodpecker activity and individuals are often seen or heard by forest personnel during field visits to the area. The presence and signs of pileated woodpeckers remain largely undocumented because of their common occurrence.

ENVIRONMENTAL CONSEQUENCES

ALTERNATIVE 1 (No Action)

Direct and Indirect Effects

Under Alternative 1, natural successional processes would continue to occur throughout existing old growth stands, and stands containing OG attributes used by pileated woodpeckers. Habitat would be provided for PWP nesting pairs that find suitable feeding and breeding conditions provided by the structural features and overall environment within these stands. There would be no change in PPI (Table 3.87).

Replacement old growth (ROG) habitat currently provides less suitable stand conditions for territory occupation. Over the next several decades, in the absence of catastrophic fires or windstorms, these stands would develop better habitat features for PWPs such as larger trees, larger snags and more down logs. Also, higher levels of decadence would develop producing better substrate for food resources such as carpenter ants and their larvae, one of the primary prey items for pileated woodpeckers in the Northern Rockies (McClelland & McClelland 1999 1977) and in the Pacific and Inland Northwest (Bull et al. 1992; Bull 1987 1975; and Bull et al. 1980).

Under Alternative 1, no active management is expected within effective or replacement old growth habitat, with the exception of fire suppression activities. Continued disruption of the historic pattern of frequent fires in the drier ponderosa pine/Douglas-fir cover type would continue to result in ecological changes, such as the encroachment of Douglas-fir saplings in the understory. Eventually, these sites would develop a higher percentage of Douglas-fir trees, snags, and down logs more suitable as foraging habitat for pileated woodpeckers.

Over the next several decades, this successional trend may result in a reduction in quality PWP nest trees (ponderosa pine), since Douglas-fir was not found to be important for pileated woodpecker nest cavity excavation in the northern Rocky Mountains (McClelland & McClelland 1999 1977), in northeast Oregon (Bull 1987 1975; Thomas 1979), or in British Columbia (Harestad & Keisker 1989).

Under this alternative, the impact of the existing road system on snags, an important attribute of the pileated woodpecker territory, would remain as described under the analysis for snags and old growth habitat. The effects of edge on PWP habitat from adjacent regeneration units would also remain as described under the old growth analysis.

ALTERNATIVE 2 and 3

Direct and Indirect Effects

Impacts to OG habitat are disclosed in the Old Growth Section. These effects can translate to potential impacts to the PWP as loss of nesting and foraging habitat or reduced habitat quality.

Habitat impacts from the action alternatives would not result in the loss of old growth in any established category. However, they would result in an increased edge effect of 250 acres (all categories) in Alternative 2, and 241 acres in Alternative 3 due to proposed adjacent harvest acres (Table 3.80).

Both Alternatives 2 and 3 also propose approximately 666 feet of road (system or temporary) thru or adjacent to old growth. Although these roads would remain closed to the public or decommissioned after management activities, they would result in the loss of snags within the PSU. This loss has been accounted for in the analysis for the snag resource, previously discussed.

Under Alternative 2, treatments to reduce the vertical structure within both designated and undesignated OG are proposed in approximately 137 acres in conjunction with vegetation management and prescribed fire to assist in reducing fuel loadings. An additional 1,326 acres of prescribed burning, without pre-treating the vertical structure, is proposed in old growth. These activities have the potential to both reduce and create PWP feeding and nesting habitats. The vertical structure treatments and fuel treatments however, are not expected to affect the canopy closure, tree species present, basal area of the large diameter trees, nor the overall snag capacity of these stands. Likewise, these proposed management activities would not affect the continuity of PWP habitat or old growth stands given that no mature timber would be removed from old growth stands.

Alternative 3 was designed to meet the intent of Forest Supervisor Paul Bradford's letter of April 13, 2007, in that project analyses must include an alternative in addition to the no-action alternative, which does not propose any treatments (including prescribed fire) in any type of old growth.

Conversely, in Alternative 2, fuel treatments should assist in promoting tree growth by decreasing competition and contribute to the large tree component of treated dry-site old growth stands.

All action alternatives propose motorized trail access changes in that they convert approximately 37 miles of motorized trails to non-motorized and covert approximately 16 miles of seasonally or yearlong restricted roads into an intermittent stored status. Both of these actions would benefit any adjacent old growth stands by making them less susceptible to firewood cutting. Contrarily, Alternative 3 proposes to convert approximately 1.7 miles of seasonally restricted roads and approximately 13.5 miles of undetermined roads to NFS roads which allow legal use. Although this is a legal access change, any impact to adjacent old growth stands has likely already occurred from illegal firewood gathering due to the easy topography of these lands along Koocanusa Reservoir. Additional impacts to any old growth in these areas are not anticipated.

Ground disturbing activities, such as the proposed dispersed campground improvements (Fivemile, Yarnell) in or adjacent to old growth may result in noxious weed invasion. The project design should include measures to reduce this potential risk (e.g. washing equipment, weed spraying). These activities would not remove old growth attributes, such as snags, unless deemed unsafe to recreation users/campers. These activities would occur in all action alternatives.

The Army COE is proposing to harvest and or slash/burn approximately 421 acres on Corp lands included in the PSU boundary. There are no NFS old growth stands adjacent to any COE activities so no impacts to this resource, such as edge effect, are anticipated.

Under all action alternatives, project activities (e.g. falling and yarding) are likely to cause pileated woodpeckers to, at least temporarily, move away from the disturbed areas.

Cumulative Effects

Summary of the Existing Condition

The past reduction of functional OG as well as snags, as previously discussed, via forest management actions and natural occurrences have contributed cumulatively to the existing habitat conditions for the pileated woodpecker. Over time, these cumulative impacts have likely reduced both nesting and feeding habitat as well as the number of nesting territories within the PSU and on the Forest. Based on the expected low level of impacts to old growth acres from the action alternatives, (Table 3.80) the PPI is not expected to change as seen in Table 3.87.

Table 3.87 - Potential Population Index by Alternative

ANALYSIS AREA	EXISTING PPI	ALT 1	ALT 2	ALT 3
Cripple PSU	9	9	9	9

Forestwide	429	429	429	429

EFFECTS of CURRENT and REASONABLY FORESEEABLE ACTIONS
All activities identified to occur within the analysis area that have the potential to affect this species are discussed in the following paragraphs.

Vegetation Management and Fuels Reduction Activities
There are 25 acres planned for underburning within the East Reservoir analysis area which initiated under the treatment of FWF Unit 589. These 25 acres are within designated old growth and would alter the understory as described under direct effects for action alternatives on old growth. No projects under the Forestwide Blowdown EA are planned within the East Reservoir analysis area /Cripple PSU at this time.

Cumulatively, the proposed activities (timber harvest, prescribed fire, ground fuel reduction) in designated and undesignated OG would not reduce the amount and distribution of old growth below KNFP requirements. However, due to cumulative edge effects (Table 3.80) there may be reduced old growth quality for PWPs, such as resulting in less interior habitat and more edge where predation is more likely to occur or where noxious weed invasions are more likely to become established. However, given the level of impact and the quantity of old growth in the PSU, this effect should be minimal and would diminish in approximately 50 years (Russell and Jones 2001; Ripple et al. 1991; Russell et al. 2000). Private lands in the Cripple PSU were assumed to not provide any old growth, based on past harvest practices.

The action alternatives, in combination with other current and reasonably foreseeable actions including tree planting, precommercial thinning (5,563 ac), Christmas tree cutting, boughs collection, pine cone collecting would maintain the designated management level of old growth by avoidance. In the instance where existing old growth is burned or blown down, replacement old growth will be designated to account for this loss.

Livestock Grazing
Cattle grazing (Fivemile and Warland Allotments) would not result in a change of old growth habitat, snags or down woody debris in the PSU, as it does not involve the harvest of trees, dead or alive. Grazing cattle predominantly move along road systems and within past harvest units where an abundance of forage can be found.

Noxious Weed Treatment
Noxious weed management would result in no loss or change in snags and down woody debris because weed treatments primarily focus on the herbaceous layer along roads and in previously disturbed areas. Typically, approximately 200 acres are treated within the PSU on an annual basis.

Fire Suppression
In the event of a wildfire, construction of firelines, helispots and safety zones could potentially result in impacts to old growth habitat and the pileated woodpecker. Conversely, wildfire suppression also serves to preserve existing old growth habitat. Suppression activities are typically subject to input from District Resource Advisors, and protection of special habitats, including old growth, is considered. However, if cumulative effects to old growth habitat result in the habitat no longer functioning as old growth, additional old growth habitat would be designated.

Road Management/Use Activities
Road management actions such as road maintenance and administrative use associated with permit administration, data collection and monitoring of NFS lands are not likely to affect old growth and other specialized habitats (e.g. snags, down woody debris) because they generally do not result in vegetation removal. These activities include the Koocanusa Marina re-paving project (0.9 miles) to occur in the summer or fall of 2012. The standing tree and snag component would only be affected if considered a hazard to road users. These activities would not result in any change to the quantity of old growth, thus no

adverse cumulative effects on the pileated woodpecker would be expected.

Recreation Maintenance
Routine maintenance of trails and developed and dispersed recreation sites would not contribute to the cumulative impact on old growth and the pileated woodpecker because maintenance of these facilities do not typically involve removal of old growth elements such as large trees or snags unless deemed to be a safety hazard to forest users. In this situation, the removal of a tree or snag is considered negligible.

Special Uses
There are areas previously impacted by special use permits such as mineral material sites (pits quarries, borrow, roadsides), water developments, utility corridors, private land access routes, and outfitter/guide trails/camps, COE monitoring stations, that would continue to be present and utilized. Ground disturbance on resources such as old growth have been included under the existing condition and would have no additional impacts. Any expansion of existing gravel pits would be analyzed for potential impacts on old growth and the PWP at that time.

The Koocanusa Marina plans to expand its camping site system and increase its septic capabilities beginning in 2012 through 2013. These expansions fall within the acreage for which it is already permitted and would not involve the removal or alteration of designated old growth stands.

Public Use
Firewood gathering would continue to remove some snags from old growth along open road corridors and these acres were previously accounted for as part of the existing condition. Other forest use activities such as mushroom and berry picking, camping, hunting, Christmas tree cutting, bough collection, etc. have little to no measurable impact on old growth and the PWP because they are largely non-consumptive or rapidly re-established and would not contribute to the cumulative effect on this resource.

Private Property
Private activities such as land clearing, home construction, livestock grazing, etc. are likely to continue on those private lands within the PSU. Therefore there would likely be a decrease in dry-site old growth within the PSU, but outside of NFS lands.

Other Lands
The state of Montana is proposing to regenerate 198 acres and build approximately 0.84 miles (3.4ac) of road in T31N, R29W, Section 12. However, these proposed actions are not adjacent to any mapped old growth type on NFS lands and therefore would have no edge effect on old growth stands. **Section 2??**

Summary of Cumulative Effects
Alternative 1 would not measurably contribute any cumulative effects. The Forestwide PPI (Table 3.87) reflects cumulative changes from each alternative and all past, present and reasonably foreseeable actions. Only 25 acres of prescribed burning under FWF 598 would occur in old growth under this alternative.

Alternatives 2or 3 would not measurably contribute to cumulative effects on PWP habitat. Other planned management activities, such as prescribed burning in old growth under Alternative 2 is expected to both create and reduce woodpecker feeding and nesting habitat equally. The potential for firewood cutters to reduce PWP habitat coinciding with old growth habitat along forest roads was previously accounted for in the discussion of old growth. Likewise, the impacts of timber harvesting immediately adjacent to old growth areas, has also been disclosed under the old growth section. No other current or reasonably foreseeable activities occurring within the PSU (Pg. 3-5) are expected to impact this resource because most are prohibited from occurring within old growth areas.

Based on the analysis for pileated woodpecker, the MIS for old growth, snags and down wood, and the KNF Conservation Plan (Johnson 2004), habitat for old growth forest species and cavity habitat users should be provided in sufficient quality and quantity to meet the needs for viable populations. Because sufficient old growth forest, and snag and down wood habitat is available, the populations of species

using that habitat should remain viable.

REGULATORY CONSISTENCY

Forest Plan

All alternatives are consistent with KNFP direction for old growth (see old growth section). All alternatives are consistent with KNFP direction for snags and down wood (see snag and down wood section)

All alternatives are consistent with KNFP direction to maintain diverse age classes of vegetation for viable populations (FP II-1 #7) by maintaining appropriate amounts and quality of suitable habitat in order to maintain species viability based on best science.

National Forest Management Act

The project complies with the 2012 National Forest System Land and Resource Management Planning rule of March 27, 2013, by meeting KNF Land Management Plan direction for old growth.

OTHER SPECIES of INTEREST

NORTHERN GOSHAWK

Data Sources, Methods, Assumptions, Bounds of Analysis

Goshawk population ecology, biology, habitat description and relationships identified by research are described in McGrath et.al. (2003), Brewer et al. (2009) and Reynolds et al. (1992).That information is incorporated by reference. Goshawk occurrence data comes from recent District wildlife observation records and Forest historical data (NRIS Wildlife). Goshawk habitat was modeled using TSMRS vegetation data filtered through a series of queries of associated habitat elements such as forest types, aspect, slope and elevation (see project file). The potential population index (PPI) (habitat acres divided by average territory acres) was calculated using 5,400 acres as the average goshawk pair territory (Reynolds et al. 1992). Therefore, the analysis boundary for project direct, indirect and cumulative impacts to individuals and their habitat is the Cripple PSU containing over 92,000 acres of forest stands. The boundary for determining trend or viability is the Kootenai National Forest.

Management Status

In 2004, the Region reevaluated the set of species that would be placed on the Sensitive Species List. A standardized process to evaluate each species was followed. The goshawk was not placed on the 2004 sensitive species list based on the criteria used. It was added to the list in 2005 (Kimbell 3/31/2005) because it had been previously petitioned for listing under ESA, remained a focal point of project appeals, and was a species of special interest with certain segments of the public.

The goshawk was to remain on the list until the Region completed new data collection and evaluation, at which time its status was to be reconsidered. The work of Samson (2005) and a Region-wide survey (2006) provided the data and evaluation on which to base reconsideration of the goshawk status as sensitive. Based on these works, the Forest Wildlife Biologists across the Region asked the Regional Forester to remove the northern goshawk from the Region 1 sensitive species list in March of 2007. In July of 2007, the Regional Forester responded to the biologists request stating: “The Forest Service Manual (2670.5) states that Sensitive Species are those for which there is a significant current or predicted downward trend in population numbers/density and a similar downward trend in habitat capability that would reduce distribution of the species. Regional data collection and analysis demonstrates that neither condition exists; therefore, the species no longer meets the definition for “sensitive.” Due to this decision, the northern goshawk is no longer listed as a “sensitive” species for the KNF. The species is being addressed under this proposal due to concerns raised during public scoping.

AFFECTED ENVIRONMENT/EXISTING CONDITION

Goshawk observation and monitoring data indicates that goshawks are utilizing at least portions of the

Cripple PSU. Surveys conducted in the summer of 2011 confirmed their presence in the PSU with one new active nest located and mapped. Johnson (1999) shows goshawk presence confirmed in all eight planning units on the KNF. At the end of 2008, Forest survey records show 37 nest sites, with four sites no longer in use. This information included the results of surveys conducted on the KNF from 2006-2008 under an agreement with the Natural Heritage Program (Johnson 2008).

Goshawk habitat modeling identifies approximately 57,006 acres of primary (nesting) goshawk habitat in the Cripple PSU based on the habitat parameters used for the modeling (see Project File). Brewer et al. (2009) summarized reports from various research projects that indicate goshawks utilize a wide range of habitats for hunting including: forest edges with riparian, clearcuts and sage, as well as non-forested openings, dense forests and open forests. Based on these findings, the Cripple PSU may provide as much as 64,569 acres of suitable habitat. Since most goshawk populations are thought to be limited by available food sources (Brewer et al. 2009), the amount of habitat available for goshawks to forage becomes increasingly important. A conservation assessment by Samson (2005) also suggests the importance of goshawk foraging habitats and the varying age classes and structures suitable for a variety of prey species.

Based on the average goshawk pair territory and the modeled nesting habitat acres, the PPI for the Cripple PSU is 10 goshawk pairs. Using the nesting (modeled) habitat acres from Johnson (Ibid), the minimum PPI for the KNF would be 139 goshawk pairs. The most recent data show 37 known or suspected pairs and an additional ten known individual goshawks on the KNF(KNF goshawk data). The confirmations of the nest sites found in the Cripple PSU and on the Three Rivers Ranger District in 2011 will update this information.

Research shows that while goshawks use structural components found in old growth (e.g. large diameter trees, high crown closure) those same components are also found in other age classes of forested habitat. Approximately eleven percent (8,533 acres) of the Cripple PSU, below 5,550 feet, is made up of MA 13 old-growth in both the designated effective and replacement categories. Additional information on old-growth conditions and its management indicator species, the pileated woodpecker, can be found in those respective sections.

ENVIRONMENTAL CONSEQUENCES

Table 3.88 summarizes the cumulative changes in habitat acres and PPI due to each alternative.

Table 3.88 - Nesting Habitat and Cumulative PPI Remaining by Alternative

	ALT 1	ALT 2	ALT 3
Nesting Acres – Cripple PSU (% change)	57,006 (0%)	49,580 (-13.0%)	50,411 (-11.6%)
PPI - Project Area Pair Territories (% change)	10 (0%)	9 (-1%)	9 (-1%)
All Habitat Acres (Forest-wide) (% change)	752,296[2] (0%)	744,870 (-1%)	745,701 (-.88%)
PPI - Forestwide Pair Territories (% change)	139 (0%)	137 (-2%)	138 (-1%)
Foraging Acres - Cripple PSU (% change)[1]	64,569 (0%)	56,176 (-13.0%)	57,010 (-11.7%)

[1] Foraging acres modeled are not mutually exclusive from nesting habitat acres affected. FS managed lands equate to approximately 78,607 of the acres within the Cripple PSU. Timber stands treated by prescribed burn only were considered to maintain suitable habitat for goshawks.

[2]approximately 203 Forest-wide acres are foreseeable to be treated by the State of Montana within the Cripple PSU which would equate to approximately 3.8% of a given territory.

ALTERNATIVE 1 (No-Action)

Direct and Indirect Effects

Alternative 1 (no-action) would have no immediate direct or indirect effects on the northern goshawk or its habitat due to the lack of action. However, lack of at least prescribe burning, over portions of the

territory, would likely result in poorer quality foraging habitat due to the natural maturing of the forest canopy. This effect could result outside of any natural vegetation altering occurrences such as wildfires, insect infestations, etc. General nesting habitat would continue to naturally develop under Alternative 1.

The East Reservoir proposal as described under Alternative 2 would alter a newly discovered (summer 2011) goshawk nesting site based on field surveys and monitoring. Details of alterations by treatment unit are displayed in the accompanying process paper (Volume U of the Project File). Briefly, Alternative 2 would propose to treat approximately 1,913 acres within the established territory (based on Reynolds et al. 1992) by some type of timber harvest including precommercial thinning and help maintain habitat via prescribe underburning on approximately 1,519 acres. The timber harvesting would bring the territory above (to 50.7%) suggested management levels according to Reynolds (ibid) which recommends to manage no more than 40% of suitable habitat within a territory and to maintain at least 60% of the territory in mature/late seral forest stands while Alternative 3 slightly below or better than recommendation at 35%.

Of general modeled habitat, both action alternatives would alter potential goshawk habitat as disclosed in Table 3.88. As can be seen, of the foraging habitat within the PSU, Alternative 2 would alter approximately 8,393 acres of foraging habitat leaving 56,176 acres following implementation. Vegetation alterations would largely impact prey species associated with more dense forest canopies including squirrels. Alternative 2 would alter 7,426 acres (not exclusive of foraging acres) of goshawk nesting acres making the goshawks and their young more susceptible to predation and competition from other raptors like the red-tail hawk, therefore resulting in unsuitable nesting habitat. Effects are similar, though on less acreage, for Alternative 3.

Alternative 3 would alter approximately 7,559 acres of foraging habitat, within the PSU. Indirectly, these habitat alterations may temporarily displace goshawks and/or their prey species from currently suitable habitat. Indirect effects on goshawks should abate after approximately 15 to 25 years depending upon the growing site. Impacts to prey could diminish as recent as five years following habitat alterations depending upon the species of prey (e.g. game birds, some songbirds, rodents, etc.)

Also under Alternative 2, the new road construction (9.3 miles) and temporary road construction/reconstruction (approximately 4.26 miles), especially when occurring adjacent to suitable nesting habitat, could have similar effects on goshawks as those timber harvest effects, described previously, resulting in competition for nesting habitat and predation of young by other raptors. Road storage or decommissioning would have long-term beneficial effects to goshawks as these prisms return to forest cover decreasing forest edge effect.

Alternative 2 proposes motorized trail access changes in that they convert approximately 37 miles of motorized trails to non-motorized and covert approximately 16 miles of seasonally or yearlong restricted roads into an intermittent stored status and remove 9.3 miles of road from the landscape. Alternative 3 proposes motorized trail access changes in that they convert approximately 27 miles of motorized trails to non-motorized and covert approximately 17.6 miles of seasonally or yearlong restricted roads into an intermittent stored status and remove 12.4 miles of road from the landscape. All of these actions would benefit any adjacent goshawk habitat by making them less susceptible to firewood cutting and by lowering human disturbance levels.

Contrarily, both action alternatives propose to convert approximately 1.6 to 1.8 miles of seasonally restricted roads and approximately 13.5 miles of undetermined roads to NFS roads which allow legal use. Although this is a legal access change, any impact to adjacent goshawk habitat has likely already occurred from illegal firewood gathering due to the easy topography of these lands along Koocanusa Reservoir. Additional impacts to any goshawks and mature forest stands in these areas are not anticipated.

Ground disturbing activities, such as the proposed dispersed campground improvements (Fivemile, Yarnell) in or adjacent to goshawk habitat may result in noxious weed invasion. The project design should include measures to reduce this potential risk (e.g. washing equipment, weed spraying). These activities would not remove habitat attributes, such as snags, unless deemed unsafe to recreation users/campers. These activities would occur in all action alternatives.

The Army COE is proposing to harvest and or slash/burn approximately 421 acres on Corp lands included in the PSU boundary. There are no known goshawk nests adjacent to any COE activities so no impacts to this resource, such as edge effect, are anticipated.

Under all action alternatives, project activities (e.g. falling and yarding) within a half-mile of known nests are likely to cause goshawks to, at least temporarily, move away from the disturbed areas.

In summary, the proposed action may disturb individuals and/or their habitat, but would not contribute to a trend toward federal listing or loss of species viability for the northern goshawk. This determination is based on:
1) Known nests have been avoided by the proposed alternatives;
2) All alternatives maintain the existing level of all categories of old growth within the PSU;
3) All alternatives maintain goshawk habitat above 50% in mature stands which is close to management recommendations of Reynolds 1992;
4) The distribution of habitat needed for viable populations on a Forest level would not be affected;
5) based on Region 1 reviews (Brewer et al. 2009; Samson 2005) habitat for the northern goshawk is readily available and well-distributed and there is no evidence that goshawk numbers are declining based on increases in the amount, distribution and connectivity of forested habitat since European settlement; decline in the level of timber harvesting in the region; and the natural succession of forested habitats.

For disturbance to goshawk habitat falling within all old growth types within the Cripple PSU please refer to the Old Growth Resource Section of this document and associated maps.

Cumulative Effects
Summary of the Existing Condition
Cumulative changes in habitat and PPI levels are displayed in Table 3.88. The existing condition includes the results from all past activities. Alternative 1 includes all reasonably foreseeable projects that were able to be modeled. Based on the modeled acres that are suitable as goshawk habitat versus the land area under federal management, it can be deduced that past activities and natural incidences of wildfires have contributed to cumulative altering of suitable and available goshawk habitat. As previously stated, approximately 64,569 acres or 82% of the federally managed land in the Cripple PSU (includes nesting acres), are currently modeled as suitable goshawk foraging habitat. When comparing this figure to the average recommended age class distribution for VRUs 3 through 9, where the majority of northern goshawk habitat would be found on the KNF, the Cripple PSU is within the range (roughly 20 to 95% for these VRUs age classes greater than 101 years old) of historic vegetation patterns (USDA, Gautreaux 1999 p169). The cumulative effect becomes more evident when modeling potential goshawk nesting habitat, which is currently approximately 72.5% (or 57, 006 of 78,607 ac), falling slightly lower in this historic range of availability. The effect, also becomes more evident, with the amount of MA 13 (old growth) remaining in the PSU. Therefore, proposed long-term vegetation management benefits should outweigh immediate impacts to existing goshawk nesting habitat.

Effects of Current and Reasonably Foreseeable Actions
All activities identified to occur within the analysis area that have the potential to affect goshawks are

discussed in the following paragraphs.

Vegetation Management and Fuels Reduction Activities
There is 25 acres planned for underburning within the East Reservoir analysis area which initiated under the treatment of FWF Unit 589. These 25 acres are within designated old growth and would alter the understory as described under direct effects for action alternatives. These types of projects have the potential to reduce the down wood component or element of mature stands thereby potentially impacting associated species that provide prey for goshawks.

Cumulatively, the proposed activities (timber harvest, prescribed fire, ground fuel reduction) in designated and undesignated OG, that can serve as goshawk habitat, would not reduce the amount and distribution of old growth below KNFP requirements. However, due to cumulative edge effects (Table 3.80) there may be reduced OG quality for some plant and animal species, such as resulting in less interior habitat and more edge where predation is more likely to occur or where noxious weed invasions are more likely to become established. However, given the level of impact and the quantity of old growth in the PSU, this effect should be minimal and would diminish in approximately 50 years (Russell and Jones 2001; Ripple et al. 1991; Russell et al. 2000). Private lands in the Cripple PSU were assumed to not provide any old growth, based on past harvest practices.

The action alternatives, in combination with other current and reasonably foreseeable actions including tree planting, precommercial thinning (140 ac in suitable habitat), Christmas tree cutting, bough collection, pine cone collecting would maintain the designated management level of old growth and other mature forest stands by avoidance. In the instance where existing old growth is burned or blown down, replacement old growth will be designated to account for this loss.

Livestock Grazing
Cattle grazing (Fivemile Allotment, Warland Allotment) would not result in a change of old growth or mature habitats that provides nesting areas for this species, as it does not involve the harvest of trees, dead or alive. Additionally, changes to the grass/herbaceous layer of vegetation would not affect goshawk habitat characteristics and generally, due to the lack of ungulate forage in old growth and mature forest stands, cattle grazing is typically not an issue.

Noxious Weed Treatment
Weed treatment activities would not lead to any adverse effects on goshawks or their habitat because treatment of weeds would actually benefit forage species important to many species or their prey (USDA Forest Service 1997, 30). No loss or change in specific habitats (e.g. old growth, mature forests), including snags and down woody debris inhabited by prey species would result from this activity because weed treatments primarily focus on the herbaceous layer along roads and in disturbed areas. Typically, approximately 200 acres are treated within the PSU on an annual basis.

Fire Suppression
With the direction to suppress all wildland fires on NFS lands, construction of firelines, safety zones and other control structures could impact individuals on a site-specific basis. Avoidance of known goshawk nests would be attempted during suppression efforts but some impacts may still occur. Due to the unpredictable nature of wildfires, contributions of fire suppression to the cumulative effect on this species can only be surmised but may certainly include temporary disturbance and loss of individual snags and or potential nest trees. Also refer to cumulative effects on old growth.

Road Management/Use Activities
Road management actions such as road maintenance and administrative use associated with permit administration, data collection and monitoring of NFS lands are not likely to affect goshawks and specialized habitats (e.g. snags, down woody debris) because they generally do not result in vegetation removal. Although road restoration and maintenance projects (brushing, blading, gate repairs, culvert replacement, etc.) may temporarily displace goshawks from a localized area or impact individuals, they

typically benefit the species in the long-term, especially if the projects involve closing previously open road systems (refer to road storage in Transportation/Hydrology Sections. Also refer to cumulative effects on old growth). These activities include the Koocanusa Marina re-paving project (0.9 miles) to occur in the summer or fall of 2013. The standing tree and snag component of goshawk habitat would only be affected if considered a hazard to road users. These activities would not result in any change to the quantity of old growth, thus no adverse cumulative effects would be expected to that resource.

Recreation Maintenance
Routine maintenance of trails and developed and dispersed recreation sites have the potential to remove nesting and foraging trees for goshawks if they are close to a trail or road and present a safety hazard. Effects would include removing site-specific, individual trees, and would not be expected to contribute measurably to the cumulative effect on the northern goshawk.

Special Uses
There are areas previously impacted by special use permits such as mineral material sites (pits quarries, borrow, roadsides), water developments, utility corridors, private land access routes, and outfitter/guide trails/camps, COE monitoring stations, that would continue to be present and utilized. Operations of outfitter/guides would not result in any change to general and specialized goshawk habitats (e.g. old growth or mature forests, snags or down woody debris), as they do not involve the harvest of trees. There would be no cumulative effects to goshawks or their habitats associated with these activities other than possible temporary and local avoidance of an area due to the presence of humans. Ground disturbance on resources such as old growth and mature forest stands have been included under the existing condition and would have no additional impacts. Any expansion of existing gravel pits would be analyzed for potential impacts on goshawks at that time.

There are no known land exchanges planned within the PSU at this time.

The Koocanusa Marina plans to expand its camping site system and increase its septic capabilities beginning in 2012 through 2013. These expansions fall within the acreage for which it is already permitted and would not involve the removal or alteration of designated old growth stands.

Public Use
The temporal occurrence of forest uses such as summer activities (camping, hiking, and berry picking) versus fall (hunting, firewood cutting) or winter (skiing, snowmobiling) activities, and the scheduling of management actions to avoid key time periods (nesting, rearing) when goshawks may be more sensitive to human disturbances, allow for the avoidance of measurable cumulative impacts. There may be some situations where isolated or localized cumulative effects may occur, due to an overlap of forest activities, but these situations are typically short in duration, and do not persist through the lifecycle of the raptor, either temporally or spatially.

Other forest product activities occurring presently and typically on an annual basis are the gathering of pine cones, bough collection and commercial gathering of Christmas trees. These activities occur throughout the PSU, and have little-to-no effect on the landscape due to the unspecific nature of the use and the low impact on the resources (foot traffic, hand tools). Additionally, Christmas trees are harvested from existing regeneration units, so this activity would have no cumulative effect on the specialized habitats of goshawks, such as old growth and riparian areas.

Private Property
Private activities such as land clearing, home construction, livestock grazing, etc. are likely to continue on those private lands within the PSU. Therefore, there would likely be a decrease in dry-site old growth within the PSU, but outside of NFS lands. Any cumulative effects to goshawks would be partially dependent on the duration (seasonal versus year-round) of use of these parcels and homes. Anticipated effects include species displacement, nest failure, habitat alteration and/or habitat loss.

Other Lands

The state of Montana is proposing to regenerate 198 acres and build approximately 0.84 miles (3.4 ac) of road in T31N, R29W, Section 12. While these proposed actions are not adjacent to any mapped OG type on NFS lands and therefore would have no edge effect on old growth stands, they are in mature forest stands. The regeneration of these stands would reduce potential goshawk habitat by 198 acres. These acres are not reflected in Table 3.88 because they would not occur on NFS lands. The disturbance associated with this activity would likely cause goshawks to avoid adjacent areas during implementation.

Summary of Cumulative Effects

Direct, indirect and cumulative impacts on potential goshawk habitat are disclosed in Table 3.88 and show slight reductions within the Cripple PSU and on the KNF. However, the proposed activities would not affect the 10% standard for old growth at either the PSU or KNF scale. The most recent Forestwide old growth analysis concludes that at least 10% of the KNF below 5,500 feet elevation is designated for old growth management. Overall, the habitat reductions from the East Reservoir Project are minimal and would not result in habitat fragmentation nor inhibit this species' from reproducing and maintaining its viability on the KNF.

REGULATORY CONSISTENCY

Forest Plan

- All alternatives are consistent with KNFP direction to maintain a minimum of 10% old growth below 5,500 feet in elevation in each third order drainage or compartment, or a combination of compartments (Kootenai Supplement No 85; supplement to FSM 2432.22).
- Based on April 26th, 2004 direction (Castaneda 2004), old growth will be analyzed at the PSU scale. After implementation of the action alternatives, the Cripple PSU would have 11.2% designated old growth below 5,500 feet elevation. In addition, 1,147 acres of undesignated old growth would remain. The most recent Forestwide assessment as documented in the KNFP Monitoring and Evaluation Report (USDA Forest Service 2011) shows that the KNF has 11.6% old growth designated (includes both effective and replacement). The KNFP established that maintaining 10% of OG habitat is sufficient to support viable populations of old-growth dependent species (Vol 1 II-1 7; III-54; Vol 2 A17).
- All alternatives are consistent with KNFP direction to maintain diverse age classes of vegetation for viable populations (FP II-1 #7) by maintaining appropriate amounts and quality of suitable habitat in order to maintain species viability based on best science.

National Forest Management Act

- The project complies with the 2012 National Forest System Land and Resource Management Planning rule of March 27, 2013, by meeting KNF Land Management Plan direction for old growth.
- The project complies with NFMA direction (16 USC 1604 (G)(3)(b) to "provide for diversity of plant and animal communities based on the suitability and capability of the specific land area in order to meet overall multiple-use objectives, and within the multiple-use objectives of a land management plan adopted pursuant to this section, provide, where appropriate, to the degree practicable, for steps to be taken to preserve the diversity of tree species similar to that existing in the region controlled by the plan."

NORTH AMERICAN BEAVER

Data Sources, Methods, Assumptions, Bounds of Analysis

American beaver population ecology, biology, habitat description and relationships are described in www.nhptv.org/natureworks/beaver; www.wikipedia.org/wiki/beaver; Allred (1980); Loates and Hvenegaard (2008).That information is incorporated by reference. Beaver occurrence data comes from recent District wildlife observation records and Forest historical data (NRIS Wildlife). Beaver habitat was modeled and noted during field review of the analysis area, via information request from FS personnel, and later mapped for display purposes as part of the Project File. Defensible territories were assumed to be similar in size found in research, being at least 1km in length (0.62 miles) and in low gradient streams

(<6 percent). The analysis boundary for project and cumulative disturbance to individuals and their habitat is the Cripple PSU. The boundary for determining trend or viability is the KNF.

Management Status

In the State of Montana, the beaver is considered a species that is hunted, trapped or fished and a furbearer. In Montana as well as most of the northwest United States, beaver populations have rebounded well from their bleak numbers of the 19th and early 20th centuries. Beavers have become so numerous in Montana that the State no longer requires trappers to tag or report them as in the past; therefore, a reasonable estimate on current population numbers is unavailable (Thier, pers. comm. 2011). Beavers are also not a listed species under Endangered Species Act (ESA) nor do they have any special status on the KNF or Northern Region of the Forest Service. The North American beaver is being analyzed for this project due to public concerns raised during the initial scoping process.

AFFECTED ENVIRONMENT/EXISTING CONDITION

As stated previously, population numbers of beaver within the State of Montana are currently unknown. However, some information suggests that current beaver numbers in North America are believed to range between 10 and 15 million (www.wikipedia.org). During field reviews of the Cripple PSU or East Reservoir analysis area, crews documented two active beaver colonies and several of past beaver use. They are considered a keystone species in an ecosystem by creating wetland habitats used by a variety of species including fish. Beaver dams and created wetlands can have both beneficial and negative impacts on other resources such and fisheries and hydrology (refer to the Fisheries and Hydrologic analyses for associated effects) by altering water levels and stream courses, however, their functions are largely beneficial to shaping the landscape and expanding wetland habitats. Other effects of beaver activity and dams include; increased water surface area, regulation of stream flow, newly created water reservoir, filtration system for low density particulates, and simply creating a diversity of wildlife habitats (Allred 1980). Modeling stream gradients (<6%) within the Cripple PSU indicated that approximately 49 linear stream miles may be suitable and available for beaver occupancy.

ENVIRONMENTAL CONSEQUENCES

Table 3.89 summarizes the cumulative changes in habitat acres due to each alternative.

Table 3.89 - Habitat Changes by Alternative

	ALT 1	ALT.2	ALT. 3
Habitat miles – Cripple PSU (% change)	49 (0%)	49 (0%)	49 (0%)
Number of suitable habitat crossing by roads in the PSU removing riparian veg.	D, I = 0 C = 28	D, I = 0 C = 28	D, I = 0 C = 28
Estimated number of acres removed by stream crossing (1/4 ac per crossing)	D, I = 0 ac C = 7 ac	D, I = 0 ac C = 7ac	D, I = 0 ac C = 7ac

D = direct effect I = indirect effect C = cumulative effect

ALTERNATIVES 1, 2 and 3

Direct and Indirect Effects

All alternatives, including the action alternatives would not result in any direct or indirect effects on existing beaver habitat. No additional road crossings which would disturb or remove foraging habitat would be constructed. Likewise, none of the alternatives propose timber harvesting in riparian areas which would also reduce foraging and vegetation suitable for dam construction. All alternatives would allow natural progression of beaver habitat to occur.

Under Alternatives 2 and 3, the new (9.3 to 8.1 miles) and temporary (4.3 to 4.1 miles) miles of road construction, especially when occurring adjacent to suitable beaver habitat, could expose the species to increased trapping due to increased human access. Contrarily, road decommissioning or storage would

have long-term beneficial effects to beavers as these prisms return to forest cover decreasing the access effect.

All action alternatives propose motorized trail access changes in that they convert approximately 36 to 27 miles of motorized trails to non-motorized and covert approximately 16 to 17.6 miles of seasonally or yearlong restricted roads into an intermittent stored status. Both of these actions would benefit any beavers by making them less susceptible to trapping. Contrarily, Alternatives 2 and 3 each propose to convert approximately 1.8 to 1.6 miles of seasonally restricted roads and approximately 13.5 miles of undetermined roads to NFS roads which allow legal use. However, these roads are located along Koocanusa Reservoir where suitable beaver habitat is largely absent.

Ground disturbing activities, such as the proposed dispersed campground improvements (Fivemile, Yarnell) are not likely to directly or indirectly impact beavers due to their location in reference to known beaver use areas. These recreation areas are along Koocanusa Reservoir where suitable beaver habitat is largely absent. These activities would occur in all action alternatives.

The Army COE is proposing to harvest and or slash/burn approximately 421 acres on COE lands included in the PSU boundary. There are no known beaver sites adjacent to any COE activities so no impacts to this resource, such as habitat loss, are anticipated.

Cumulative Effects
Summary of the Existing Condition
North American beaver populations reached their low point during the late 19th century due to over-trapping for their fur which was used to make clothing and hats (www.wikipedia.org). Since then, the beaver, through conservation efforts, have made a complete recovery and have been documented on every district of the KNF (Deavours 2011 pers. comm. with KNF biologist; various emails). Forest activities including timber harvesting and the associated road building have likely contributed to the cumulative disturbance on beavers and their habitat. Forest road systems provide easier trapper access to beaver populations and increase waterflows can result in the weakening or loss of beaver dams. Overall, however, the disturbances to beavers from forest practices are negligible compared to the fur trapping days of the 19th century. Today, beaver sign is fairly common in the PSU with efforts to increase their populations continuing on the Libby District.

Effects of Current and Reasonably Foreseeable Actions
All activities identified to occur within the analysis area that have the potential to affect the North American beaver are discussed in the following paragraphs.

Vegetation Management and Fuels Reduction Activities
No blowdown projects are planned within the East Reservoir analysis area/Cripple PSU at this time. These types of projects would have the potential to reduce the down wood component or element of riparian stands thereby potentially impacting associated species. Also please refer to vegetation management activities under Other Lands.

Livestock Grazing
Cattle grazing (Fivemile and Warland Allotments) would not result in a change of known beaver habitat. Cattle grazing and beaver foraging areas do not overlap in content. Some resource damage can occur due to cattle grazing along stream courses but these are very localized and typically corrected through additional fencing and consulted with the forest range specialist.

Noxious Weed Treatment
Beavers away from wetlands or home sites could accidently be sprayed with herbicides being utilized along road systems, however the chances of incidentally spraying the mammal would be extremely low based on their periods of activity. The effect of being sprayed is accounted for in the application rates/toxicity and chemicals disclosed in the 2007 KNF Invasive Plant Management FEIS (pp3-72 to 3-

73). Any herbicide application within the Cripple PSU and near riparian areas would be consistent with that document and its range of effects on small mammal species. Typically, approximately 200 acres are treated within the PSU on an annual basis.

Fire Suppression
With the direction to suppress all wildland fires on NFS lands, construction of firelines, safety zones and other control structures could impact individuals on a site-specific basis. Avoidance of known beaver dams and riparian areas would be attempted during suppression efforts but some impacts may still occur. Due to the unpredictable nature of wildfires, contributions of fire suppression to the cumulative effect on this species can only be surmised but may include loss of riparian food sources, reduction of riparian down wood cover and increase sediment into areas streams due to emergency fireline construction near streams.

Road Management/Use Activities
Road management actions such as road maintenance and administrative use associated with permit administration, data collection and monitoring of NFS lands are not likely to affect beavers and specialized habitats (e.g. riparian food sources, dam sites, down woody debris) because they generally do not result in vegetation removal. Although road restoration and maintenance projects (brushing, blading, gate repairs, culvert replacement, etc.) may temporarily disturb beavers in localized areas they typically benefit the species in the long-term, especially if the projects involve closing previously open road systems (refer to road decommissioning in Transportation/Hydrology Sections). The Koocanusa Marina re-paving project (0.9 miles) to occur in the summer or fall of 2013 would not impact beavers due to avoidance of suitable habitat.

Recreation Maintenance
Routine maintenance of trails and developed and dispersed recreation sites has little potential to disturb beavers or their habitat largely due to avoidance. Some trails may follow closely or cross stream courses so disturbance could occur but this impact would be very limited in scope in both time and space.

Special Uses
There are areas previously impacted by special use permits such as mineral material sites (pits quarries, borrow, roadsides), water developments, utility corridors, private land access routes, and outfitter/guide trails/camps, COE monitoring stations, that would continue to be present and utilized. Operations of outfitter/guides would not result in any change to general and specialized beaver habitats (e.g. riparian areas) by avoidance. There would be no cumulative effects to beavers or their habitats associated with these activities other than possible temporary and local avoidance of an area due to the presence of humans. Ground disturbance (e.g. stream crossings, road construction) on this resource has been included under the existing condition and would have no additional impacts. Any expansion of existing gravel pits would be analyzed for potential impacts on beavers at that time if this species is an issue.

There are no known land exchanges, which could involve riparian habitats, planned within the PSU at this time.

The Koocanusa Marina plans to expand its camping site system and increase its septic capabilities beginning in 2012 through 2013. These expansions fall within the acreage for which it is already permitted and would not involve the removal or alteration of riparian habitat nor any stream courses.

Public Use
Other forest product activities occurring presently and typically on an annual basis are the gathering of pine cones, boughs and commercial gathering of Christmas trees. These activities occur throughout the PSU, and have little-to-no effect on the landscape due to the unspecific nature of the use and the low impact on the resources (foot traffic, hand tools). Additionally, Christmas trees are harvested from existing regeneration units, so this activity would have no cumulative effect on the specialized habitats of beavers, such as streams and associated riparian areas.

Private Property
Private activities such as land clearing, home construction, livestock grazing, etc. are likely to continue on those private lands within the PSU. While most of these activities avoid stream side riparian areas and associated beaver food sources, some impacts to these resources could occur. Anticipated effects include species displacement, breeding failure, habitat alteration and/or habitat loss but area outside of FS jurisdiction. Occasionally the State of Montana will trap beavers considered a nuisance on private lands and relocate them to NFS lands in lieu of removing them from the ecosystem.

Other Lands
The State of Montana is proposing to regenerate 198 acres and build approximately 0.84 miles of road in T31N, R29W, Section 12. These acres contain one mapped stream course and associated riparian area that may facilitate beaver travel across the PSU. The State would have to comply with state management direction for timber harvesting near streams, therefore any potential habitat within this block of state land would be protected by stream management zones. State of Montana activities on this parcel may disturb any beavers in the area or cause them to temporarily avoid the area.

Summary of Cumulative Effects
The temporal occurrence of forest uses such as summer activities (camping, hiking, berry picking) versus fall (hunting, firewood cutting) or winter (skiing, snowmobiling) activities, and the scheduling of management actions to avoid key time periods (breeding, rearing) when beavers may be more sensitive to human disturbances, allow for the avoidance of measurable cumulative impacts. There may be some situations where isolated or localized cumulative effects may occur, due to an overlap of forest activities, but these situations are typically short in duration, and do not persist through the lifecycle of the beaver, either temporally or spatially.

REGULATORY CONSISTENCY

Forest Plan

- All alternatives are consistent with KNFP direction to maintain diverse age classes of vegetation for viable populations (FP II-1 #7) by maintaining appropriate amounts and quality of suitable habitat in order to maintain species viability based on best science.
- All Alternatives are consistent with KNFP riparian standards and guidelines (FP Vol 1 II-28 thru 33) as amended by INFS and by creation of SMZs.

National Forest Management Act

- The project complies with NFMA direction (16 USC 1604 (G)(3)(b) to “provide for diversity of plant and animal communities based on the suitability and capability of the specific land area in order to meet overall multiple-use objectives, and within the multiple-use objectives of a land management plan adopted pursuant to this section, provide, where appropriate, to the degree practicable, for steps to be taken to preserve the diversity of tree species similar to that existing in the region controlled by the plan.”
- The project complies with the 2012 National Forest System Land and Resource Management Planning rule of March 27, 2013, by meeting KNF Land Management Plan direction for vegetation treatments in or near riparian habitats as well as State SMZs.

SENSITIVE SPECIES

REGULATORY FRAMEWORK

The sensitive species analysis in this document meets the requirements for a biological evaluation as outlined in FSM 2672.42.

Sensitive species are administratively designated by the Regional Forester (FSM 2670.5; updated 2011)

and managed under the authority of the National Forest Management Act (NFMA). FSM 2670.22 requires the maintenance of viable populations of native and desired non-native species and to avoid actions that may cause a species to become threatened or endangered.

The NFMA (36 CFR 219.19) directs the FS to "provide for diversity of plant and animal communities based on the suitability and capability of the specific land area in order to meet overall multiple-use objectives." [16 U.S.C. 1604(g) (3) (B)] Providing ecological conditions to support diversity of native plant and animal species in the planning area satisfies the statutory requirements [(36 C.F.R. 219.10(b)]. The Forest Service's focus for meeting the requirements of NFMA and its implementing regulations is on assessing habitat to provide for diversity of species.

The KNF Land and Resource Management Plan (1987) establishes forestwide goals, objectives, standards, guidelines and monitoring requirements. Direction for sensitive species includes determining the status of sensitive species and providing for their environmental needs as necessary to prevent them from becoming endangered (FP II-1). The KNFP also requires the maintenance of diverse age-classes of vegetation for viable populations of all existing native, vertebrate wildlife species (FP II-1).

Table 3.90 - Sensitive Wildlife Species on the Kootenai National Forest
(Kimbell 2004 2005; Weldon 2011)

SENSITIVE SPECIES	STATUS IN ANALYSIS AREA	COMMENTS**
Bald Eagle (*Haliaeetus leucocephalus)*	K	Analyzed for this project
Bighorn sheep *(Ovis Canadensis)*	K	Analyzed for this project
Black Backed Woodpecker (*Picoides arcticus*)	K	Analyzed for this project
Coeur d'Alene Salamander (*Plethodon vandykei idahoensis*)	NS	1
Common loon (*Gavia immer*)	NS	1
Fisher (*Martes pinnanti*)	S	Analyzed for this project
Flammulated Owl (*Otus flammeolus*)	K	Analyzed for this project
Harlequin Duck (*Histrionicus histrionicus*)	NS	1
Northern Bog Lemming (*Synaptomys borealis*)	NS	1
Northern Leopard Frog (*Rana pipiens*)	NS	2
Peregrine Falcon (*Falco peregrinus*)	NS	1
Townsend's Big-eared Bat *(Corynorhinus townsendii)*	K	Analyzed for this project
Western Toad (*Bufo boreas*)	K	Analyzed for this project
Gray Wolf (*Canis lupus*)	K	Analyzed for this project

K = This species is known to occur within the project area.
S = Species is suspected to occur within project area based on historical records, however recent sightings are scarce primarily due to lack of documentation and formal surveys..
NS = Species is not suspected to occur within the project area, and is dropped from further evaluation.
1 = Suitable habitat does not occur in the analysis area
2 = Only known location on Rexford Ranger District north of the Cripple PSU.

BALD EAGLE

Data Sources, Methods, Assumptions, Bounds of Analysis

Eagle population ecology, biology, habitat description and relationships identified by research are described in USDI U.S. Fish and Wildlife Service (USDI 1995), USDI 1999, Montana Bald Eagle Working Group (MBEWG) 1991, MBEWG 1994 and FWS 2007a. That information is incorporated by reference. Eagle occurrence data comes from recent District wildlife observation records, Forest historical data (NRIS Wildlife), and other agencies (USFWS, MFWP).

The National Bald Eagle Management Guidelines (FWS 2007a) provide the recommendations for avoiding disturbance to bald eagles. Habitat management guidelines from the Montana Bald Eagle

Management Plan (MBEMP) (MBEWG 2010, 1994, 1991) serve as the measure for bald eagle habitat management on the KNF. The effect of any proposed activity on potential eagle habitat (½ mile of major water source; MBEMP 1994) and any known eagle nests located within the bald eagle habitat will be discussed in relation to the 2010 Montana Bald Eagle Management Guidelines in lieu of the National Bald Eagle Management Guidelines (NBEMG; USFWS 2007a). This rationale is based on the fact that the NBEMG are more appropriate for states such as Florida which, have higher concentrations of bald eagles and have built nests near pre-existing human activity whereas Montana bald eagles are likely more accustomed to areas with less human activity and rural areas.

The analysis boundary for project impacts to individuals and their habitat is all lands within the Cripple PSU that fall within ½ mile of open water and defined in the 1994 Bald Eagle Management Plan (2010 Addendum). The boundary for cumulative effects and making the effects determination is the Cripple PSU because it contains more than adequate shoreline for more than one bald eagle territory. The boundary for determining trend and population viability is the Kootenai National Forest.

AFFECTED ENVIRONMENT/EXISTING CONDITION

The Bald Eagle was officially removed from the threatened species list on August 8, 2007. It was immediately placed on the FS Northern Region's sensitive species list for a period of five years, after which a status review will be made to determine the need to remain on or be removed from that list.

Bald eagles occur as both seasonal migrants and year-round residents within the boundaries of the KNF. Nesting has increased significantly over the last two decades within the boundaries of the KNF. Only one active nest was known to occur in 1978, whereas 45 nests (20 on NFS and 25 other lands) were known and monitored in 2009. Nest success for active nests over the last twenty-year period is about 84%, with an average of 1.3 fledglings per active nest (KNF Bald Eagle Monitoring Records).

Wintering bald eagle numbers have fluctuated over the years depending on food sources (fish from open waters and dead animals along roads and railroad tracks) and winter conditions (open verses frozen water for foraging habitat). Mid-winter bald eagle counts have averaged 95 bald eagles over the past 25 years (KNF Bald Eagle Monitoring Records).

About 11,229 acres of the bald eagle habitat area occur in the Cripple PSU based on forested acres influenced by Koocanusa Reservoir. Forestwide potential bald eagle habitat covers about 564,558 acres (242,965 NFS; 275,470 PVT; 46,123 water; based on USDI 2001).

ENVIRONMENTAL CONSEQUENCES

Direct and Indirect Effects

The Montana Bald Eagle Management Guidelines (2010 Addendum) provide the following recommendations for avoiding disturbance effects to bald eagles at nest sites:

Seasonal Restrictions

Recommended seasonal restrictions from approximately February 1 through August 15th for the following activities (do not apply to unoccupied or alternate nest sites, nests with fledged eaglets, failed nests):

- Construction and maintenance including buildings, roads, trails or any other outside construction within direct line of sight of an active nest.
- Loud noises such as fireworks, blasting, and operation of forest harvest machinery (skidders, trucks, chainsaws, etc.), jackhammers, construction equipment, etc.
- Forest management activities, thinning and fuels reduction including all activities associated with the removal of forest vegetation around occupied nests.
- Concentrated recreation including but not limited to, hiking, bird-watching, fishing (on and offshore), hunting, boating and use of personal watercraft.

There is one known bald eagle nest (Dunn Creek) tree in the Cripple PSU on COE lands; any proposed treatment units (COE3, COE4, COE5, COEF12, COE7) within the influence area of this nest would be implemented post-fledging (generally August 15) in conjunction with visual and distance buffers as recommended. These treatment units total approximately 322 acres and are a mixture of improvement cuts (188 ac) and fuels reductions/burning (134 ac).

Visual Buffers

Recommended activities for visual buffer maintenance and enhancement:

- Managing forest and riparian habitats to protect and enhance important habitat components (i.e. perch trees, visual screening, etc.)
- Thinning around large potential or active bald eagle nest trees to protect them from crown fires. Thinning should be done so as not to compromise visual buffers (direct line of sight) between nest trees and potential human disturbance.
- Placing new construction (homes, buildings, trails, boat launches/marinas, etc.) only in areas where visual buffers around nests can be retained.
- Retaining a natural buffer around active nests, alternate nests, and large live trees and snags during fire protection activities that meet Wildland Urban Interface (WUI) safety requirements and recommendations while providing visual security (direct line of sight) for bald eagles.

There is one known bald eagle nest tree in the Cripple PSU on COE lands; any proposed treatment units (COE3, COE4, COE5, COEF12, COEF7) within the influence area of this nest will be implemented post fledging (generally August 15) in conjunction with timing restrictions and distance buffers as recommended. These treatment units total approximately 322 acres and are a mixture of improvement cuts (188 ac) and fuels reductions/burning (134 ac).

Distance Buffers

Recommended distance buffers in the <u>absence of a visual buffer</u>; are intended to apply to activities near nest sites, concentrated foraging areas and communal roost sites during the appropriate season of eagle use. A half (½) mile for the following activities:

- Any activity that will result in more than one house or permanent construction to include commercial use, buildings three or more stories high, activity that would increase human use, or project with a footprint greater than ½ acre.
- Construction of new marinas with routine use by six or more boats.
- Any use of explosives or activities that produce extremely loud noise, such as blasting, use of jackhammers or gravel crushing equipment, or fireworks.
- Forest management activities that include harvesting and heavy truck traffic in areas that don't normally have that type of activity.
- Construction of new above ground power and utility lines.

The proposed treatment units (COE3, COE4, COE5, COEF12, COEF7) include timber harvesting, hauling, slashing and burning and are within the ½ mile influence area of this nest. These activities would not only protect the nest tree but would maintain adjacent trees, and forest stand integrity, to break up direct line of site from activities occurring on Koocanusa Reservoir. The treatments would be implemented post-fledging (generally August 15) on approximately 322 acres and are a mixture of improvement cuts (188 ac) and fuels reductions/burning (134 ac). The road construction, reconstruction, storage and access changes are outside the influence of this bald eagle nest territory and would not impact the species' ability to nest or forage in suitable habitat. Likewise, the improvements of the Fivemile and Yarnell Campgrounds are outside of the ½ buffer of influence for this known eagle nest and would not impact the species.

A quarter (¼) mile for the following activities:

- Any permanent construction to include single home properties (<3 stories tall) and outbuildings.
- Any construction of infrastructure such as roads and trails including dozer lines for fire management activities, except when specifically constructed to save a bald eagle nest from fire.
- Forest management activities to include timber harvest layout, snag removal, prescribed fires, planting and thinning.
- Recreation activities during the breeding season such as non-motorized hiking, fishing, hunting, camping, rafting, bird-watching, biking, as well as motorized activities including driving, off-road vehicle use, boating and personal watercraft (continued movement activities listed previously have less impact than those that include stopping (camping, anchoring boats) or constant human use (popular hiking trails).
- Or 1,000 feet above nest sites for helicopter and aircraft use during breeding season except for biologist conducting bald eagle nest surveys.

The associated activities with proposed treatment units (COE3, COE4, COE5, COEF12, COEF7) include timber layout, marking, and cruising, in addition to those mentioned previously, and are within the ¼ mile influence area of this nest. These activities would be implemented post-fledging (generally August 15) and prior to spring occupancy depending on crew availability. These activities would also occur on approximately 322 acres as previously described.

MBEMP guidelines identify four general habitat categories and management concerns for bald eagles. They are: nesting habitat, foraging habitat (including perch sites), winter habitat (including roost sites) and mortality risks.

Nesting habitat is typically associated with mature forest stands in close proximity (less than 1 mile) to large bodies of water, including lakes and fourth order streams, which provide an adequate prey base. Potential effects from this project on nesting habitat were previously addressed.

Foraging habitat consists of lakes, rivers, wetlands and meadows that provide open flight paths, perches and adequate prey. It also includes highway and railroad corridors (especially in the winter) due to dead animals found in these areas. Any forest management activities associated with the COE treatment units listed previously will occur following the post-fledgling period and avoid impacts on foraging bald eagles for this nest territory.

Winter habitat is generally dictated by the presence and abundance of food, open water and secure night roost sites (MBEWG 1994). Eagles are known to winter within or near the Cripple PSU. While some forest activities including winter timber harvest could occur within ½ mile of the Dunn Creek eagle nest, impacts on foraging eagles is expected to be minor given the abundance of winter foraging along Koocanusa Reservoir and below Libby Dam along the Kootenai River.

The MBEMP (1994) identifies bald eagle **mortality risks** as shooting, accidental trapping, poisoning, diseases and electrocution. On the KNF, bald eagles have also died from collisions with motor vehicles and trains. Accidental electrocution due to utility lines, servicing private residences or near Libby Dam would represent the highest probability for eagle mortality within the Cripple PSU with motor vehicle collision representing the second highest risk for mortality during the winter carrion feeding months.

Cumulative Effects
Summary of the Existing Condition
Past management actions occurring since the initial operation of Libby Dam in 1972 are not believed to have measurably contributed to cumulative impacts on bald eagles or their habitat. The higher quality bald eagle habitat north of the dam was covered with the creation of Koocanusa Reservoir. With the development of the Forest Plan, management activities have been largely restricted along the reservoir

outside of established recreation areas. Additionally, wildfire suppression near the reservoir has contributed to protecting large diameter trees suitable for perching, roosting and nesting. It is likely that windstorms have had, and will continue to have, the greatest impact on suitable bald eagle habitat on the Libby Ranger District.

Effects of Current and Reasonably Foreseeable Actions
All activities identified to occur within the analysis area that have the potential to affect bald eagles are discussed in the following paragraphs.

Vegetation Management and Fuels Reduction Activities
The action alternatives, in combination with other current and reasonably foreseeable actions including tree planting, precommercial thinning, Christmas tree cutting, bough collection, pine cone collecting and blowdown salvaging, would maintain suitable bald eagle habitat by avoidance. Other than possibly annoying individual birds, human disturbance from these activities would have minimal impacts on area bald eagles especially in concert with recommended timing restrictions from the MBEMP (2010).

Livestock Grazing
Cattle grazing (Fivemile Allotment; Warland Allotment) would not result in a change of old growth or mature habitats that provides nesting areas for this species, as it does not involve the harvest of trees, dead or alive. Additionally, changes to the grass/herbaceous layer of vegetation would not affect eagle habitat characteristics and generally, due to the lack of ungulate forage in old growth and mature forest stands, cattle grazing is typically not an issue.

Noxious Weed Treatment
Weed treatment activities, implemented according to the 2007 KNF Invasive Plant Management EIS ROD would not lead to any adverse effects on bald eagles or their habitat because treatment of weeds would actually benefit forage species important to many species or their prey (USDA Forest Service 1997, 30). No loss or change in specific habitats (e.g. old growth, mature forests, lakes, wetlands) inhabited by prey species would result from this activity because weed treatments primarily focus on the herbaceous layer along roads and in disturbed areas. Typically, approximately 200 acres are treated within the PSU on an annual basis.

Fire Suppression
With the direction to suppress all wildland fires on NFS lands, construction of firelines, safety zones and other control structures could impact individuals on a site-specific basis. Avoidance of known eagle nests would be attempted during suppression efforts but some impacts may still occur. Due to the unpredictable nature of wildfires, contributions of fire suppression to the cumulative effect on this species can only be surmised but could include loss of actual nest tree (nest failure), loss of forested habitat around wetlands or lakes, avoidance of habitat by eagles due to heavy smoke or suppression activities.

Road Management/Use Activities
Road management actions such as road maintenance and administrative use associated with permit administration, data collection and monitoring of NFS lands are not likely to affect bald eagles and specialized habitats (e.g. snags, wetlands, nest trees) because they generally do not result in vegetation removal. Although road restoration and maintenance projects (brushing, blading, gate repairs, culvert replacement, etc.) may temporarily displace eagles from a localized area or impact individuals, they typically benefit the species in the long-term, especially if the projects involve closing previously open road systems (refer to road storage in Transportation/Water Sections) that would reduce the risk of human disturbance. Under the East Reservoir Project, these activities include the Koocanusa Marina re-paving project (0.9 miles) to occur in the summer or fall of 2013. The standing tree and snag component of eagle habitat would only be affected if considered a hazard to road users. These activities would not result in any change to the quantity of habitat, thus no adverse cumulative effects would be expected to that resource.

Recreation Maintenance
Normal road and trail maintenance activities have the potential to remove nesting and foraging trees for eagles if they are close to a trail or road in suitable habitat, as defined, and present a safety hazard. These situations are extremely rare and are often mitigated via distance buffers. Effects could include removing site-specific, individual trees, and would not be expected to contribute measurably to the cumulative effect on the bald eagle under consultation with a biologist.

Routine maintenance of dispersed recreation sites would not contribute to the cumulative impact on bald eagles because maintenance of these facilities do not typically involve removal of habitat elements such as large trees or snags unless deemed to be a safety hazard to forest users. In this situation, the removal of a tree or snag is considered negligible. In the situation where nest trees need to be removed due to safety concerns, removal would occur upon conclusion of the reproduction period.

Special Uses
There are areas previously impacted by special use permits such as mineral material sites (pits quarries, borrow, roadsides), water developments, utility corridors, private land access routes, and outfitter/guide trails/camps, COE monitoring stations, that would continue to be present and utilized. Operations of outfitter/guides would not result in any change to general and specialized eagle habitats (e.g. mature forests, snags, wetlands, lake shore), as they do not involve the harvest of trees. There would be no cumulative effects to eagles or their habitats associated with these activities other than possible temporary and local avoidance of an area due to the presence of humans. Ground disturbance on resources such as mature forest stands have been included under the existing condition and would have no additional impacts. Any expansion of existing gravel pits would be analyzed for potential impacts on eagles at that time.

There are no known land exchanges planned within the PSU at this time.

The Koocanusa Marina plans to expand its camping site system and increase its septic capabilities beginning in 2012 through 2013. These expansions fall within the acreage for which it is already permitted and are outside of the ½ mile influence area of the Dunn Creek eagle nest.

Public Use
The temporal occurrence of forest uses such as summer activities (camping, hiking, berry picking) versus fall (hunting, firewood cutting) or winter (skiing, snowmobiling) activities, and the scheduling of management actions to avoid key time periods (nesting, rearing) when eagles may be more sensitive to human disturbances, allow for the avoidance of measurable cumulative impacts. There may be some situations where isolated or localized cumulative effects may occur, due to an overlap of forest activities, but these situations are typically short in duration, and do not persist through the lifecycle of the raptor, either temporally or spatially.

Other forest product activities occurring presently and typically on an annual basis are the gathering of pine cones, boughs and commercial gathering of Christmas trees. These activities occur throughout the PSU, and have little-to-no effect on the landscape due to the unspecific nature of the use and the low impact on the resources (foot traffic, hand tools). Additionally, Christmas trees are harvested from existing regeneration units, so this activity would have no cumulative effect on the specialized habitats of eagles, such as mature trees and riparian areas. During the reproduction period, adult eagles may become agitated if humans partaking in activities mentioned above become too close to active bald eagle nests. Typically, public use, outside of those water related, are outside of the more sensitive distance buffers recommended by the MBEMP.

Private Property
Private activities such as land clearing, home construction, livestock grazing, etc. are likely to continue on

those private lands within the PSU. Therefore, there would likely be a decrease in dry-site old growth within the PSU, but outside of NFS lands. Any cumulative effects to eagles would be partially dependent on the duration (seasonal versus year-round) of use of these parcels and homes and their proximity to known bald eagle nest territories. Anticipated effects include species displacement, nest failure, habitat alteration and/or habitat loss.

Other Lands

The state of Montana is proposing to regenerate 198 acres and build approximately 0.84 miles of road in T31N, R29W, Section 12. While these proposed actions are in mature forest stands they are greater than ½ from the Dunn Creek eagle nest and Koocanusa Reservoir where eagle foraging occurs. Therefore these state activities would have minimal impacts on any bald eagles utilizing suitable habitat in the general area.

Summary of Cumulative Effects

Project scheduling/staging would be required in order to avoid possible cumulative impacts from various vegetation management and fuel reduction activities occurring within and adjacent to the Dunn Creek bald eagle nest. These activities in conjunction with recreation activities occurring along the Kootenai River near this nest have the potential to displace resident bald eagles and result in nest failure if allowed to occur during the breeding season. See season restriction recommendations addressed previously.

REGULATORY CONSISTENCY

- All Alternatives meet KNFP direction for sensitive species (FP Vol. 1, II-1 #6) by maintaining appropriate amounts and quality of suitable habitat in order to maintain species viability.
- The project is consistent with the Bald and Golden Eagle Protection Act (16 U.S.C. 668-668C 1978) by avoiding disturbance or resulting in take of bald eagles by avoiding the nesting season of the Dunn Creek bald eagle territory.
- The project is consistent with the Migratory Bird Treaty Act (17 U.S.C. 703-712) by avoiding the nesting season when eggs or chicks could be impacted and by protecting the nest tree from management activities.

National Forest Management Act

- The project complies with NFMA direction (16 USC 1604 (G)(3)(b) to "provide for diversity of plant and animal communities based on the suitability and capability of the specific land area in order to meet overall multiple-use objectives, and within the multiple-use objectives of a land management plan adopted pursuant to this section, provide, where appropriate, to the degree practicable, for steps to be taken to preserve the diversity of tree species similar to that existing in the region controlled by the plan."
- The project complies with the 2012 National Forest System Land and Resource Management Planning rule of March 27, 2013, by meeting KNF Land Management Plan direction for potential impacts on this habitat resource.

STATEMENT OF FINDINGS

Alternative 1 will have <u>no direct impact</u> on bald eagles due to the lack of action. However, the lack of action may indirectly result in forest habitat conditions that could lead to more stand replacement fires which would remove suitable nesting habitat for the eagle. No action could also result in growing conditions less suitable for producing large diameter nest trees due to increased competition for soil nutrients and moisture. Neither of these conditions are supportive of the purpose and need for this project.

Alternatives 2and 3 <u>may impact individuals or their habitat but will not contribute to a trend toward federal listing or loss of species viability for the bald eagle</u>. This determination is based on:

1) Adherence to timing, distance, and buffer recommendations for forest management activities occurring near active bald eagle nests;

2) Although management activities would occur during the post-fledgling period, some foraging bald eagles may be agitated if utilizing the immediate area, however this effect would be minimal due to the abundance of foraging habitat both above and below Libby Dam
3) The actions would protect known nest tree(s) and would have no direct impacts on major prey species (fish, waterfowl) of the bald eagle.

BIGHORN SHEEP

Data Sources, Methods, Assumptions, Bounds of Analysis

Bighorn sheep population ecology, biology, habitat description and relationships identified by research are described in Geist (1971), Buechner (1960), and Couey (1950). That information is incorporated by reference. Rocky Mountain bighorn sheep are the largest of several species of mountain sheep in North America. They are a very social species and segregate into groups of mature males only or females, lambs and immature males for most of the year. Primarily, they eat grasses and forbs, although herds in northwest Montana eat more shrubs than herds in other areas. The most important habitat requirement for the species is suitable escape habitat; steep, rocky terrain is necessary for them to escape from predators. This type of escape terrain must be found in all of their seasonal ranges in order for the habitat to be usable by bighorn sheep. Their rut begins in early November and lasts for approximately two months. Mature females produce 1 lamb in late May.

The greatest threat to bighorn populations is from disease. The animals are susceptible to pneumonia and a population involved in a pneumonia outbreak would see a significant number of animals die and reproduction and recruitment would be reduced for several years. The reasons for disease outbreaks are unclear. However, there is evidence to suggest that contact with domestic sheep or goats can play a role (MFWP 2010). The recent die-off of Montana's bighorn sheep populations was instrumental in the listing of the species as sensitive within the NFS Region 1. Three neighboring NFS Regions (R2, R3, R4) previously listed the sheep as sensitive prior to 2011 even with larger sheep populations. With these dramatic die-offs and widely accepted knowledge of reduced sheep habitat, Region 1 finalized listing for the bighorn sheep in 2011 (Tomasik 2011).

Bighorn occurrence data comes from recent District wildlife observation records and Forest historical data (NRIS Wildlife). Additional data comes from Montana FWP records. The analysis boundary for project impacts and cumulative effects to individuals and their habitat is the Cripple PSU. The boundary for determining trend or viability is the Kootenai National Forest.

AFFECTED ENVIRONMENT/EXISTING CONDITION

There are four herds of bighorn sheep within the boundaries of the KNF. Two of the herds (Ural-Tweed, Ten Lakes) are native herds, totaling 90 individuals based on observations. The Kootenai Falls and Cabinet (Berray Mtn.) herds are both transplanted herds, herds that have been reestablished or established by the relocation of sheep from other populations.

The Cripple PSU or East Reservoir analysis area includes the Koocanusa/Ural-Tweed "Trench" bighorn sheep herd (Hunting District 101). The herd is estimated at 30 individuals with only two actually observed via aircraft (MFWP 2010). Most observations come from government personnel and the general public while traveling Montana Highway 37 along Koocanusa Reservoir as compiled by MFWP. The area used by the herd includes about 22,400 acres of sheep habitat all on NFS lands except approximately 100 acres of privately owned lands. The habitat extends from the upper Pinkham Creek area in the north to Fivemile Creek in the south and generally consists of steep, rocky and primarily dry forested terrain. The habitat management strategies for this herd (MFWP 2010) include as summarized; cooperative work with FS and Bonneville Power Administration (BPA) in habitat needs/improvements and continuing cooperation with the Montana Department of Highways to identify possible sheep crossings along Highway 37, high risk areas of vehicle collisions as well as solutions to these issues. This analysis will

evaluate how well the East Reservoir project assists in meeting or meets these habitat management strategies and objectives.

Forestwide, there are 90,880 acres of bighorn sheep habitat (Hunting Districts #100, 101, 102, 123). It is found widely distributed in pockets that include steep, rocky terrain. The total number of bighorn sheep on the KNF is 248, statewide the total number of sheep is 5,694 animals in 49 herds (MFWP 2010). This analysis modeled primary bighorn sheep habitat within the Cripple PSU based on parameters from the conservation strategy and the associated map is located in the Project File for this project. Briefly, the results indicate that there are approximately 940 acres of bighorn sheep escape habitat, 3,060 acres of foraging habitat, and 9,049 acres of winter range available within the Cripple PSU. However, some of these acres are outside of the known Ural-Tweed bighorn herd home range as previously described. Local biologists agree that the limited use (known 22,400 acre home range) of the Cripple PSU by bighorn sheep can likely be attributed to the limited amount of quality bunchgrass winter range which has been encroached by various conifers during years of continued fire suppression.

There are no domestic sheep grazing allotments within the Cripple PSU and no known domestic sheep on private lands that could pose a risk to this sheep herd via transfer of epizootic diseases such as pneumonia.

ENVIRONMENTAL CONSEQUENCES

According to the Montana Bighorn Sheep Conservation Strategy (MFWP 2010) there are three essential elements of managing bighorn sheep habitat and these elements are subject to degradation by humans and plant succession. These elements in brief are: 1) escape cover or terrain in all seasons; 2) high visibility to detect predators and access to forage; 3) low elevation winter range near escape cover receiving no more than ten inches of snow cover. Forest activities and treatments that can assist in maintaining or enhancing these habitat needs will assist in perpetuating this species (Table 3.91).

Proposed activities for Alternatives 2and 3 have the potential to expand or improve foraging opportunities. Timber harvest (regeneration or thinning) and slash treatment (burning) have the potential to improve bighorn sheep foraging habitat (Table 3.91). Opening the canopy and burning decadent grasses and shrubs improves conditions for grasses and forbs.

Another issue which can have impacts on bighorn sheep, especially on critical winter range and lambing habitat is human disturbance much of which typically results from recreation activities. The East Reservoir Project will be analyzed on how, if at all, it may contribute to human disturbance of sheep on these habitats.

Table 3.91 - Change in Bighorn Sheep Habitat

HABITAT CHANGE (% change)	ALT 1	ALT 2	ALT 3	HABITAT ELEMENT EFFECT
Change in Habitat Quality due to vegetation management /1	198	1573 ac = WR 0.02 ac = ESC 106 ac = FOR	1,473 ac = WR 0 ac = ESC 106 ac = For	Increase foraging, improve escape visibility, decrease encroachment of trees on winter range
Change in Habitat Quality due to prescribed burning	0	2,641 ac = WR 786 ac = ESC 1,507 ac = FOR	2,641 ac = WR 786 ac = ESC 1507 ac = FOR	Improve winter range foraging, summer foraging, escape visibility

/1 – Not all harvested or thinned forested acres may be suitable for sheep due to lack of escape habitat as in steep rocky slopes, however, these areas do provide foraging habitat for other ungulates therefore decreasing foraging competition on steeper habitats.

WR = winter range **ESC** = escape habitat **FOR** = foraging habitat within 300 meters of escape habitat.

ALTERNATIVE 1 (No-Action)

Direct and Indirect Effects

Alternative 1 (no-action) would largely maintain/allow the natural successional processes to continue,

treating only 2% of potential sheep winter range. Open foraging areas would continue to decrease in size and productivity as conifers encroached upon the openings on all seasonal ranges. No cooperative habitat improvements outside of weed management along area roads would occur under this alternative. Human recreational use of the area would remain at or near current levels growing closely with population increase of the general area. No new recreation facilities that may enhance human use of the area would occur.

ALTERNATIVES 2and 3
Direct and Indirect Effects
Generally, agency management practices that may have impacts (both negative and positive) to bighorn sheep can include: domestic sheep allotments; non-sheep livestock allotments; domestic sheep trailing routes; noxious weed management or lack thereof; fire exclusion; prescribed fire; thinning of conifers; management of conifer encroachment; placing treatments that will attract bighorns between bighorns and domestic sheep or goats on non-NFS ownership; use of domestic sheep or goats for weed treatment; use of pack goats; human disturbance (and associated dogs) in lambing and wintering habitats; and motorized or non-motorized routes in key habitat areas (Tomasik 2011).

As can be seen in Table 3.92, Alternative 2 would create forest openings with various harvest prescriptions on 17% of the potential (available, but underutilized by Ural herd) bighorn sheep winter range in the PSU, zero percent on escape habitat and 3.5% on general foraging habitat. This alternative would burn approximately 29% of the potential bighorn sheep winter range in the PSU, 84 % on escape habitat and 49% on general foraging habitat in the PSU. However, only about 11% of the estimated big horn sheep habitat for the Ural-Tweed herd (25,600 ac) is within the Cripple PSU as the southern extent of their range ends at Fivemile Creek.

Similarly, Alternative 3 would create forest openings with various harvest prescriptions on 16% of the potential bighorn sheep winter range in the PSU, zero percent on escape habitat and 3.5% on general foraging habitat. This alternative would burn approximately 29% of the potential bighorn sheep winter range in the PSU, 84% on escape habitat and 49% on general foraging habitat in the PSU. Additionally, the remaining vegetation treatments outside of the home range may serve to shift other foraging ungulates into other areas and decrease foraging competition in the immediate area. In summary, all of the action alternatives would benefit bighorn sheep habitat and assist in meeting the purpose and need for this project.

Both action alternatives propose motorized trail access changes in that they convert approximately 37 (Alt 2) to 27 (Alt 3) miles of motorized trails to non-motorized and covert approximately 16 to 17.5 miles of seasonally or yearlong restricted roads into an intermittent stored status. Both of these actions would benefit bighorn sheep by making potential habitat more secure from human activities. Although not overly sensitive to humans outside the lambing season, bighorn sheep are measurably stressed by uncontrolled dogs that often accompany forest recreationists. Contrarily, Alternatives 3 and 4 each propose to convert approximately 1.8 to 1.6 miles of seasonally restricted roads and approximately 13.5 miles of undetermined roads to NFS roads which allow legal use. Although this is a legal access change would facilitate human activities, the effect would be largely negligible because these roads are located near Koocanusa Reservoir where the sheep avoid until winter and early spring when humans are largely absent.

Ground disturbing activities, such as the proposed dispersed campground improvements (Fivemile, Yarnell) may result in noxious weed invasion. The project design should include measures to reduce this potential risk (e.g. washing equipment, weed spraying) and its potential effects on sheep winter range. The disturbance of these improvements would occur during the summer and fall when bighorn sheep are typically absent from the lower elevation winter range and are not expected to impact the species. These

activities would occur in all action alternatives.

The Army COE is proposing to harvest and or slash/burn approximately 421 acres on COE lands included in the PSU boundary. Because the management activities would occur during the late spring, summer and fall, they should have little disturbance impact on big horn sheep. However, the fuel treatments would likely have beneficial effects for bighorn sheep foraging during the winter, especially in conjunction with noxious weed treatments.

Ability of the East Reservoir Project to meet or contribute to the specific management strategies for the Ural-Tweed bighorn sheep herd, as paraphrased:

1) ***Cooperative work between FS and MFWP in habitat needs/improvements (Obj., Strategy)*:** The FS and State of Montana have worked cooperatively on habitat enhancement burns on the Woods Ranch Wildlife Management Area (WMA) in the past for the northern Kootenai Ten Lakes Bighorn Sheep Herd. Similarly, under this project, there are several proposed prescribe burn treatment units within the Ural herd home range that would be opportunities to again work cooperatively. Additionally, this project would allow for continued management of noxious weeds on NFS and COE lands, on and adjacent to bighorn sheep winter range.
2) ***Maintain/develop cooperative relationships with domestic sheep owners including double fencing (Obj., Strategy)*:** Direct management of bighorn sheep and potential risk from domestic sheep or goats beyond NFS grazing allotments are outside of FS jurisdiction and must be addressed by State of Montana personnel. However, fencing opportunities on NFS lands that may contribute to the control of domestic sheep and goats may exist and could be explored via a cooperative agreement.
3) ***Maintain High Quality Habitat (Winter Range) within the Ural-Tweed Bighorn Sheep Herd Home Range (aggressive management of weeds and grazing) (Obj., Strategy)*:** These opportunities exist and were addressed previously under objective/strategy 1.
4) ***Continuance of cooperative relations with land trust organizations to assist in protecting private lands adjacent to FS sheep habitat (Strategy)*:** This strategy is outside the scope of the East Reservoir Project, it does not appear that areas adjacent to the Ural sheep home range have this need.

Cumulative Effects

Summary of the Existing Condition

Past management actions, in the general area, especially within or adjacent to the known home range of the Ural-Tweed Bighorn Sheep Herd have been both beneficial and harmful to bighorn sheep. While past trail and recreation facility construction has exposed the sheep to humans and any accompanying dogs, vegetation management has increased foraging opportunities for sheep. Conversely, years of active fire suppression have not benefited the sheep by allowing conifers to encroach, not only on winter range, but also on escape habitat, in general, degrading the habitat. Likely the greatest benefits to the local herd were implementation of the Forestwide Fuels EA (2001) and years of noxious weed control.

EFFECTS of CURRENT and REASONABLY FORESEEABLE ACTIONS

Vegetation Management and Fuels Reduction Activities

There are four Forestwide Fuel units (FWF 545 (265 ac), FWF 536 (195ac), FWF 52403 (450ac), FWF 589 (25ac)) that were initiated (slashed) under the corresponding EA. The subsequent burning for these units would occur between 2012 and 2014 and may kill individual green trees within these units on the drier end of the burning prescription. This loss however, should be minimal and not result in measurable impacts to large ungulate cover. Steep slopes (>60%) are more critical for sheep escape cover than is its ability to hide in vegetation.

Neighboring Fortine Ranger District, to the east of the analysis area, has six vegetation projects that may be active concurrently with treatments proposed under this project. These projects total 3360 acres and include: Davis Be Good (124 ac); Trego (673 ac); S. Meadow Fuels (280 ac); N. Meadow Fuels (2095

ac); Little Feet (178 ac) and Elk Twins (10 ac). Large roaming species like elk, bears, lynx, etc. are more likely to be disturbed by these neighboring activities due to the typical sizes of their home ranges. Bighorn sheep are not likely to be disturbed by these activities due to the known range of the local Ural-Tweed herd and lack of overlap with these projects.

The action alternatives, in combination with other current and reasonably foreseeable vegetation related actions including tree planting, precommercial thinning, Christmas tree cutting, wreath bough collection, character wood collection (log furniture), and rock collecting (Pg. 3-5) would have minimal impacts on sheep cover due to their limited spatial scope and minimal removal of vegetation. They may cause sheep to temporarily (hours) avoid an area until the human activity has ceased.

Livestock Grazing
Although grazing allotments (Fivemile and Warland Allotments) cover several thousand acres of the PSU, competition between cattle and resident sheep for forage is not expected to be an issue. Domestic cattle typically utilize forage areas readily available along roadsides and recently harvested areas that have more gentle slopes whereas sheep utilize forage on and adjacent to steep, rocky slopes where they are likewise safe from most predators.

Noxious Weed Treatment
Weed treatment activities would not lead to any adverse effects on bighorn sheep or their habitat because treatment of weeds would actually benefit forage species important to sheep and other big game species (USDA Forest Service 1997, 30). Typically, approximately 200 acres are treated within the PSU on an annual basis.

Fire Suppression
In the event of a wildfire, construction of firelines, heli-spots and safety zones could potentially result in displacing bighorn sheep and other big game from site specific areas until the event is contained. Upon completion of wildfire suppression activities, rehabilitation of these same areas can create micro-foraging areas since these sites are seeded for soil stabilization. Suppression activities are typically subject to input from District Resource Advisors, and protection of specialized habitats is considered.

Road Management/Use Activities
Road management actions such as road maintenance and administrative use associated with permit administration, data collection, and monitoring of NFS lands are not likely to affect specialized habitats, such as most sheep range because they generally do not result in vegetation removal nor do they occur on such steep slopes. Although not overly sensitive to humans, sheep may simply avoid the disturbance area until human activities terminate, which usually comprises of a few hours. These activities include the Koocanusa Marina re-paving project (0.9 miles) to occur in the summer or fall of 2013. This action would not result in a loss of cover because the road already exists. The area of this road is also highly unlikely to be used by sheep during the summer or fall due to lack of need. Although water restoration projects may temporarily displace sheep and other wildlife from a localized area, they typically benefit wildlife in the long-term by increasing security, providing pulses of foraging when seeded, or by simply stabilizing soils where certain habitat components can remain available.

Recreation Maintenance
Actions such as road, trail, or campground maintenance and administrative use associated with permit administration, data collection and monitoring of NFS lands are not likely to measurably affect sheep and other big game species. These species would typically simply avoid the disturbance area until human activities terminate, which usually comprises of a few hours.

Special Uses
There are areas previously impacted by special use permits such as mineral material sites (pits quarries, borrow, roadsides), water developments, utility corridors, private land access routes, and outfitter/guide trails/camps, COE monitoring stations, that would continue to be present and utilized. The ground

disturbance on resources such as sheep winter range, escape habitat and cover, etc. have been included under the existing condition and would have no additional impacts. Any expansion of existing gravel pits would be analyzed for potential impacts on bighorn sheep at that time.

The Koocanusa Marina plans to expand its camping site system and increase its septic capabilities beginning in 2012 through 2013. These expansions fall within the acreage for which it is already permitted but could add to the cumulative impact from human activities and their effects on sheep if human activity remains high in the winter which is typically not the situation.

Public Use
Other public uses such as wildlife viewing, berry picking, firewood gathering, camping, snowmobiling, etc. have negligible impacts on sheep given their limited scope (time and space) and the unlikelihood for overlapping with sheep habitat during much of the year. Infrastructure, such as roads and campgrounds, that facilitate these activities have already been accounted for under the existing condition.

Private Property
Private activities such as land clearing, home construction, livestock grazing, etc. are likely to continue on those private lands within the Cripple PSU. Therefore, there would likely be a slight impact on sheep cover, especially on winter range where most privately owned acres occur. For road construction on private lands, an estimated four acres per mile of cover can be expected to be lost. For home construction, garage, parking, lawn, approximately 1-2 acres of cover can be estimated to be lost per resident. These acres would be affected on private lands and would cumulatively add to those disclosed impacts on NFS and COE lands under the action Alternatives 2and 3 in Table 3.92.

Other Lands
The state of Montana is proposing to regenerate 198 acres and build approximately 0.84 miles (3.4 ac) of road in T31N, R29W, Section 12. These activities will likely result in cover loss and would cumulatively add to those disclosed impacts on NFS and COE lands under the action Alternatives 2and 3.

Summary of Cumulative Effects
Timber sales and other management projects, such as salvaging, road work, precommercial thins and fuels reductions, listed previously, may have temporary effects on bighorn sheep and other big game. These effects may include avoidance of activity areas, increase in vulnerability during the hunting season, raised stress levels and short-term displacement from key habitats, like foraging areas or winter range. Although these effects may occur, they are not expected to result in lower sheep populations due to the utilization of seasonal design criteria, such as avoidance of the lambing season. Contrarily, vegetation management activities can have beneficial effects, once management activities cease, by providing additional and/or reconditioned areas of big game foraging. Other forest activities such as hiking and berry picking are thought to have minimal impacts to sheep, typically resulting in temporary (hours) avoidance of an area.

REGULATORY CONSISTENCY

Forest Plan:

- All alternatives meet KNFP direction for sensitive species (FP Vol. 1, II-1 #6) by utilization of best science in support of the species, maintaining associated habitat for the sheep, and meeting KNFP direction for big game with the Ural-Tweed bighorn sheep herd home range.
- All alternatives meet KNFP direction for big game species (FP Vol 1 II-1 #12) by meeting KNFP standards for big game hiding and thermal cover and open road densities.
- All alternatives, with their associated Regional Forester approval for the over 40 acre unit request, are consistent with the KNFP (1987) for distance to cover for big game.

National Forest Management Act:

- The project complies with NFMA direction (16 USC 1604 (G)(3)(b) to “provide for diversity of plant

and animal communities based on the suitability and capability of the specific land area in order to meet overall multiple-use objectives, and within the multiple-use objectives of a land management plan adopted pursuant to this section, provide, where appropriate, to the degree practicable, for steps to be taken to preserve the diversity of tree species similar to that existing in the region controlled by the plan."

- The project complies with the 2012 National Forest System Land and Resource Management Planning rule of March 27, 2013, by meeting KNF Land Management Plan direction for big game.

STATEMENT of FINDINGS

Alternative 1, due to its lack of action, will have no direct impact on individual sheep or their habitat. However, a lack of action would allow vegetation to continue to encroach on foraging and escape habitat which could have long-term negative impacts to the species by decreasing forage and increasing risk of predation.

Alternatives 2and 3 may impact individuals but will not contribute to a trend toward federal listing or loss of species viability for the bighorn sheep. This determination is based on:
1) The limited amount of activities within the Ural-Tweed sheep herd home range;
2) The beneficial effects of vegetation management and access changes (producing secure habitat) both within the home range and the Cripple PSU;
3) Continued monitoring and control of noxious weeds in the area; and 4) implementation, as applicable to NFS, of the management strategies for the Ural-Tweed herd.

BLACK-BACKED WOODPECKER

Data Sources, Methods, Assumptions, Bounds of Analysis

Black-backed woodpecker population ecology, biology, habitat description and relationships identified by research are described in Powell (2000), Cherry (1997), Hutto (1995) and O'Connor and Hillis (2001). That information is incorporated by reference. Black-backed occurrence data comes from recent District wildlife observation records and Forest historical data (NRIS Wildlife). Black-backed woodpecker habitat was modeled using TSMRS/FACTS vegetation data and running the Kootenai TSMRS black-backed woodpecker habitat model (KNF Wildlife Model 2007). The potential population index (PPI) (number of potential territories) was calculated for a breeding pair by dividing general forest habitat acres by 800 acres (approximate largest home range) and by dividing high quality habitat acres by 175 acres (approximate smallest home range; Johnson et al. 2004 Appendix G). The difference in territory size used in the two habitat components is based on the assumption that higher quality habitat can support a breeding pair with fewer acres. High quality habitat is defined as recent ($\leq$ 5 years old) mixed-lethal or stand-replacement fire areas where an abundance of snags are available. Black-backed woodpeckers (BBWs) have been found to be almost restricted to early post-fire forests (Hutto 1995). Territory sizes are from the summary paper by Cherry (1997). The analysis boundary for project impacts and cumulative effects to individuals and their habitat is the Cripple PSU. The boundary for determining trend or viability is the Kootenai National Forest (KNF).

AFFECTED ENVIRONMENT/EXISTING CONDITION

Habitat for black-backed woodpeckers consists of boreal and montane forests where beetle outbreaks are occurring as a result of disturbances caused by fire, wind and disease. In the PSU, BBW habitat consists mainly of lower quality effective old growth habitat with small scattered patches of snags produced by insect and disease. This lower quality habitat supports low populations of resident black-backed woodpeckers. The Kootenai TSMRS/FACTS black-backed woodpecker habitat model (KNF Wildlife Model 2007) identified 9,296 acres of lower quality habitat (categorized as unburned effective old growth, designated and undesignated, as well as recent areas of insect infestations). High quality habitat in the form of recent (in the last five years) mixed lethal and stand-replacing wildfire or prescribed fire consists of zero acres in the PSU. The most recent wildfires occurred between 1986 and 1994 totaling about 7,415 acres (see map in Project File), however these are long past serving as primary or premium

habitat for BBWs. The available low quality and high quality habitat combined would produce a PPI of 11 to possibly 12 pairs.

As a primary cavity-nester, BBWs require dead or live trees with heartwood rot and show a preference for Douglas-fir, ponderosa pine, lodgepole pine and western larch. According to Thomas (1979 p.74), a snag level of 40% or more should maintain viable populations of birds dependent on cavities for nest sites. The existing snag habitat level for the PSU is conservatively estimated at 67.9%.

On a Forestwide level, modeled BBW habitat is abundant, broadly distributed and amounts to 201,577 acres of lower quality habitat (unburned effective old growth habitat; KNF Files, 1987 KNFP Monitoring Old Growth spreadsheet; Libby, MT). Recent (Spring 2011) sightings of the black-backed woodpecker occurred in the Cripple PSU by Libby District personnel conducting goshawk surveys in an old growth forest stand. Historical documentation in the PSU includes three additional sightings dating back to 1992.

ENVIRONMENTAL CONSEQUENCES

Proposed activities for Alternatives 2and 3 have the potential to alter or reduce low quality habitat foraging opportunities, and at the same time, create foraging habitat during post-harvest burning and prescribed burning activities. Regeneration harvest would remove general opportunities, leaving a minimum number of wildlife trees available for foraging. Regeneration harvest almost always includes underburning, and with heavier slash, has potential to kill trees left on site. Overall, a larger amount of low-quality habitat would be replaced with a smaller amount of higher-quality habitat. Commercial thinning would leave a number of trees on site for general foraging opportunities. Underburning in these stands would create more potential for BBW foraging habitat than regeneration harvest. Commercial thinning with underburning and stands with underburning-only would be most similar to historical conditions created by mixed-severity fires, and could provide high-quality BBW habitat for 2-3 years, then declining and rarely providing insect food sources beyond 5-7 years (Murphy and Lehnhausen 1998).

Table 3.92 - Cumulative Change in Black-Backed Woodpecker Habitat and PPI

HABITAT CHANGE (% CHANGE)	Existing Condition	ALT 1	ALT 2	ALT 3
Number of acres treated that may result in isolated patches of high-quality habitat due to underburning and/or thinning	0	223	13,361	14,748
Change in Lower-Quality Habitat (OG; insect infested areas)	N/A	N/A	0	0
Change in High-Quality Habitat (recent burn areas)	N/A	N/A	N/A	N/A
PPI – Pair Territories in Project Area	11	11	11	11
Reduction in Lower-Quality Habitat Forest-wide	201,577*	0	0	0
PPI – Pair Territories Forestwide	251	251	251	251

*Only includes Forestwide OG acres below 5,500 feet in elevation; insect and disease area were not mapped for the PSU; this is the existing condition.

ALTERNATIVE 1 (No-Action)

Direct and Indirect Effects

Alternative 1 would maintain and allow the natural insect and disease processes to occur. Effective old growth stands would continue to provide low quality foraging. The potential for stand-replacing fires escaping initial attack would continue to increase as fuel levels increased. If a wildfire were to occur, prime BBW habitat would be created, and conditions would benefit this species. Local populations would experience an immediate increase as bark beetles increased, lasting three to five years, until beetle populations declined. Habitat patch size resulting from wildfires would largely be dependent upon the conditions at the time of the fire, however, the sizes could be expected to be larger than historical events due to 100 years of continued fire suppression.

ALTERNATIVES 2 and 3

Direct and Indirect Effects

Alternatives 2and 3 would create forest openings with regeneration harvest on 2,443 (includes improvement/shelterwood prescriptions), and 2,868 acres in the PSU, respectively. The action alternatives would also commercially thin/improvement/salvage cut on 5,649 and 4,945 acres, respectively. While these activities reduce and/or alter the amount of mature forest available for general woodpecker use (low-level of foraging) they would also create some good forage trees following underburning, especially in the commercially thinned areas. Habitat reductions in high-quality habitat (recent burned areas) or low-quality habitat (effective old growth areas) would not result following implementation of any of these alternatives because the action does not include salvaging in any recently burned forest stands.

A minimum of approximately 12% or 9,296 acres of lower-quality habitat would remain following implementation of all action alternatives. There are currently no areas of recently burned stands within the PSU to qualify as high-quality habitat. Additionally, both action alternatives proposed to prescribe burn anywhere from 11,427 (Alternative 2) to 11,358 (Alternative 3) acres that may create isolated, small pockets of high quality black-backed woodpecker habitat in the PSU. On a Forestwide level, there would be no reduction in the quantity of either lower-quality or high-quality BBW habitat as previously defined. No effects on distribution of habitat needed for viable populations of black-backed woodpeckers in the PSU or the Forest would occur. In addition, the thinning and underburning treatments may provide additional foraging trees if tree stress or mortality occurs during or following the prescribed burns, however, these newly areas of habitat would likely be smaller than many historical events due to slash treatments and Forest direction on treatment unit sizes. There would be no change in the PPI for either the PSU or Forest as a result of the action alternatives based on modeled habitat.

All action alternatives propose motorized trail access changes in that they convert approximately 36 (Alt 2) to 27 (Alt 3) miles of motorized trails to non-motorized and covert approximately 16 (Alt 2) to 17.6 (Alt 3) miles of seasonally or yearlong restricted roads into an intermittent stored status. Both of these actions are likely to have little effect on the black-backed woodpecker either positively or negatively. Alternatives 2 and 3 also propose to convert approximately 1.8 to 1.6 miles of seasonally restricted roads and approximately 13.5 miles of undetermined roads to NFS roads which allow legal use. Although this is a legal access change, any impact to snags has likely already occurred from illegal firewood gathering due to the easy topography of these lands along Koocanusa Reservoir. Additional impacts to any old growth in these areas are not anticipated.

Ground disturbing activities, such as the proposed dispersed campground improvements (Fivemile, Yarnell) would have negligible effects on the snag resource and old growth because these areas are maintained as natural as possible. Only those snags determined to be a threat to users and campers would be removed. The potential for tree or snag due to the creation of permanent or temporary roads has already been accounted for in the effects of road systems (see Table 3.82 on snag capability in that any areas 100 feet from any road are considered to have a zero capability to produce snags.
The Army COE is proposing to harvest and or slash/burn approximately 421 acres on COE lands included in the PSU boundary. The impacts on snags from these activities would be similar to those described above and were included in the snag capability results found in Table 3.82. The potential for these COE actions to produce black-backed habitat were accounted for in the acres presented above in Table 3.92.

Cumulative Effects
Summary of the Existing Condition
Past and present actions, including wildfire suppression, have resulted in measurable cumulative impacts to BBWs and their habitat. These impacts have largely been in the form of either removal of prime nesting/foraging habitat via fire salvage, harvesting of old growth forest considered low-quality habitat, or unintentionally affecting potential habitat via wildfire suppression. Suggestions (Cherry 1997) related to wildfire salvage (retaining 30 to 50% depending on size of fire) as well as old growth protection would assist in perpetuating this species into the future. Likewise, implementation of the wildfire use

management concept would also assist in creating additional habitat for this species across the KNF.

The existing situation provides habitat for eleven BBW territories based on the availability of lower-quality habitat of adequate size and even distribution. There are no recent burned areas to provide high-quality habitat however, snag habitat, which is above the minimum needed of 40%, would assist in perpetuating the species through time until new areas of wildfire occur on the landscape. Being that the existing habitat for black-backed woodpeckers consists only of lower quality effective old growth, please refer to the Old Growth Resource Section for further discussion of possible cumulative effects on black-backed woodpeckers.

Effects of Current and Reasonably Foreseeable Actions
All activities identified to occur within the analysis area that have the potential to affect this resource are discussed in the following paragraphs.

Vegetation Management and Fuels Reduction Activities
There are 25 acres planned for underburning within the East Reservoir analysis area which initiated under the treatment of Forestwide Fuels Unit 589. These 25 acres are within designated old growth and would alter the understory as described under direct effects for action alternatives and perhaps create micro acres of high quality habitat.

Cumulatively, the proposed activities (timber harvest, prescribed fire, ground fuel reduction) in designated and undesignated OG would not reduce the amount and distribution of old growth below Forest Plan requirements. However, due to cumulative edge effects (Table 3.80) there may be reduced old growth quality for some plant and animal species, such as resulting in less interior habitat and more edge where predation is more likely to occur or where noxious weed invasions are more likely to become established. However, given the level of impact and the quantity of old growth in the PSU, this effect should be minimal and would diminish in approximately 50 years (Russell and Jones 2001; Ripple et al. 1991; Russell et al. 2000). Private lands in the Cripple PSU were assumed to not provide any old growth, based on past harvest practices.

The action alternatives, in combination with other current and reasonably foreseeable actions including tree planting, precommercial thinning ,Christmas tree cutting, boughs, pine cone collecting would maintain the designated management level of old growth by avoidance. In the instance where existing old growth is burned or blown down, replacement old growth would be designated to account for this loss. Any burned old growth would become high-quality habitat for BBW for at least 2 to 3 years, then diminishing overtime.

Livestock Grazing
Cattle grazing (Fivemile Allotment, Warland Allotment) would not result in a change of old growth habitat, snags or down woody debris in the PSU, as it does not involve the harvest of trees, dead or alive and therefore would not affect the suitability of OG stands to serve as low-quality BBW habitat. Grazing cattle predominantly move along road systems and within past harvest units where an abundance of forage can be found.

Noxious Weed Treatment
Noxious weed management would result in no loss or change in OG as low quality BBW habitat, because weed treatments primarily focus on the herbaceous layer along roads and in previously disturbed areas. Typically, approximately 200 acres are treated within the PSU on an annual basis.

Fire Suppression
In the event of a wildfire, construction of firelines, helispots and safety zones could potentially result in impacts to old growth habitat serving as low-quality BBW habitat. Ironically, wildfire suppression serves to preserve existing old growth habitat while directly reducing production of high quality habitat created by wildfires. Suppression activities are typically subject to input from District Resource Advisors, and

protection of special habitats, including old growth, is considered. However, if cumulative effects to old growth habitat result in the habitat no longer functioning as old growth, additional old growth habitat would be designated.

Road Management/Use Activities
Road management actions such as road maintenance and administrative use associated with permit administration, data collection and monitoring of NFS lands are not likely to affect old growth and its suitability as BBW habitat because they generally do not result in vegetation removal. These activities include the Koocanusa Marina re-paving project (0.9 miles) to occur in the summer or fall of 2013. The standing tree and snag component would only be affected if considered a hazard to road users. These activities would not result in any change to the quantity of old growth, thus no adverse cumulative effects would be expected.

Recreation Maintenance
Routine maintenance of trails and developed and dispersed recreation sites would not contribute to the cumulative impact on old growth because maintenance of these facilities do not typically involve removal of old growth elements such as large trees or snags unless deemed to be a safety hazard to forest users. In this situation, the removal of a tree or snag is considered negligible.

Special Uses
There are areas previously impacted by special use permits such as mineral material sites (pits quarries, borrow, roadsides), water developments, utility corridors, private land access routes, and outfitter/guide trails/camps, COE monitoring stations, that would continue to be present and utilized. Ground disturbance on resources such as old growth have been included under the existing condition and would have no additional impacts. Any expansion of existing gravel pits would be analyzed for potential impacts on old growth as low quality BBW habitat at that time.

The Koocanusa Marina plans to expand its camping site system and increase its septic capabilities beginning in 2012 through 2013. These expansions fall within the acreage for which it is already permitted and would not involve the removal or alteration of designated old growth stands.

Public Use
Firewood gathering would continue to remove some snags from OG along open road corridors and these acres were previously accounted for as part of the existing condition. Other forest use activities such as mushroom and berry picking, camping, hunting, Christmas tree cutting, bough collection, etc. have little to no measurable impact on old growth because they are largely non-consumptive or rapidly re-established and would not measurably affect the suitability of surrounding forest stands to serve as low-quality BBW habitat.

Private Property
Private activities such as land clearing, home construction, livestock grazing, etc. are likely to continue on those private lands within the PSU. Therefore there would likely be a decrease in dry-site OG within the PSU, but outside of NFS lands. Unless these lands were consumed in wildfire(s) or suffered insect infestation(s) prior to becoming harvested, there would be negligible impacts on any resident BBWs.

Other Lands
The state of Montana is proposing to regenerate 198 acres and build approximately 0.84 miles of road in T31N, R29W, Section 12. However, these proposed actions are not adjacent to any mapped old growth type on NFS lands and therefore would have no measurable impact on BBW or its habitat.

Summary of Cumulative Effects
As previously stated, fire suppression over the last century has altered stands historically maintained by fire disturbance and had a net reduction in quality BBW habitat. The affected stands have developed fuel loading and ladder fuels that are uncharacteristic for some sites. These conditions would continue to

develop until a natural disturbance occurs.

Potential natural disturbances (wildfire, insect or disease epidemics, wind) could reduce old growth characteristics or completely remove an area of old growth under extreme conditions. Likewise, there is the potential for human caused fires initiating on private lands to move on to adjacent NFS lands and remove old growth that has not been, at least partially, managed either by prescribed burning and/or removal of ladder fuels. Conversely, these same disturbances would create high-quality BBW habitat resulting in beneficial impacts to the species or at least 3 to 5 years.

The most recent Forestwide old growth analysis concludes that at least 10% of the KNF below 5,500 feet elevation is designated for old growth management. The proposed activities would not affect the 10% standard for old growth at either the PSU or Forest scale.

REGULATORY CONSISTENCY

Forest Plan:

- All Alternatives meet KNFP direction for sensitive species (FP Vol 1 II-1 #6) by maintaining appropriate amounts and quality of suitable habitat in order to maintain species viability.
- All alternatives are consistent with KNFP direction for old growth below 5,500' (FP Vol 1 II-1 #7; II-7; II-22 & 23; Appendix 17; and Kootenai FSM 2432.22 Supplement No. 85) by maintaining a minimum of 10% old growth below 5500 feet in elevation in each third order drainage or compartment, or a combination of compartments (PSU).

National Forest Management Act:

- KNFP direction (Vol. I; II-1; Goal A. 7) is to "Maintain diverse age classes of vegetation for viable populations of all existing native, vertebrate, wildlife species,… in sufficient quality and quantity to maintain viable populations". The diversity requirement of NFMA is met by all alternatives as documented in the individual sensitive species and MIS analyses and supported by the statement of findings for each species.

STATEMENT of FINDINGS

Alternative 1 will have no direct impact to individual black-backed woodpeckers but may contribute to extreme forest stand conditions (fuel loadings) where wildfire intensities may reach beyond what would be expected, historically.

Alternatives, 2and 3 will have <u>no impact individuals or their habitat and will not contribute to a trend toward federal listing or loss of species viability for the black-backed woodpecker</u>. This determination is based on the fact that: 1) the project does not involve the removal of high-quality or lower-quality habitat as previously defined; 2) the current and foreseeable snag level is maintained above the 40% viability threshold as described by Thomas (1979); 3) the project meets KNFP standards and guidelines for this species related to old growth and snags; and 4) associated prescribed burn activities may produce small isolated pockets of high quality habitat for this species.

FISHER

Data Sources, Methods, Assumptions, Bounds of Analysis

Fisher population ecology, biology, habitat description and relationships identified by research are described in Powell and Zielinski (1994) and Heinemeyer and Jones (1994). That information is incorporated by reference. Fisher occurrence data comes from recent District wildlife observation records and Forest historical data (NRIS Wildlife) and other agencies (MFWP). Fisher habitat was modeled using the KNF Fisher Model using vegetation data from various sources including TSMRS and FACTS databases. The potential population index (PPI) (habitat acres divided by average home range acres) was calculated using 10,000 acres as the average male and 3,700 acres as the average female fisher home ranges (Powell and Zielinski 1994). The index shows both male and female fisher because their home

ranges overlap extensively (Ibid). The analysis boundary for project impacts to individuals and their habitat is the Cripple PSU. The boundary for cumulative effects is the PSU because the size of the PSU is much larger than the average home range of the fisher. The boundary for determining trend or viability is the KNF because of the association of fisher with riparian habitats which can naturally limit (i.e. available habitat versus home range size) fisher densities.

AFFECTED ENVIRONMENT/EXISTING CONDITION

Johnson (1999) shows fisher presence confirmed in five of the eight planning units on the Kootenai, and the Cripple PSU, located in the larger Koocanusa Planning Unit, is not an area of confirmed presence. However, fisher observations and monitoring data indicates that one fisher mortality was recorded (2000) on lands managed by the State of Montana within the Young Dodge PSU (also Koocanusa Planning Unit) to the north on the Canada boundary. It is likely that the fisher was a transient from Canada based on the occurrence of a re-introduction project out of Cranbrook, British Columbia in 1995. Another sighting (Sheep Creek, 1983) was only about six air miles from the Cripple PSU but is nearly 30 years dated, so its status remains uncertain in the PSU. This fisher may have been genetically linked to those transplanted in Pink Creek in 1959 (Vinkey 2003), however this is purely speculative as most of these individuals are thought to have migrated east to the Whitefish Range. The most recent sightings of fisher have been the result of a wolverine study conducted by the Friends of the Scotchman Peaks (2011-2012). This study documented the presence of fisher 23 times during this timeframe; however, it is unknown how many individual fisher sightings occurred versus repeated counts of the same individual. This study area is more than 36 air miles southwest of the Cripple PSU on the Montana-Idaho border.

Population Information and Potential Habitat

According to Vinkey (2003), there is little known of fisher populations beyond 1989 for the Purcell Mountains with few verified records. Other than those sightings listed previously in the adjacent areas, there are no additional sightings that may hint fisher use of the Cripple PSU. Likewise, there are no State trapping records for fisher in Lincoln County (Trapping District 1) since 2003 when five fisher were harvested within the county (www.fwp.mt.gov). It is uncertain whether this lack of information is due to fewer trappers or fisher distribution or both. Vinkey speculated that the more recently established populations pulsing from transplant efforts may have “vanished due to habitat alterations, direct mortality, random demographic and environmental events, or a combination of these factors.” Regardless of the cause, there is no recent information on fisher in the Cripple PSU to suggest nothing other than transient use of any habitat that may be available and suitable. Additionally, the fisher spends much of its time within thick, riparian habitats where human access and use is limited due to ruggedness. For this reason, fisher go largely undetected from humans by avoidance. Therefore potential habitat has been modeled assuming fisher may be present as a transient species and each alternative will be analyzed for its impact on potential habitat.

Reudiger (1994) shows the KNF as a primary habitat area for fisher. Modeling (KNF Model 2010) fisher habitat identifies 1,291 acres of potential fisher habitat and 22,150 acres of riparian habitat (within ¼ mile of a perennial stream) in the Cripple PSU. Following the identification process outlined in Reudiger (Ibid), the Koocanusa Planning Unit (major drainage) is assigned as a secondary fisher conservation area (Johnson 2004a). The Cripple PSU (sub-drainage) was determined to be low quality fisher habitat area (Ibid).

Based on the average male and female fisher home range sizes and the modeled habitat acres, the PPI for the Cripple PSU is <u>possibly</u> one female and one male fisher. Using the yearlong (modeled) habitat acres from Johnson (1999), the minimum PPI for the KNF would be 29 male and 80 female fisher.

ENVIRONMENTAL CONSEQUENCES

Table 3.93 summarizes the changes in habitat acres and PPI due to each alternative.

Table 3.93 - Cumulative Habitat and PPI Changes by Alternative

	EXISTING CONDITION	ALT 2	ALT 3
Habitat Acres – Cripple PSU (% decrease)	1291 ac (0%)	-483 (-37%)	-353 (-27%)
Riparian Habitat w/in ¼ mile of Perennial Stream (% treated)	22,150 ac (0%)	-4500 (-20.3%)	-4119 (-18.6%)
PPI - Project Area (Males/Females)	1 / 1*	1 / 1*	1 / 1*
Habitat Acres - Forest-wide (% change)	294,531	294,048 (-0.16%)	294,178 (-0.12%)
PPI - Forest-wide (Males/Females)	29 / 80	29 / 80**	29 / 80**

*Adequate amount of suitable habitat may not be present under the existing condition or under any action alternative. Live fishers have not been recently documented (last 5 years) in the associated Koocanusa fisher planning unit.

**Due to the limited amount of habitat present under the existing condition and the effect of the action alternatives, the effect on PPI for this species within the PSU and Forest is difficult to quantify.

ALTERNATIVES 1 (No-Action)

Direct and Indirect Effects

Alternative 1 (no-action) would have no direct effects on fisher habitat within the PSU due to the lack of action. However, potential natural disturbances (wildfire, insect or disease epidemics, wind) could reduce old growth characteristics or completely remove an area of fisher habitat under extreme conditions. Likewise, there is the potential for human caused fires initiating on private lands to move on to adjacent NFS lands and remove old growth and possibly riparian habitats that have not been, at least partially, managed either by prescribed burning and/or removal of ladder fuels. In either case, if the large tree component of old growth is removed then replacement old growth would need to be designated.

ALTERNATIVES 2 and 3

Direct and Indirect Effects

Two action alternatives propose vegetation management activities that would reduce or alter the amount of fisher habitat in the Cripple PSU (Table 3.93). Alternative 3 would adjust several proposed treatment units to avoid more modeled fisher habitat. Both alternatives would still adhere to KNFP direction for vegetation treatments in riparian zones and follow state SMZ regulations. The treatments as disclosed in Table 3.93, may alter or remove habitat for prey species of the fisher, locally affect the way fisher move through the habitat, remove denning habitat in the form of down and hollow logs, as well as remove resting habitat in the form of large, mature trees and again, down hollow logs. However, given the scattered nature of the proposed treatment units and the adherence to SMZ laws and regulations, Alternatives 2and 3 are not expected to prevent the movement of any transient fisher that may utilize the Cripple PSU. In that respect, the project is not expected to contribute to any perceived or documented downward trend in population by limiting their movement via habitat fragmentation.

While research does not show fisher to be highly sensitive to human activity, the presence of people and machines during project implementation may still displace fisher using the suitable habitat in or near the proposed units. The displacement would last until the machines are turned off or leave the area and the people are gone. Heinemeyer and Jones (1994) show the most sensitive time for fisher is the breeding, denning and rearing period (Feb. 15-June 30). Impacts within 200 meters (1/8th mile) of perennial streams are especially important to avoid (Ibid). The project design, for Alternatives 2and 3, includes timing constraints that only allow activities from July 1 to February 15 on all units in this zone if fisher are confirmed in the PSU. This measure should reduce displacement impacts during the most sensitive time for fisher.

All action alternatives propose motorized trail access changes in that they convert approximately 36 (Alt 2) to 27 (Alt 3) miles of motorized trails to non-motorized and covert approximately 16 (Alt 2) to 17.6 (Alt 3) miles of seasonally or yearlong restricted roads into an intermittent stored status. In addition, both

alternatives covert 5.9 miles of restricted roads to decommissioned. All of these actions are likely to result in beneficial effects for fisher by reducing motorized access which can facilitate trapping for furbearers. Alternatives 2 and 3 also propose to convert approximately 1.8 (Alt 2) to 1.6 (Alt 3) miles of seasonally restricted roads and approximately 13.5 miles of undetermined roads to NFS roads which allow legal use. Although this is a legal access change, additional impacts to fisher or their habitat is unlikely because these roads are along Koocanusa Reservoir and away from potential fisher habitat. Additional impacts to any old growth, which is often present in riparian environments and coincides with fisher habitat in these areas, is not anticipated based on past use of the area and the resulting existing condition.

Ground disturbing activities, such as the proposed dispersed campground improvements (Fivemile, Yarnell) would have negligible effects on the riparian and old growth elements of fisher habitat because these areas are maintained as natural as possible and planned to avoid more sensitive wet environments. Only those snags determined to be a threat to users and campers would be removed. The potential for tree or snag due to the creation of permanent or temporary roads has already been accounted for in the effects of road systems (Table 3.82) on snag capability in that any areas 100 feet from any road are considered to have a zero capability to produce snags.

The Army COE is proposing to harvest and or slash/burn approximately 421 to acres on COE lands included in the PSU boundary. The treatment areas avoid Dunn Creek which provides the only potential fisher habitat on these lands. Therefore, the actions on COE lands would not impact this species.

Cumulative Effects

Summary of the Existing Condition

As previously stated, fire suppression over the last century has altered stands historically maintained by fire disturbance. The affected stands have developed fuel loading and ladder fuels that are uncharacteristic for some sites. These conditions would continue to develop into quality fisher habitat until a natural disturbance occurs.

The most recent Forestwide old growth analysis concludes that at least 10% of the KNF below 5,500 feet elevation is designated for old growth management, much of which is in riparian areas and available to fisher. The proposed activities would not affect the 10% standard for old growth at either the PSU or Forest scale.

Effects of Current and Reasonably Foreseeable Actions

All activities identified to occur within the analysis area that have the potential to affect this species are discussed in the following paragraphs.

Vegetation Management and Fuels Reduction Activities

There is 25 acres planned for underburning within the East Reservoir analysis area which initiated under the treatment of Forestwide Fuels Unit 589. These 25 acres are within designated old growth and would alter the understory as described under direct effects for action alternatives. However, this is dry type ponderosa pine old growth which has limited suitability as fisher habitat.

Cumulatively, the proposed activities (timber harvest, prescribed fire, ground fuel reduction) in designated and undesignated old growth would not reduce the amount and distribution of old growth below KNFP requirements. However, due to cumulative edge effects (Table 3.80) there may be reduced old growth quality for the fisher, such as resulting in less interior habitat which may impede movement. However, given the level of impact and the quantity of old growth in the PSU, this effect should be minimal and would diminish in approximately 50 years (Russell and Jones 2001; Ripple et al. 1991; Russell et al. 2000). Private lands in the Cripple PSU were assumed to not provide any old growth, based on past harvest practices.

Neighboring Fortine Ranger District, to the east of the analysis area, has six vegetation projects that may

be active concurrently with treatments proposed under this project. These projects total 3360 acres and include: Davis Be Good (124 ac); Trego (673 ac); S. Meadow Fuels (280 ac); N. Meadow Fuels (2095 ac); Little Feet (178 ac) and Elk Twins (10 ac). Large roaming species like the fisher are more likely to be disturbed by these neighboring activities due to the typical sizes of their home ranges. Area fisher may temporarily avoid (hours to days) these areas while activities are occurring. Rearing, foraging, and resting habitat may also be removed or altered depending on the treatment prescriptions. Although these areas may cumulatively add to disturbance on fisher or its habitat, these projects will also be required to adhere to streamside management regulations where the highest quality fisher habitat is typically found. Additionally, there are approximately 26,000 acres within the analysis area that are available for the species as secure habitat.

The action alternatives, in combination with other current and reasonably foreseeable actions including tree planting, precommercial thinning, Christmas tree cutting, boughs, pine cone collecting would maintain the designated management level of old growth by avoidance. In the instance where existing old growth is burned or blown down, replacement old growth would be designated to account for this loss with emphasis in riparian ecosystems which serve well as movement corridors for many species including the fisher.

Livestock Grazing
Cattle grazing (Fivemile and Warland Allotments) would not result in a change of old growth or riparian habitat, snags or down woody debris in the PSU, as it does not involve the harvest of trees, dead or alive. Grazing cattle predominantly move along road systems and within past harvest units where an abundance of forage can be found.

Noxious Weed Treatment
Noxious weed management would result in no loss or change in fisher habitat, as defined, because weed treatments primarily focus on the herbaceous layer along roads and in previously disturbed areas. Riparian ecosystems are considered to be more sensitive to herbicides and are largely avoided by noxious weed treatments. Typically, approximately 200 acres are treated within the PSU on an annual basis.

Fire Suppression
In the event of a wildfire, construction of firelines, helispots and safety zones could potentially result in impacts to old growth and riparian habitats. Conversely, wildfire suppression also serves to preserve these ecosystems serving as fisher habitat. Suppression activities are typically subject to input from District Resource Advisors, and protection of special habitats, including old growth, is considered. However, if cumulative effects to old growth habitat result in the habitat no longer functioning as old growth, additional old growth habitat would be designated.

Road Management/Use Activities
Road management actions such as road maintenance and administrative use associated with permit administration, data collection and monitoring of NFS lands are not likely to affect old growth and other specialized habitats (e.g. riparian, wetlands, etc.) because they generally do not result in vegetation removal. These activities include the Koocanusa Marina re-paving project (0.9 miles) to occur in the summer or fall of 2013. The standing tree and snag component would only be affected if considered a hazard to road users. These activities would not result in any change to the quantity or suitability of old growth and riparian areas to serve as fisher habitat, thus no adverse cumulative effects would be expected.

Recreation Maintenance
Routine maintenance of trails and developed and dispersed recreation sites would not contribute to the cumulative impact on old growth because maintenance of these facilities do not typically involve removal of old growth elements such as large trees or snags unless deemed to be a safety hazard to forest users. In this situation, the removal of a tree or snag is considered negligible.

Special Uses

There are areas previously impacted by special use permits such as mineral material sites (pits quarries, borrow, roadsides), water developments, utility corridors, private land access routes, and outfitter/guide trails/camps, COE monitoring stations, that would continue to be present and utilized. Ground disturbance on resources such as old growth and riparian habitats have been included under the existing condition and would have no additional impacts. Any expansion of existing gravel pits would be analyzed for potential impacts on old growth and fisher habitat at that time.

The Koocanusa Marina plans to expand its camping site system and increase its septic capabilities beginning in 2012 through 2013. These expansions fall within the acreage for which it is already permitted and would not involve the removal or alteration of designated old growth stands or riparian areas serving as fisher habitat.

Public Use
Firewood gathering would continue to remove some snags from old growth along open road corridors and these acres were previously accounted for as part of the existing condition. Other forest use activities such as mushroom and berry picking, camping, hunting, Christmas tree cutting, bough collection, etc. have little to no measurable impact on old growth or riparian areas because they are largely non-consumptive or rapidly re-established and would not contribute to the cumulative effect on this resource or the fisher.

Private Property
Private activities such as land clearing, home construction, livestock grazing, etc. are likely to continue on those private lands within the PSU. Therefore, there would likely be a decrease in dry-site old growth within the PSU, but outside of NFS lands and primary fisher habitat.

Other Lands
The state of Montana is proposing to regenerate 198 acres and build approximately 0.84 miles of road in T31N, R29W, Section 12. However, these proposed actions are not adjacent to any mapped old growth type on NFS lands and therefore would have no edge effect on old growth stands. This area does contain one riparian zone which may serve as fisher habitat, however, these acres did not model as such. This riparian area would be subject to state SMZs and would be protected in accordance with its status as a perennial or intermittent stream.

Summary of Cumulative Effects
As previously stated, fire suppression over the last century has altered stands historically maintained by fire disturbance. The affected stands have developed fuel loading and ladder fuels that are uncharacteristic for some sites. These conditions would continue to develop into fisher habitat until a natural disturbance occurs.

Potential natural disturbances (wildfire, insect or disease epidemics, wind) could reduce old growth characteristics or completely remove an area of old growth under extreme conditions. Likewise, there is the potential for human caused fires initiating on private lands to move on to adjacent NFS lands and remove old growth that has not been, at least partially, managed either by prescribed burning and/or removal of ladder fuels. In either case, if the large tree component of old growth is removed then replacement old growth would need to be designated.

The most recent Forestwide old growth analysis concludes that at least 10% of the KNF below 5,500 feet elevation is designated for old growth management, much of which is in riparian areas and available to fisher. The proposed activities would not affect the 10% standard for old growth at either the PSU or Forest scale.

REGULATORY CONSISTENCY

Forest Plan:

- All alternatives meet KNFP direction for sensitive species (FP Vol 1 II-1 #6) by maintaining appropriate amounts and quality of suitable habitat in order to maintain species viability.

- All alternatives are consistent with Forest Plan riparian standards and guidelines (FP Vol 1 II-28 thru 33) as amended by INFS.
- All alternatives are consistent with KNFP direction for old growth below 5500' (FP Vol 1 II-1 #7; II-7; II-22 & 23; Appendix 17; and Kootenai FSM 2432.22 Supplement No. 85) by maintaining a minimum of 10% old growth below 5500 feet in elevation in each third order drainage or compartment, or a combination of compartments (PSU).

National Forest Management Act:

- Forest Plan direction (Vol. I; II-1; Goal A. 7) is to "Maintain diverse age classes of vegetation for viable populations of all existing native, vertebrate, wildlife species,… in sufficient quality and quantity to maintain viable populations". The diversity requirement of NFMA is met by all alternatives as documented in the individual sensitive species and MIS analyses and supported by the statement of findings for each species.

STATEMENT of FINDINGS

Alternative 1 would have no direct impact on the fisher or its habitat due to the lack of action. Also refer to old growth section, previously addressed.

Alternatives 2and 3 may impact individuals and/or their habitat, but will not likely contribute to a trend towards federal listing or cause a loss of species viability for the fisher**.** This determination is based on: 1) lack of confirmed presence of live fisher in the Koocanusa fisher planning unit and the minimal quantity of habitat available; 2) all action alternatives meet the 40 acres regeneration harvest limitation required by NFMA (with Regional approval) and/or KNFP requirements to maintain 400 feet between regeneration units (MA 15), both of which assist in avoiding forest fragmentation; 4) INFS guidelines protect the highest-quality fisher habitat along major stream courses in the PSU; 5) no alternative results in an increase of open roads or an overall increase in human access in the PSU that would facilitate the trapping of fisher.

FLAMMULATED OWL

Data Sources, Methods, Assumptions, Bounds of Analysis

Flammulated owl population ecology, biology, habitat description and relationships identified by research are summarized in Hayward and Verner (1994). More recent research on nesting, food habits, home range and territories, and habitat quality conducted in Colorado, Idaho, and Montana is discussed in Linkhart (2001), Linkhart and Reynolds (1997), Linkhart et al. (1998), Powers et al. (1996), Wright (1996) and Wright et al. (1997). That information is incorporated by reference. Flammulated owl occurrence data comes from recent District wildlife observation records and Forest historical data (NRIS Wildlife). Flammulated owl habitat was modeled using TSMRS vegetation data and running the Kootenai TSMRS/ FACTS flammulated owl habitat model (KNF 2010; see Project File).
The Kootenai National Forest "A Conservation Plan: Based on The Kootenai National Forest Land Management Plan, as amended, (Johnson 2004) determines potential population index (number of potential territories) for breeding pairs by dividing habitat acres by 40 acres. Changes to habitat and resulting potential population index were used to display the effects of alternatives.

The analysis boundary for project impacts and cumulative effects to individuals and their habitat is the Cripple PSU because of the small home range of the owl and the quantity of habitat available in the PSU. The boundary for determining trend or viability is the Kootenai National Forest (KNF).

AFFECTED ENVIRONMENT/EXISTING CONDITION

A KNF status summary, of the flammulated owl, was documented by Johnson (1999 unpublished). The summary shows that potential habitat occurs across all eight planning subunits. Forestwide, there are 237,098 acres of potential habitat (Ibid). Field surveys have confirmed flammulated owl presence in six of eight planning units. The population size on the KNF is unknown (Ibid), however Libby District

records indicate at least 11 past sightings/vocalizations of flammulated owls within the Cripple PSU (NRIS Wildlife) dating from 1992 to present. The latest flammulated owl documented to occur in the Cripple PSU was during recent surveys (2011) which solicited responses using taped owl calls.

Unsuccessful surveys for this species can often be attributed to the presence and response from other owl species, especially great horned owls, which are known to prey on the flammulated. Once other owl species respond, the flammulated owl, out of self-preservation, typically do not answer solicited calls. Surveyors are trained to stop calling for flammulated owls when other (large predators) owls respond at a given survey point(s). Due to the abundance of great horned owls and the risk of predation, the flammulated owl can be difficult to find.

Implementation of the KNF TSMRS/FACTS Flammulated Owl Model (KNF 2010) indicated that there is approximately 17,518 acres of potential flammulated owl habitat on NFS lands within the Cripple PSU.

ENVIRONMENTAL CONSEQUENCES

Proposed timber harvest has the potential to impact flammulated owl habitat. Selective logging that removes large ponderosa pine or Douglas-fir trees can decrease the availability of early-season feeding sites, song and roost sites, and trees for snag recruitment in areas already limited in large snag abundance (Wright 1996 p. 77). Snag removal during timber harvest for OSHA safety standards also removes suitable habitat for flammulated owls.

Some research has suggested that flammulated owls are not likely to forage further than 300 feet from forest cover (Goggans 1985). Regeneration harvest creating areas greater than 300 feet from cover would likely receive minimal use. This equates to a harvest unit of about eight acres in size, or a relatively square unit 600 feet on each side. Those proposed regeneration harvest units that are greater than eight acres in size would, likely receive little or no foraging use until understory and mid-story canopies develop.

Prescribed fires and/or slashing may have short-term (2-3 years) negative effects on the availability of habitat for prey species, but in the long-term habitat for prey species would be maintained and/or increased due to the vigorous shrub/forb layer that would result from the fire. These activities would benefit flammulated owls (Illg and Illg 1994).

Cumulative changes in potential flammulated owl habitat caused by the various activities in the proposed project are shown in Table 3.94.

Table 3.94 - Cumulative Acre Changes in Flammulated Owl Habitat
on NFS Lands in the Cripple PSU

ACTIVITY TYPE	ALT 1	ALT 2	ALT 3
Acres unsuitable due to regeneration harvest [1]	198	447	412
Potential acres changed due to improvement harvest	N/A	1049	1045
Acres impacted by slash and/or burn/PCT	935[2]	5842	45756

[1] Includes acres of all regeneration units greater than 8 acres in size as worst case scenario and 4 ac for roads.
[2] There are four Forestwide Fuel units (FWF 545 for 265 ac, FWF 536 for 195ac, FWF 52403 for 450ac, FWF 589 for 25ac) that were initiated (slashed) under the corresponding EA.

Based on the sum of acres impacted from Table 3.94, cumulative changes in suitable habitat acres and PPI values on NFS lands are displayed in Table 3.95. Decreases in habitat quality may be less than displayed as not all harvest acres are regeneration, and slashing and burning activity impacts are short-term. However, this table displays a worst-case scenario as if all suitable snags, large-diameter trees, and other characteristics of suitable flammulated owl habitat were removed, at least in the short-term.

Table 3.95 - Cumulative Changes in Flammulated Owl Habitat and PPI Changes

	EXISTING CONDITION	ALT 1	ALT 2	ALT 3
Habitat Acres – Cripple PSU NFS lands (+/- % change)	17,518 0	202* + 935** -1.2%	1,496 -8.5%	1,457 -8.3%
PPI –Cripple PSU (# potential territories remaining in unaltered habitat)	437	432	400	401
Habitat Acres – Forestwide – NFS (+/- % Change)	237,098 (0%)	236,896 (-0.1%)	235,602 (-0.63%)	235,631 (-0.62%)
PPI – Forestwide (# potential territories)	5927	5,922	5,890	5,891

*Includes 198 acres of State of MT regeneration harvest plus 4 ac in roads and 935 acres** of FS slash/burning under the no action alternative; only the 202 regeneration acres have the potential to remove owl habitat.

ALTERNATIVE 1 (No-Action)
Direct and Indirect Effects
No activities are proposed under Alternative 1, so no direct effect to flammulated owls would occur. Plant succession would continue, resulting in an increasing canopy closure and increasing density of understory conifers. This plant succession could have an indirect effect on flammulated owls if they occur in the area because the owls forage in open areas within the drier ponderosa pine and Douglas-fir forest. An increasing density of understory conifers would decrease the available habitat for prey species, and may also impede flight maneuvers needed for foraging (Illg and Illg 1994 58). Any impacts to flammulated owl habitat under this alternative result from cumulative foreseeable activities in the PSU.

ALTERNATIVES 2and 3
Direct and Indirect Effects
Alternatives 2and 3 propose vegetation management activities that would reduce or impact the amount of flammulated owl habitat in the Cripple PSU (Table-3.94). The changes in the amount of available habitat could result in a PPI change in the Cripple PSU (Table 3.95).

The improvement harvests would follow a basal area reduction prescription (Table 3.94). The prescription would favor ponderosa pine and larch by removing smaller Douglas-fir trees that are competing for growing space. These stands are expected to retain the larger and older ponderosa pine and Douglas-fir trees in the overstory, while exhibiting a more open understory complementing the purpose and need for this project. Retaining large trees and snags in the overstory would preserve abandoned flicker and pileated woodpecker cavities, which are the primary nesting sites for flammulated owls. While an upper-diameter size limit is not incorporated into the silvicultural prescriptions, larger diameter trees are typically not removed because they are more resistant to subsequent prescribed fuel treatments and better meet FP guidelines for snags. On those improvement harvests logged with skyline, fewer snags are expected to remain due to OSHA safety standards.

The improvement harvest would however, alter or remove potential rearing and security habitat in the form of sapling and pole-size Douglas-fir. Recommendations to retain areas of understory fir and young ponderosa pine for these purposes would occur in specific treatment areas based on the feasibility to protect un-thinned areas from prescribe burning.

All action alternatives propose motorized trail access changes in that they convert approximately 36 (Alt 2) to 27 (Alt 3) miles of motorized trails to non-motorized and covert approximately 16 (Alt 2) to 17.6 (Alt 3) miles of seasonally or yearlong restricted roads into an intermittent stored status as well as 5.9 miles to decommissioned. Both of these actions would benefit any adjacent flammulated owl habitat by making them less susceptible to firewood cutting (preserving cavity habitat) and by lowering human disturbance levels. Contrarily, they each propose to convert approximately 1.8 (Alt 2) to 1.6 (Alt 3) miles of seasonally restricted roads and approximately 13.5 miles of undetermined roads to NFS roads which allow legal use. Although this is a legal access change, any impact to adjacent owl habitat has likely

already occurred from illegal firewood gathering due to the easy topography of these lands along Koocanusa Reservoir. Additional impacts to the flammulated owl and mature forest stands in these areas are not anticipated.

Ground disturbing activities, such as the proposed dispersed campground improvements (Fivemile, Yarnell) in or adjacent to flammulated owl habitat may result in noxious weed invasion. The project design should include measures to reduce this potential risk (e.g. washing equipment, weed spraying). These activities would not remove habitat attributes, such as snags, unless deemed unsafe to recreation users/campers. These activities would occur in all action alternatives.

The Army COE is proposing to harvest and or slash/burn approximately 421 acres on COE lands included in the PSU boundary. There are no known owl nests adjacent to any COE activities so no impacts to this resource, such as edge effect, are anticipated. If any new flammulated nest trees are found, the cavity tree and habitat would be protected during management activities by utilizing a treatment buffer and other mitigating factors.

Cumulative Effects Summary of the Existing Condition

Over the past 75 to 100 years, partially due to the Warland Mill, low-elevation timber harvesting has contributed cumulatively to the reduction or alteration of flammulated owl nesting and foraging habitat. These timber harvests typically removed or reduced the large diameter ponderosa pine and often thinned the understory affecting nesting, roosting and foraging habitats. Stands thinned too much also allowed for increase predation on this small owl by larger owls, such as the great horned. Another forest management activity that has contributed both positively and negatively to flammulated owl habitat is fuels reduction in the urban interface where much of the low-elevation ponderosa pine forests grow. While the reduction of ladder fuels assist in maintaining the mature canopy trees and nesting snags, it also reduces thickets of young Douglas-fir that provide roosting and escape cover for fledgling owls. Contrarily, these same activities can have beneficial effects to the owl's foraging habitat. Given the current direction of the agency related to the protection of the urban interface, it is anticipated that fuels management in the urban interface would continue to have both positive and negative cumulative effects on flammulated owl habitat where suitable habitat is present.

Effects of Current and Reasonably Foreseeable Actions

All activities identified to occur within the analysis area that have the potential to affect flammulated owls are discussed in the following paragraphs.

Vegetation Management and Fuels Reduction Activities

There are four Forestwide Fuel units (FWF 545 (265 ac), FWF 536 (195ac), FWF 52403 (450ac), FWF 589 (25ac)) that were initiated (slashed) under the corresponding EA. The subsequent burning for these units would occur between 2012 and 2014, would likely remove and create snags therefore their impact is considered negligible. All of these acres are reflected in Table 3.84, in that resource section. Twenty-five of these acres are within designated dry-type old growth and would alter the understory as described under direct effects for action alternatives. These treatments would likely impact security and rearing habitat for young flammulated owls and have been reflected under Alternative 1 (no-action) in Table 3.95. Blowdown salvaging would have little, if any, impact to this owl given associated habitat typically does not involve down wood material for either cover or foraging.

Cumulatively, the proposed activities (timber harvest, prescribed fire, ground fuel reduction) in designated and undesignated old growth, that can serve as flammulated owl habitat, would not reduce the amount and distribution of old growth below KNFP requirements. However, due to cumulative edge effects (Table 3.80) there may be reduced old growth quality for some plant and animal species, such as resulting in less interior habitat and more edge where predation is more likely to occur or where noxious weed invasions are more likely to become established. However, given the level of impact and the

quantity of old growth in the PSU, this effect should be minimal and would diminish in approximately 50 years (Russell and Jones 2001; Ripple et al. 1991; Russell et al. 2000). Private lands in the Cripple PSU were assumed to not provide any old growth, based on past harvest practices.

The action alternatives, in combination with other current and reasonably foreseeable actions including tree planting, precommercial thinning, Christmas tree cutting, boughs, pine cone collecting would maintain the designated management level of old growth and other mature forest stands by avoidance. Other than possibly annoying individual owls, in areas outside of old growth, (i.e. disturbing roosting individuals) human disturbance from these activities would have minimal impacts on flammulated owls. In the instance where existing old growth serving as flammulated owl habitat, is burned or blown down, replacement old growth will be designated to account for this loss.

Livestock Grazing
Cattle grazing (Fivemile Allotment, Warland Allotment) would not result in a change of old growth or mature habitats that provides nesting areas for this species, as it does not involve the harvest of trees, dead or alive. Additionally, changes to the grass/herbaceous layer of vegetation would not affect owl habitat characteristics and generally, due to the lack of ungulate forage in old growth and mature forest stands, grazing cattle are typically not an issue.

Noxious Weed Treatment
Weed treatment activities would not lead to any adverse effects on flammulated owls or their habitat because treatment of weeds would actually benefit forage species important to many species or their prey (USDA Forest Service 1997, 30). No loss or change in specific habitats (e.g. old growth, mature forests), including snags for nesting, would result from this activity because weed treatments primarily focus on the herbaceous layer along roads and in disturbed areas. Typically, approximately 200 acres are treated within the PSU on an annual basis.

Fire Suppression
With the direction to suppress all wildland fires on NFS lands, construction of firelines, safety zones and other control structures could impact individuals on a site-specific basis. Avoidance of known owl cavity nests would be attempted during suppression efforts but some impacts may still occur. Due to the unpredictable nature of wildfires, contributions of fire suppression to the cumulative effect on this species can only be surmised but may certainly include temporary disturbance and loss of individual snags and or potential nest trees. Also refer to cumulative effects on old growth.

Road Management/Use Activities
Road management actions such as road maintenance and administrative use associated with permit administration, data collection and monitoring of NFS lands are not likely to affect flammulated owls and specialized habitats (e.g. snags, shrubs, fir thickets) because they generally do not result in vegetation removal. Although road restoration and maintenance projects (brushing, blading, gate repairs, culvert replacement, etc.) may temporarily disturb individuals, they typically benefit the species in the long-term, especially if the projects involve closing previously open road systems (refer to road storage in Transportation/Hydrology Sections). Also refer to cumulative effects on old growth. These activities include the Koocanusa Marina repaving project (0.9 miles) to occur in the summer or fall of 2013. The standing tree and snag component of owl habitat would only be affected if considered a hazard to road users. These activities would not result in any change to the quantity of old growth, thus no adverse cumulative effects would be expected to that resource.

Recreation Maintenance
Routine maintenance of trails and developed and dispersed recreation sites have the potential to remove nesting and foraging trees for flammulated owls if they are close to a trail or road and present a safety hazard. Effects would include removing site-specific, individual trees, and would not be expected to contribute measurably to the cumulative effect on the owl. In this situation, the removal of a single tree or snag is considered negligible unless an owl nest is determined to be present.

Special Uses
There are areas previously impacted by special use permits such as mineral material sites (pits quarries, borrow, roadsides), water developments, utility corridors, private land access routes, and outfitter/guide trails/camps, COE monitoring stations, that would continue to be present and utilized. Ground disturbance on resources such as old growth and mature forest stands have been included under the existing condition and would have no additional impacts. Any expansion of existing gravel pits would be analyzed for potential impacts on the owl at that time.

Operations of outfitter/guides would not result in any change to general and specialized flammulated owl habitats (e.g. old growth or mature forests, snags or fir thickets), as they do not involve the harvest of trees. There would be no cumulative effects to the owl or its habitats associated with these activities other than possible temporary and local avoidance of an area due to the presence of humans.

There are no known land exchanges planned within the PSU at this time.

The Koocanusa Marina plans to expand its camping site system and increase its septic capabilities beginning in 2012 through 2013. These expansions fall within the acreage for which it is already permitted and would not involve the removal or alteration of designated old growth stands.

Public Use
The temporal occurrence of forest uses such as summer activities (camping, hiking, berry picking) versus fall (hunting, firewood cutting) or winter (skiing, snowmobiling) activities, and the scheduling of management actions to avoid key time periods (nesting, rearing) when flammulated owls may be more sensitive to human disturbances, allow for the avoidance of measurable cumulative impacts. There may be some situations where isolated or localized cumulative effects may occur, due to an overlap of forest activities, but these situations are typically short in duration, and do not persist through the lifecycle of the owl, either temporally or spatially.

Other forest product activities occurring presently and typically on an annual basis are the gathering of pine cones, boughs and commercial gathering of Christmas trees. These activities occur throughout the PSU, and have little-to-no effect on the landscape due to the unspecific nature of the use and the low impact on the resources (foot traffic, hand tools). Additionally, Christmas trees are harvested from existing regeneration units, so this activity would have no cumulative effect on the specialized habitats of this owl, such as old growth and other mature forests.

Private Property
Private activities such as land clearing, home construction, livestock grazing, etc. are likely to continue on those private lands within the PSU. Therefore, there would likely be a decrease in dry-site old growth and mature forests within the PSU, but outside of NFS lands. Any cumulative effects to flammulated owls would be partially dependent on the duration (seasonal versus year-round) of use of these parcels and homes. Anticipated effects include species displacement, nest failure, habitat alteration and/or habitat loss.

Other Lands
The state of Montana is proposing to regenerate 198 acres and build approximately 0.84 miles of road in T31N, R29W, Section 12. While these proposed actions are not adjacent to any mapped old growth type on NFS lands and therefore, would have no edge effect on old growth stands, they are in mature forest stands. The regeneration of these stands would reduce potential habitat by 198 acres. These acres are reflected in Table 3.95 under Alternative 1 (no-action). The disturbance associated with this activity would likely cause flammulated owls to avoid adjacent areas during implementation.

Summary of Cumulative Effects
Although, habitat changes, which add to those of the existing condition as previously described, would occur under the proposed actions, the Cripple PSU would continue to provide habitat for resident

flammulated owls. Following implementation of the proposed activities, the Cripple PSU is expected to potentially provide suitable habitat for at least 400 nesting pair of flammulated owls with minimal effect on the Forest level to this species due to perpetuation of suitable habitat.

REGULATORY CONSISTENCY

Kootenai National Forest Plan:

- All alternatives meet KNFP direction for sensitive species (FP Vol 1 II-1 #6) by maintaining appropriate amounts and quality of suitable habitat in order to maintain species viability.
- All alternatives are consistent with KNFP direction for old growth below 5,500' (FP Vol 1 II-1 #7; II-7; II-22 & 23; Appendix 17; and Kootenai FSM 2432.22 Supplement No. 85) by maintaining a minimum of 10% old growth below 5,500 feet in elevation in each third order drainage or compartment, or a combination of compartments (PSU).
- Forest Plan direction (Vol. I; II-1; Goal A. 7) is to "Maintain diverse age classes of vegetation for viable populations of all existing native, vertebrate, wildlife species,… in sufficient quality and quantity to maintain viable populations". This direction is met by developing a full range of alternatives which consider both habitat quantity and quality for resident species.

National Forest Management Act:

- The project complies with the 2012 National Forest System Land and Resource Management Planning rule of March 27, 2013, by meeting KNF Land Management Plan direction for potential impacts on old growth/mature habitats and their associated species.
- The project complies with NFMA direction (16 USC 1604 (G)(3)(b) to "provide for diversity of plant and animal communities based on the suitability and capability of the specific land area in order to meet overall multiple-use objectives, and within the multiple-use objectives of a land management plan adopted pursuant to this section, provide, where appropriate, to the degree practicable, for steps to be taken to preserve the diversity of tree species similar to that existing in the region controlled by the plan.

STATEMENT of FINDINGS

Implementation of Alternative 1 would have <u>no direct impact</u> on the flammulated owl as no activities are proposed. Cumulatively other reasonably foreseeable activities on federal land (i.e. continued fire suppression) would occur and may affect their habitat.

Alternatives 2and 3 <u>may impact individuals and/or their habitat, but would not contribute to a trend toward federal listing or loss of species viability for the flammulated owl</u>. This determination is based on the fact that: 1) avoidance or displacement could occur during implementation if owls are present; 2) modeled foraging and nesting habitat would be impacted but locations of known owl nest(s) are protected; 3) habitat change at the Forest scale is only -0.1 to -0.63%; 4) the potential decrease in PPI may not occur as surveys indicate because occupancy level is less than the densities estimated by the PPI , and potential to impact or displace an owl is low; 5) the prescribed burning and improvement harvest may improve potential habitat; and 6) Forest Plan standards related to flammulated owl habitat (old growth) are met.

TOWNSEND'S BIG-EARED BAT

Data Sources, Methods, Assumptions, Bounds of Analysis

Townsend's big-eared bat population ecology, biology, habitat description and relationships identified by research are described in the following: Christy and West (1993), Thomas and West (1991), Reel et al. (1989), Perkins and Schommer (1991), Kunz and Martin (1982), Montana Natural Heritage Program (1993), Ross (1967), Whitaker et al. (1977) and Pierson et al. (1999). That information is incorporated by reference. Townsend's big-eared bat occurrence data comes from recent District wildlife survey records and Forest historical data (NRIS Wildlife) and other agencies (MNHP).

All known caves, mines, tunnels or lakes, and old growth were located within the Cripple PSU. After reviewing District records and mineral maps, no caves were identified, however field crews found one mine (Hoyt Mine) location with at least two adits or entrance tunnels. These sites will require additional documentation.

The analysis boundary for project impacts and cumulative effects to individuals and their habitat is the Cripple PSU. The boundary for determining trend or viability is the Kootenai National Forest (KNF).

AFFECTED ENVIRONMENT/EXISTING CONDITION

A KNF status summary of the Townsend's big-eared bat was documented by Johnson (1999). Surveys of the KNF (1993-1995) by Hendricks et al. (1995 1996) have located the species in all planning units (Johnson 1999) but no key roosting sites such as caves or mines have been located. Population size on the KNF is unknown. Lenard et al. (2009) also documented that Townsend's big-eared bat occurs on every district of the KNF. Libby District NRIS records show four documented sightings or vocalizations of this species dating back to 1994 (map included in Project File).

Big-eared bats are known to feed along forest edges, and can be associated with either dry or wet type coniferous forests. The species show a preference for old growth forest for roosting habitat (Thomas and West 1991). Young and mature forests are used for feeding (Ibid), with primary foraging areas near lakes (Grindal 1995). Based on this information, this species likely utilizes the major creek drainage bottoms (Hendricks et al. 1995, 1996) within the PSU.

As stated previously, only one mine location is known to exist within the Cripple PSU. Therefore, as the Townsend's big-eared bat has the potential to roost in tree cavities (Perkins and Schommer 1991, MNHP 1993), the larger-diameter snags or trees with cavities in the area could be used for summer roosting. As discussed in the old growth section of this document, the Cripple PSU has 11.2% (8533 ac) designated effective old growth, and 12.1% (9262 ac) total old growth acres, both designated and undesignated. These stands and the remaining timbered habitat provide suitable roosting habitat in the form of large snags with cavities and slouching bark, as well as abundant foraging habitat across the forest landscape. The analysis for cavity habitat within the Cripple PSU determined that the cavity habitat potential (CHP) on NFS lands was 67.9%. Please see the Snag Habitat section of this document for more detailed discussion.

ENVIRONMENTAL CONSEQUENCES

ALTERNATIVE 1 (No-Action)

Direct and Indirect Effects

Under Alternative 1, no activities are proposed, and no Townsend's big-eared bats would be directly disturbed by any timber harvest or associated slashing and/or under burning. No direct effects to Townsend's big-eared bats would be expected. Plant succession would continue on many of sites, with increasing canopy closure and increasing density of understory conifers. This plant succession may have an indirect effect on Townsend's big-eared bats since they forage in open areas within forests and the increasing density of understory conifers may decrease the available habitat for prey species. It may also impede flight maneuvers needed for foraging. If a wildland fire was to occur, potential roosting in the form of snags could be both lost and created, but no direct effect on key roosting habitat, in the form or caves, mines, or rock outcrops, would occur, as a wildfire should not disturb these types of fire resistant habitats. There would be no expected change in the existing condition with implementation of Alternative 1 in the short-term other than those disclosed under cumulative effects. On NFS lands, no direct effect to cavity habitat potential would occur, and CHP would remain at 67.9%.

ALTERNATIVES 2and 3

Direct and Indirect Effects

Under Alternatives 2and 3, regeneration and improvement harvest activities have the potential to disturb or reduce day roosting habitat (trees and snags with cavities or thick, loose bark). The potential for reduction in snags was disclosed in Table 3.82 in the Snag and Down Woody Resource Section. Improvement harvests that open up suitable habitat or edge habitat created, may improve foraging opportunities for bats that use the area. Underburning could both reduce and create snag habitat. Disturbance or mortality of bats could occur if bats were using a snag that was cut down. Displacement could occur during prescribed burning. Effects would be site-specific, affecting individuals rather than colonies, and are not likely to affect the viability of the Townsend's big-eared bat.

The maintenance of old growth habitat, as previously described would provide large-diameter tree and snag habitat through time, and snag levels would be maintained at a minimum of 40% through time to provide cavity habitat. None of the alternatives reduce the current designation level of old growth.

All action alternatives propose motorized trail access changes in that they convert approximately 36 (Alt 2) to 27 (Alt 3) miles of motorized trails to non-motorized and covert approximately 16 (Alt 2) to 17.6 (Alt 3) miles of seasonally or yearlong restricted roads into an intermittent stored status. Both of these actions would benefit any adjacent bat habitat by making them less susceptible to firewood cutting (preserving cavity/snag habitat) and by lowering human disturbance levels. Contrarily, Alternatives 2 and 3 each propose to convert approximately 1.8 to 1.6 miles of seasonally restricted roads and approximately 13.5 miles of undetermined roads to NFS roads which allow legal use. Although this is a legal access change, any impact to adjacent bat habitat has likely already occurred from illegal firewood gathering due to the easy topography of these lands along Koocanusa Reservoir. Additional impacts to the bat and mature forest stands in these areas are not anticipated.

Ground disturbing activities, such as the proposed dispersed campground improvements (Fivemile, Yarnell) in or adjacent to Townsend's big-eared bat habitat may result in noxious weed invasion affecting associated prey species. The project design should include measures to reduce this potential risk (e.g. washing equipment, weed spraying). These activities would not remove habitat attributes, such as snags, unless deemed unsafe to recreation users/campers. These activities would occur in all action alternatives.

The Army COE is proposing to harvest and or slash/burn approximately 421 to acres on COE lands included in the PSU boundary. There are no known caves, mines, or old buildings, nor cavity trees adjacent to any COE activities so no impacts to this resource, such as roosting loss, are anticipated.

Cumulative Effects

Summary of the Existing Condition

Past and present activities and natural occurrences that have contributed to the cumulative effects on Townsend's big-eared bat or its habitat include timber harvest, wildfires, wildfire suppression and the sealing of caves or mines. There is one recorded mine within the Cripple PSU that may provide suitable roosting or overwintering habitat. There have been a variety of timber harvests (Tables 3.2) and wildfires that have both reduced potential bat roosting habitat but also likely provided additional foraging areas for this species. Wildfires have also created snags suitable for roosting, even breeding for some bat species. However, the suppression of wildfires has hampered this process. In general, the combination of these activities and processes are thought have both created and reduced bat habitat and have had negligible cumulative effects on Townsend's big-eared bat except those that have affected old growth or late-successional forest stands, where an abundance of summer roosting habitat is typically available. For more information on the cumulative effects to the snag resource, please refer to that section.

Effects of Current and Reasonably Foreseeable Actions

All activities identified to occur within the analysis area that have the potential to affect this species are discussed in the following paragraphs.

Vegetation Management and Fuels Reduction Activities
There are four Forestwide Fuel units (FWF 545 (265 ac), FWF 536 (195ac), FWF 52403 (450ac), FWF 589 (25ac)) that were initiated (slashed) under the corresponding EA. The subsequent burning for these units would occur between 2013 and 2015, would likely remove and create snags therefore their impact is considered negligible. All of these acres are reflected in Table 3.84, in that resource section.

The action alternatives, in combination with other current and reasonably foreseeable vegetation related actions including tree planting, precommercial thinning, Christmas tree cutting, wreath bough collection, character wood collection (log furniture), and blowdown salvaging (Pg. 3-5) would maintain the existing level of snags by avoidance with the exception of small snags possibly lost to character wood(furniture) gatherers. Most snags removed for furniture however are small diameter trees (<10" DBH) unsuitable for most cavity nesters/roosters and this impact is considered negligible to a species such as the Townsend's big-eared bat.

Livestock Grazing
Cattle grazing (Fivemile and Warland Allotments) would not result in a change of old growth habitat, mature forest, or snags in the PSU, as it does not involve the harvest of trees, dead or alive.

Noxious Weed Treatment
Noxious weed management would result in no loss or change in snags serving as bat roosting habitat because weed treatments primarily focus on the herbaceous layer along roads and in previously disturbed areas. Herbicides are sprayed specifically on weed species and not broadcast over all vegetation, therefore, treatments are largely beneficial to native plants by removing competition for soil resources. Typically, approximately 200 acres are treated within the PSU on an annual basis.

Fire Suppression
Fire suppression activities including the construction of firelines, helispots, and safety zones could potentially result in impacts to specialized habitats (e.g. old growth, snags, riparian areas). The amount and timing of such a loss cannot be predicted; however, the number of snags created by a wildfire would far exceed those lost during fire suppression efforts. Suppression activities are typically subject to input from District Resource Advisors, and protection of specialized habitats, including snags, is considered.

Road Management/Use Activities
Road management actions such as road maintenance and administrative use associated with permit administration, data collection and monitoring of NFS lands are not likely to affect specialized habitats (e.g. snags, old growth) because they generally do not result in vegetation removal. These activities include the Koocanusa Marina re-paving project (0.9 miles) to occur in the summer or fall of 2013. The snag component would only be affected if considered a hazard to road users. These activities would not result in any change to the snag component, thus no adverse cumulative effects on this bat species would be expected.

Recreation Maintenance
Routine maintenance of trails and developed and dispersed recreation sites could involve the harvest of snags or green replacement trees that pose a hazard to users. However, the scale of the impact would be small and not measurable as a cumulative effect to snag levels or associated species such as the Townsend's big-eared bat.

Special Uses
There are areas previously impacted by special use permits such as mineral material sites (pits quarries, borrow, roadsides), water developments, utility corridors, private land access routes, and outfitter/guide trails/camps, COE monitoring stations, that would continue to be present and utilized. Ground disturbance on resources such as snags have been included under the existing condition and would have no additional impacts. Any expansion of existing gravel pits would be analyzed for potential impacts on the Townsend's big-eared bat and cavity/roosting habitat at that time.

The Koocanusa Marina plans to expand its camping site system and increase its septic capabilities beginning in 2012 through 2013. These expansions fall within the acreage for which it is already permitted but could result in the loss of individual snags due to public safety concerns.

Public Use
Firewood gathering would continue to remove some snags from the open road corridors and these acres were previously accounted for as part of the existing condition. Other public uses such as wildlife viewing, berry picking, camping, snowmobiling, etc. have negligible impacts on the snag resource. Most campers utilize down wood for campfires in lieu of felling additional dead wood so this impact would also be negligible.

Private Property
Private activities such as land clearing, home construction, livestock grazing, etc. are likely to continue on those private lands within the PSU. Therefore there will likely be a decrease in dry-site snags within the PSU, but outside of NFS lands. For road construction on private lands, an estimated four acres per mile of forest can be expected to be lost. For home construction, garage, parking, lawn, an estimated 1-2 acres of forest can be estimated to be lost per resident. Because these acres are unknown they are not reflected in Table 3.83.

Other Lands
The state of Montana is proposing to regenerate 198 acres and build approximately 0.84 miles of road in T31N, R29W, Section 12. These activities would likely result in snag loss and were considered under Alternative 1, no-action.

Summary of Cumulative Effects
Cumulatively, with all lands considered, and all other reasonably foreseeable actions on private and state lands considered, sufficient cavity habitat for the Townsend's big-eared bat would remain in the Cripple PSU (Table 3.83).

When other activities including the harvest on private, state and federal lands discussed under Alternative 1, and all past, present and reasonably foreseeable activities are considered, habitat on federal lands is considered sufficient to provide cavity habitat to cavity-dependent species. After implementation of Alternative 1 and the reasonably foreseeable FS projects, the primary cavity excavator PPL level on NFS lands is estimated to remain at approximately 67.8% After implementation of Alternatives 2or 3 and the reasonably foreseeable projects, the primary cavity excavator PPL on NFS lands would decrease from 67.9% to 60.0or 61.0% respectively. This level of snag habitat is still expected to provide for an associated species population level above 40%, which is thought to be the minimum needed to maintain self-sustaining populations of snag-dependent wildlife (Thomas 1979 72).

The 2007 KNFP Monitoring Report (USDA Forest Service 2008) documents results for the past 19 years, and indicates the Kootenai National Forest is providing sufficient cavity habitat at the drainage or compartment, as well as the Forest scale.

REGULATORY CONSISTENCY

Kootenai National Forest Plan:

- All alternatives meet KNFP direction for sensitive species (FP Vol 1 II-1 #6) by maintaining appropriate amounts and quality of suitable habitat in order to maintain species viability.
- All proposed units in Alternatives 1, 2and 3 maintain at least 40% snag level. No alternative causes the Cripple PSU overall PPL to drop below the general forest 40% or riparian 60% primary cavity excavator potential population level. This is consistent with KNFP standards. KNFP cavity habitat standard (40% PPL) in MAs 15 and 16 is met. KNFP cavity habitat standard in MA 10 is met. Alternatives 2and 3 would not require a project-specific amendment to suspend the requirement to

retain all existing cavity habitat in MA 10. All treatment units would be managed to meet the 40% minimum snag level.

- All alternatives are consistent with KNFP direction for old growth below 5,500' (FP Vol 1 II-1 #7; II-7; II-22 & 23; Appendix 17; and Kootenai FSM 2432.22 Supplement No. 85) by maintaining a minimum of 10% old growth below 5,500 feet in elevation in each third order drainage or compartment, or a combination of compartments (PSU).
- Forest Plan direction (Vol. I; II-1; Goal A. 7) is to "Maintain diverse age classes of vegetation for viable populations of all existing native, vertebrate, wildlife species,… in sufficient quality and quantity to maintain viable populations". This direction is met by developing a full range of alternatives which consider both habitat quantity and quality for resident species.

National Forest Management Act:

- The project complies with the 2012 National Forest System Land and Resource Management Planning rule of March 27, 2013, by meeting KNF Land Management Plan direction for potential impacts on snags/mature habitats and their associated species.
- The project complies with NFMA direction (16 USC 1604 (G)(3)(b) to "provide for diversity of plant and animal communities based on the suitability and capability of the specific land area in order to meet overall multiple-use objectives, and within the multiple-use objectives of a land management plan adopted pursuant to this section, provide, where appropriate, to the degree practicable, for steps to be taken to preserve the diversity of tree species similar to that existing in the region controlled by the plan.

STATEMENT of FINDINGS

Alternative 1 would have <u>no direct impact</u> on Townsend's big-eared bats or their habitat, however some indirect impacts to habitat may result as previously described. This determination is based on: 1) no direct change in the current availability of roosting and hibernacular habitat would occur, and 2) foraging habitat and potential roosting habitat would remain distributed across the Cripple PSU and across the KNF. Cumulatively, other reasonably foreseeable activities on federal land would occur and may impact individuals or their habitat.

Alternatives 2and 3 <u>may impact individuals and/or their habitat, but would not contribute to a trend toward federal listing or loss of species viability for Townsend's big-eared bat.</u> This determination is based on the fact that: 1) the action alternatives would not affect key roosting or hibernacula in the form of caves and mines, or any buildings and no impacts to the species natality or mortality rates are expected; however, displacement from summer roosting sites (snags) could occur; 2) cavity habitat in the form of snags, wildlife trees, and leave trees would continue to be provided across the Forest in managed (no less than 40% snag habitat levels) and unmanaged areas; and 3) a forested environment suitable for foraging would remain distributed across the Cripple PSU and Forestwide.

WESTERN TOAD

Data Sources, Methods, Assumptions, Bounds of Analysis

Western toad ecology, biology, habitat use, status and conservation are described and summarized in Maxell (2000) and Reichel and Flath (1995). That information is incorporated by reference. Western toad occurrence data comes from District wildlife observation records and Forest historical data (NRIS Wildlife) and other agencies (MNHP). The analysis boundary for project impacts and cumulative effects to individuals and their habitat is the Cripple PSU based on the wide-range of suitable breeding habitat. The boundary for determining trend or viability is the Kootenai National Forest based on the species' ability to disperse and use of generalized habitat.

AFFECTED ENVIRONMENT/EXISTING CONDITION

Western toads require over-wintering, breeding/rearing, and foraging habitat, and may also be dependent

on habitats suitable for migration if the three required habitat types are isolated spatially (Maxell 2000). As summarized in Maxell (2000), over-wintering may take place in underground caverns or in rodent burrows; breeding/rearing takes place in aquatic sites such as shallow areas of large and small lakes or temporary ponds; and foraging habitat is largely in terrestrial uplands. The highest elevation the species has been documented in Montana is 9,220 feet.

A KNF status summary of the western toad was documented by Johnson (1999). The species has been found in seven of the eight planning units. The population size is unknown and direct measures of population trend on the KNF are not available (Ibid 1999). However, many surveys have been conducted on the KNF since 1993. Surveys conducted between 1993 and 1995 located 63 adults. Of the 134 wetland sites surveyed during the 1993-94 field season, 10 had evidence of successful breeding (Werner and Reichel 1994); five additional sites were confirmed during the 1995 field season (Werner and Reichel 1996). Surveys of approximately 200 potential sites were conducted in the Bull River drainage during the 1997-98 field season with evidence of breeding sites (tadpoles and eggs) at eight sites (Corn et al. 1998). Historic and active breeding sites by planning unit on the KNF are summarized by Johnson (1999). Forestwide, approximately 35 breeding sites were verified between 1995 and 1998 (Ibid).

There are 11 known potential breeding (mapped wetlands) sites within the Cripple PSU. Their recent use status was checked in 2011 along with seven additional potential sites. These sites are scattered throughout PSU drainages. Of the 18 sites checked for boreal breeding evidence, two had confirmed boreal tadpoles. Additional breeding habitat is likely to occur in temporal ponds and road ditches. Another small breeding site was documented just outside the PSU boundary in the summer of 2011 during field visits to the PSU, and was also mapped for the Project File. The approximately 92,000 (78,607 NFS lands) acres of terrestrial habitat within the Cripple PSU is considered upland foraging habitat and available to the western toad.

Criteria used to compare the alternative impacts on the western toad and its habitat includes:
1) Known breeding/rearing habitat impacted;
2) Acres of upland foraging habitat harvested and burned;
3) Acres of upland foraging habitat (prescribed burned only).

ENVIRONMENTAL CONSEQUENCES

Quantitative data regarding the western toad's use of upland and forested habitats is limited. Western toads are known to migrate between the aquatic breeding and terrestrial non-breeding habitats (TNC Database 1999). Movement of toads has been documented from 2.5 km to over 5 km between breeding sites (Corn et al. 1998, Bartelt and Peterson 1994). Movement, in foraging areas, has been documented to be significantly influenced by the distribution of shrub cover, and toads may have avoided macro-habitats with little or no canopy and shrub cover (such as clearcuts) (Bartelt and Peterson 1994). Underground burrows and debris were important components of toad-selected micro-sites in a variety of macro-habitats. The western toad digs its own burrow in loose soil or uses those of small mammals, or shelters under logs or rocks, suggesting the importance of coarse woody debris on the forest floor (Ibid). Project activities (e.g. timber harvest, prescribed fire) that remove vegetation resulting in reduced canopy and/or shrub cover or reduced coarse woody debris are likely to impact western toad habitat and toad use patterns. Soil compaction from ground-based logging machines may impact over-wintering habitat (burrow sites).

ALTERNATIVES 1, 2and 3

Direct and Indirect Effects

Table 3.96 summarizes the direct and indirect and cumulative changes in habitat acres due to each alternative and/or concurrent activities.

Table 3.96 - Cumulative Toad Habitat Impacted by Alternative

on NFS lands in the Cripple PSU (acres)

COMPARISON CRITERIA	ALT 1	ALT 2	ALT 3
Known breeding/rearing habitat impacted	0	0	0
Upland foraging habitat harvested/burned	1,133*	10,644**	9,091**
Upland foraging habitat treated by prescribed burned only	935	10,049**	10,049**

* Any acres disclosed in this column are not part of this project but are concurrent and cumulative actions (DNRC = 198 ac harvesting; NFS prescribed burning under FWF (2001) = 935 ac.
** Treated acres adding to the no-action alternative including Army COE lands.

Under Alternative 1, no direct effect to the western toad would be expected with this alternative. Any impacts to potential toad habitat would be the result of cumulative effects from other planned or foreseeable projects disclosed under this alternative, in Table 3.96. Plant succession would continue on all other sites. Indirectly, this would result in an increase in canopy closure and density of understory conifers. This increase in canopy closure and understory conifer density would have no direct or indirect effect on breeding habitat, and little, if any, effect on upland habitat. Fuel loads would continue to accumulate on the upland sites. Should wildland fire occur, typically aquatic breeding habitats would not be directly affected; however, surrounding upland habitat could be burned and may have short-term impacts to toad dispersal (cover connectivity). However, western toads have been noted to re-colonize burned areas the following year with vegetation re-growth (B. Maxell, Herpetologist, State Zoologist with MTNHP, personal communication April 2003, Troy Mt., J. Holifield (Libby District Biologist) personal observation).

Timber Harvest and Road Building

A review of the available literature by Semlitsch (2000) in the United States indicates timber harvest and road construction activities can impact aquatic breeding habitat by altering the hydrological cycle of wetlands that can impair completion of larval metamorphosis through early pond drying (hydroperiod shortened), or through increased predation (if hydroperiod is lengthened). Aquatic habitat quality can also be reduced by sedimentation and increased water temperatures.

The effects of timber harvest on upland habitats are summarized in Semlitsch (2000) and can include elimination of shade, increase surface temperatures, disruption and compaction of soil structure, reduction in soil moisture, removal of coarse woody debris, and sedimentation of aquatic habitats from logging roads. The fragmentation of natural habitats from timber harvesting and road building may impede dispersal and decreases the probability of wetland re-colonization (Semlitsch 2000). Timber harvest (especially clearcutting) and associated silvicultural practices appear detrimental to terrestrial amphibian populations (Bury et al. 2000). Impacts from intensive forest management (e.g. even-aged harvesting) practices extend beyond the boundaries of harvested stands (DeMaynadier and Hunter 1998).

Recommendations for buffer zones and terrestrial habitats for corridors of movement for amphibian species are discussed by several authors (Semlitsch 1998, Hannon et al. 2002). However, western toads are considered to be more terrestrial generalists (DeMaynadier and Hunter 1998), and tend to be more tolerant than salamanders of forest edges, tree harvests and declining patch size (Renken et al. 2004).

The proposed timber harvest activities could result in incidental mortality to western toads due to ground disturbance (crushing by logging equipment), however limited the risk. If present, the toad would likely retreat under cover, underground or move away from the disturbance during project activities. Additionally, once breeding season completes in the spring, the toad is largely nocturnal in behavior which would reduce the likelihood for individual mortality due to logging equipment.

Alternatives 2 and 3 would be similar in their timber harvest effects except in quantity. See Table 3.96 for acreage comparisons. All of the action alternatives propose new road construction including temporary road construction as well as road storage (Tables 2.0 and 2.15, Chapter 2). The use of road construction equipment, like logging machinery, could impact or remove individual toads.

Fire

A review of the available literature by Russell et al. (1999) indicates that replacement of the fire-adapted vegetation by fire-intolerant associations indirectly leads to accompanying declines in overall herpetofaunal abundance and diversity. Without fire, species that use or can tolerate dense vegetation would be benefited, while those species that prefer open sites would continue to decrease through time.

There are few reports of fire-caused injury to herpetofauna even though many of these animals, particularly amphibians, have limited mobility (Russell et al. 1999). The resultant micro-site variation within burns may account for observations that fire has little effect on herpetofaunal species (Lyon et al. 2000). Maintaining preferred or required habitat features presumably outweighs any fire-induced mortality that occurs (Russell et al. 1999). Mortality may be associated with the direct and indirect effects of fire that alter prey availability or change shelter and microclimate (Lyon et al. 2000, Russell et al. 1999). Indirectly, although fire-induced disturbance may decrease herpetofauna within a particular patch, the prescribed burning should result in a mosaic of successional stages and habitat structure that should increase diversity on a broader scale assisting in meeting the purpose and need to enhance wildlife habitat within the Cripple PSU (Russell et al. 1999).

Site preparation burning in timber harvest units is also proposed under the action alternatives (Table 3.96). All activities associated with timber harvest, road construction/decommissioning, intermittent stored service and prescribed fire would be consistent with INFS and direct or indirect effects on riparian habitat (potential breeding sites) associated with the western toad would be unlikely. No harvest would occur within Streamside Management Zones.

All action alternatives propose motorized trail access changes in that they convert approximately 36 (Alt 2) to 27 (Alt 3) miles of motorized trails to non-motorized and covert approximately 16 (Alt 2) to 17.6 (Alt 3) miles of seasonally or yearlong restricted roads into an intermittent stored status. Both of these actions would benefit the western toad by making them less susceptible to being accidentally crushed by motorized vehicles. Contrarily, Alternatives 3 and 4 each propose to convert approximately 1.8 to 1.6 miles of seasonally restricted roads and approximately 13.5 miles of undetermined roads to NFS roads which allow legal use. Although this is a legal access change, any impact to adjacent toad habitat has likely already occurred from illegal firewood gathering due to the easy topography of these lands along Koocanusa Reservoir. Additional impacts to any toads and down woody cover in these areas are not anticipated.

Ground disturbing activities, such as the proposed dispersed campground improvements (Fivemile, Yarnell) in or adjacent to western toad habitat may result in noxious weed invasion affecting associated prey species. The project design would include measures to reduce this potential risk (e.g. washing equipment, weed spraying). These activities would not remove habitat attributes, such as down woody debris, unless deemed unsafe to recreation users/campers. These activities would occur in all action alternatives.

The Army COE is proposing to harvest and or slash/burn approximately 421 to acres on COE lands included in the PSU boundary. These activities would reduce existing down woody debris as cover for western toads but would also likely create new snags and subsequent down wood for this species.

Cumulative Effects

Summary of the Existing Condition

The combination of past timber harvest and years of wildfire suppression in the PSU are believed to have resulted in a balance of cumulative impacts, both positive and negative, on western toad habitat. While timber harvest have opened forest canopies, removed down woody debris, possibly altered hydroperiods, as previously discussed, and created roads, wildfire suppression has largely had the opposite effect (see Direct and Indirect Effects). With exception to trail and firebreak creation, wildfire suppression has maintained vast areas of thick forest canopy and an abundance of large woody debris on the forest floor, facilitating western toad travel across the landscape and has assisted in maintaining breeding/rearing

habitat by protecting wet micro-sites.

Effects of Current and Reasonably Foreseeable Actions
Vegetation Management and Fuels Reduction Activities
There are four Forestwide Fuel units (FWF 545(265 ac), FWF 536 (195ac), FWF 52403(450ac), FWF 589 (25ac)) that were initiated (slashed) under the corresponding EA. The subsequent burning for these units would occur between 2012 and 2014, would likely remove and create down wood (new snag creation) therefore, their impact is considered negligible.

The action alternatives, in combination with other current and reasonably foreseeable vegetation related actions including tree planting, precommercial thinning, Christmas tree cutting, wreath bough collection, character wood collection (log furniture), and blowdown salvaging (Pg. 3-5) would maintain the existing level of snags, and subsequent down wood, by avoidance with the exception of small quantities possibly lost to character wood (furniture) gatherers. Most wood removed for furniture however are small diameter trees (<10" DBH) unsuitable for most cavity nesting or hollow log rest areas. Down wood lost to firewood gatherers within 100 feet of a road has already been accounted for in the PPL for snags. These activities would have little impact on the ability of the western toad to move or forage across the landscape nor measurably increase the risk of being crushed by equipment.

Livestock Grazing
Cattle grazing (Fivemile and Warland Allotments) would not result in a change in down woody debris in the PSU to serve as toad habitat, as it does not involve the harvest of trees, dead or alive. Livestock watering in suitable toad habitat may however, crush the occasional individual with their hooves. Some toad foraging habitat may also be damaged by grazing livestock, however measurable impacts are not expected because of open range management.

Noxious Weed Treatment
Toads away from wetlands or breeding sites could accidently be sprayed with herbicides being utilized along road systems or within infested ungulate seasonal ranges (e.g. winter range). The effect of being sprayed is accounted for in the application rates/toxicity and chemicals disclosed in the 2007 KNF Invasive Plant Management FEIS (pp. 3-72 to 3-73). Any herbicide application within the Cripple PSU would be consistent with that document and its range of effects on amphibian species. Typically, approximately 200 acres are treated within the PSU on an annual basis.

Fire Suppression
Fire suppression activities including the construction of firelines, helispots and safety zones could potentially result in impacts to specialized habitats (e.g. shrub layers and down woody debris). The amount and timing of such a loss cannot be predicted; however, the number of snags and subsequent down wood created by a wildfire would far exceed those lost during fire suppression efforts. Low level vegetation, including shrubs, would be lost immediately following a wildfire, but would likely re-establish within five years. Overall, fire suppression activities serve to protect general toad habitat and are typically subject to input from District Resource Advisors, and protection of specialized habitats, including down wood, is considered.

Road Management/Use Activities
Road management actions such as road maintenance and administrative use associated with permit administration, data collection and monitoring of NFS lands are not likely to affect specialized habitats (e.g. low-level vegetation, down woody debris) because they generally do not result in vegetation removal. These activities could crush individual toads if present during operations. They could also result in the draining of potential breeding sites in ditch areas when water accumulation is a threat to the road. These activities include the Koocanusa Marina repaving project (0.9 miles) to occur in the summer or fall of 2013. The down wood component would only be affected if considered a hazard to road users. It is likely however, that any or most down wood within the permitted area of the Marina would be lost to

campers for campfires. Given the number of acres (70 ac) under permit versus the size of the PSU (>90,000), this impact is considered negligible.

Recreation Maintenance
Routine maintenance of trails and developed and dispersed recreation sites could involve the harvest of down wood that pose a hazard to forest users and the removal of low-level vegetation to facilitate human use. However, the scale of the impact would be small and not measurable as a cumulative effect to the toad, other amphibians and reptiles.

Special Uses
There are areas previously impacted by special use permits such as mineral material sites (pits quarries, borrow, roadsides), water developments, utility corridors, private land access routes, and outfitter/guide trails/camps, COE monitoring stations, that would continue to be present and utilized. The ground disturbance on resources such as shrubs and down wood has been included under the existing condition and would have no additional impacts. Any expansion of existing gravel pits would be analyzed for potential impacts on snags at that time.

The Koocanusa Marina plans to expand its camping site system and increase its septic capabilities beginning in 2012 through 2013. These expansions fall within the acreage for which it is already permitted but could result in the loss some shrubs and down wood, due to public safety concerns. It is likely however, that any or most down wood within the permitted area of the Marina would be lost to campers for campfires. Given the number of acres (70 ac) under permit versus the size of the PSU (>90,000), this impact is considered negligible.

Public Use
Firewood gathering would continue to remove some snags/down wood from the open road corridors and these acres were previously accounted for as part of the existing condition. Other public uses such as wildlife viewing, berry picking, camping, snowmobiling, etc. have negligible impacts on this species due to scope (type of use, risk of trampling, space).

Private Property
Private activities such as land clearing, home construction, livestock grazing, etc. are likely to continue on those private lands within the PSU. Therefore, there would likely be a decrease in dry-site shrubs and down wood within the PSU, but outside of NFS lands. For road construction on private lands, an estimated four acres per mile of forest/shrubs can be expected to be lost. For home construction, garage, parking, lawn, an estimated 1-2 acres of forest can be estimated to be lost per resident. Because these acres are unknown they are not reflected in Table 3.83.

Other Lands
The state of Montana is proposing to regenerate 198 acres and build approximately 0.84 miles of road in T31N, R29W, Section 12. These activities would likely result in shrub, snag and subsequent down wood loss and were considered under the No Action Alternative 1 under the snag analysis.

Summary of Cumulative Effects
Cumulatively, with all lands considered, and all other reasonably foreseeable actions on private and state lands considered as described above, sufficient down woody debris would remain in the Cripple PSU.

The 2007 KNFP Monitoring Report (USDA Forest Service 2008) documents results for the past 19 years may be the best indicator that standing dead and down habitat is being retained via management guidelines and recommendations. Additionally, based on district records, only 1,082 acres (1.4%) out of 78,607 (NFS lands) of timber harvest has occurred in the past five years within the PSU that may impede the movement of the western toad in the analysis area.

In summary, both timber harvest and slash and/or burn units would not provide habitat until shrub cover returned (2-3 years). The temporary reduction in habitat is not likely to result in a declining population trend for this species due to its use of unspecialized habitat outside of breeding.

REGULATORY CONSISTENCY

Kootenai National Forest Plan:

- There are no goals or standards for downed woody debris in the KNFP. It does contain the goal to: "Maintain diverse age classes of vegetation for viable populations of all existing native, vertebrate, wildlife species.... (FP Vol 1 II-1 Goal #7)". The KNFP provides guidelines in Appendix 16, Cavity Habitat Management (FP Vol 2 App 16 6 - Guideline #9). All alternatives are consistent with the KNFP, as a wide range of successional habitats, and associated amounts of downed wood would be available.
- All alternatives meet KNFP direction for sensitive species (FP Vol 1 II-1 #6) by maintaining appropriate amounts and quality of suitable habitat in order to maintain species viability.
- KNFP direction (Vol. I; II-1; Goal A. 7) is to "Maintain diverse age classes of vegetation for viable populations of all existing native, vertebrate, wildlife species,… in sufficient quality and quantity to maintain viable populations". This direction is met by developing a full range of alternatives which consider both habitat quantity and quality for resident species.
- All alternatives are consistent with KNFP riparian standards and guidelines (FP Vol 1 II-28 thru 33) as amended by INFS by creation of SMZs.
- All proposed units in Alternatives 2and 3 maintain at least 40% snag level, which eventually contribute to down woody resources. No alternative causes the Cripple PSU overall PPL to drop below the general forest 40% or riparian 60% primary cavity excavator potential population level. This is consistent with Forest Plan standards.

National Forest Management Act:

- The diversity requirement of NFMA is met by all alternatives as documented in the individual sensitive species and MIS analyses by maintaining a full range of associated habitats and supported by the statement of findings for each species. The project complies with the National Forest System Land and Resource Management Planning rule of March 27, 2013, as amended by meeting Kootenai National Forest Land Management Plan direction for a variety of vegetation age classes.

STATEMENT of FINDINGS

Implementation of Alternative 1 would have no impact (direct, indirect) on the western toad due to the lack of action. Similar (to those disclosed below) localized impacts could occur from cumulative activities displayed in Table 3.96.

Implementation of Alternatives 2and 3 may impact individuals or habitat, but would not likely contribute to a trend towards federal listing or loss of species viability for the western toad. This finding is based on: 1) removal and partial consumption of coarse woody material in upland sites due to harvest activities and/or prescribed fire; 2) the longer-term recruitment of coarse woody debris due to fire-killed trees falling over time; 3) no impact or change to the current availability of breeding habitat; 4) retention of riparian movement corridors; 5) the low risk of direct mortality during burning and the limited direct mortality risk during timber harvest activities; and 6) suitable habitat would remain in the Cripple PSU and distributed across the Kootenai National Forest.

GRAY WOLF

Data Sources, Methods, Assumptions, Bounds of Analysis

Strategies to protect and recover wolf populations in Montana, as well as the ecology, biology and habitat descriptions are outlined in the Northern Rocky Mountain Wolf Recovery Plan (USFWS 1987). The Northwest Montana (NWMT) Recovery area is one of three wolf recovery areas identified for the Northern Rocky Mountain wolf population (Sime et al. 2011). In 2009 (4-2-2009), Acting Director of the FWS, Rowan W. Gould published in the Federal Register (Volume 74, Number 62 pp. 1512-15188) the removal of the gray wolf from the Federal Endangered Species List in portions of the Rocky Mountain

distinct population segment (DPS) including those wolves in Montana and Idaho due to their recovery success. However, subsequent lawsuits challenging the delisting were filed in both Montana and Wyoming. Due to these lawsuits, the District Court of Montana set aside the 2009 delisting rule. Most recently, the Northern Rocky Mountain gray wolf, which includes Montana, has once again been recognized as a distinct population segment and delisted as part of the 2011 Department of Defense and Full-year Appropriations Act. This act was signed on April 15, 2011 by President Obama and on May 5, 2011 the revised List of Endangered and Threatened Wildlife took effect. Therefore the gray wolf is once again considered a sensitive species for the KNF.

The KNF is within the NWMT Recovery Area. Information for this recovery area is provided by the Rocky Mountain Wolf Recovery 2010 Annual Report (Sime et al. 2011) and is incorporated here by reference. Wolf occurrence data comes from recent District wildlife observation records, Forest historical data (NRIS Wildlife) and other agencies (USFWS, MFWP).

Measurement indicators for this wolf analysis include the following key habitat components found in the Wolf Recovery Plan (USFWS 1987):

1) **Sufficient, Year-Round Prey Base for Big Game or Alternate Prey:** This component can be measured by adhering to Forest Plan big game management recommendations. For this planning area, elk management recommendations were applied. They include cover/forage ratios, road densities, opening sizes, key habitat features, movement areas, habitat effectiveness levels, and security levels. See the MIS Section for details.
2) **Suitable and Somewhat Secluded Denning and Rendezvous Sites:** Sensitivity to disturbance at den sites and subsequent abandonment varies greatly among individual wolves. One incident of human disturbance at the den may cause abandonment for some wolves, while other wolves will tolerate some human disturbance (Thiel et al. 1998) and may not abandon dens unless there are repeated or severe incidents of disturbance (Claar et al. 1999). One recommendation for protection of den sites from human disturbance includes restricting human access within a 1.5 mile radius of an occupied den from four weeks prior to whelping to the end of denning activity. Closure area should be irregular in shape to avoid pinpointing den locations. Rendezvous sites should be similarly protected (Frederick 1991). Den and rendezvous sites can also be protected by enacting timing restrictions on proposed activities within the denning/rendezvous site areas. These restrictions would limit operating periods to the fall or winter seasons when den or rendezvous sites are unoccupied.
3) **Sufficient Space with Minimal Exposure to Humans:** This component is associated with reducing the risk of human-caused mortality to wolves. Human disturbance and accessibility of wolf habitats (i.e. road densities) are the principle factors limiting wolf recovery in most areas (Leirfallom 1970; FWS 1978; and 1987; all in Frederick 1991 and Thiel 1978). These components can be generally measured by maintaining open road density standards required by the Forest Plan, as well as maintaining any security habitat recommended in the big game habitat recommendations.

The analysis boundary for direct, indirect and cumulative effects to gray wolves and their habitat is the Cripple PSU because there are no defined pack territories or known denning or rendezvous sites within the PSU. The analysis boundary for trend and viability is the Kootenai National Forest (KNF).

AFFECTED ENVIRONMENT/EXISTING CONDITION

At the end of 2010, there were 85 wolf packs in all of Montana, with 23 meeting breeding pair criteria. These packs contained a minimum estimate of 372 wolves with 72 mortalities (Sime et al. 2011). This area includes the KNF. There are currently 16 packs (6 breeding packs) using the KNF for all or part of their territories.

No known packs utilize the Cripple PSU as a portion of their home range however, members of the Lydia Pack located north and east of this PSU or lone wolves may utilize the area during portions of the year.

Currently, there is no way to confirm use of the area by the Lydia Pack because none of the pack members are known to be radio-collared.

Prey Base: The Cripple PSU supports both summer and winter habitat for most big game species. White-tailed and mule deer are the most abundant big game species found within the Cripple PSU. Together, this mix of species provides a good year-round prey base for wolves. See the MIS species section of this document for more information on elk habitat conditions and population status in the Cripple PSU. The elk was chosen as the MIS species for this PSU and is one of the key prey items for the gray wolf. Most management recommendations for this species are being met in this PSU (MIS Section).

Den and Rendezvous Sites: There are no known den sites in the Cripple PSU. There are no known rendezvous sites that have been used in the PSU since the Lydia Pack was established. Once individual wolves are, again, fitted with radio collars, their activities will continue to be monitored, which will provided additional information on their possible use of the PSU.

Sufficient Space with Minimal Exposure to Humans: Open road densities by management area (MA) meet Forest Plan Standards for MA 12 (0.73 mi/mi^2, standard = 0.75 mi/mi$^{2)}$ within this PSU. The standard for MAs 15-18 also meet or exceed (better than) the FP standard of 3.0 mi/mi^2 currently at 1.7 mi/mi^2. Security habitat recommendations for elk are slightly below recommended levels of 30%, being currently at approximately 28% (MIS Section).

ENVIRONMENTAL CONSEQUENCES

ALTERNATIVE 1 (No-Action)

Direct and Indirect Effects

No timber harvest or road openings/closings are proposed in this alternative. This alternative maintains current conditions for prey habitat and human access within the PSU, therefore maintaining the existing level of habitat security. A number of existing young timber stands would develop cover values over time. Alternative 1 would not change the present 36 miles of motorized trail to non-motorized which would increase security for big game as well as wolves in the PSU.

ALTERNATIVES 2and 3

Direct and Indirect Effects

Prey Base: As discussed in the effects analysis for elk, these alternatives would maintain and possibly improve habitat conditions for elk, one of the wolves' main prey bases within the Cripple PSU. The action alternatives do increase elk secure habitat in the PSU from 28.1% to 35% (Alt 2) or 33% (Alt 3), being better than the Hillis et al. minimum of 30%, as previously described. Therefore, prey conditions for wolves are likely to at least be maintained with these alternatives. All habitat management recommendations for elk and other big game ungulate species are being met, as previously discussed (Table 3.86, MIS Elk).

Denning/Rendezvous Sites: There are no known denning or rendezvous sites within the PSU. Suitable habitat for denning or rendezvous sites would remain available following all alternatives which security conditions improving under Alternatives 2and 3.

Sufficient Space with Minimal Exposure to Humans: Open road densities (ORDs) by MA meet KNFP standards under all alternatives as previously discussed. Some temporary increases in risk from human-caused mortality could accompany localized road use by contractors during harvest activities (roads would not be legally accessible to the general public but unauthorized use could occur). This increased risk would be measurable during harvest activities. Effects would be limited to avoidance of activity areas however, transient use could still occur.

For timber regeneration harvest in Montana, the maximum cut is defined as 40 acres (36 CFR Part 219.27 (d)(2)). Alternative 2 includes units that would result in openings greater than 40 acres (Units 147-150; 73T; 188; 75; 80; 40). This strategy may result in openings that may not be fully utilized by wolves and

their prey as foraging areas, however, creating these openings reduces over edge effect and fragmentation that would occur with greater number of openings of lesser acreage. Additionally, stringers and groups of trees would be left within the units to provide screening and minimize the effect of the openings when possible. There may be short-term disturbances within identified big game travel corridors due to project related activities. Timber management in RHCAs would follow INFS guidelines and the state of Montana Streamside Management Zone (SMZ) law, ensuring the maintenance of travel corridors within riparian zones. Vegetated corridors facilitating movements in elevation would be maintained (see Cover/Forage maps in the Project File).

Unit #62 (seedtree prescription) was designed for various wildlife species like wolves and other large bodied mammals, to maximize forage potential within summer habitat while maintaining a 600 feet to cover standard of the 1987 KNFP. This strategy allows prey species, like elk, to utilize both forage opportunities along the unit's edge and interior without the need to venture to far from forest cover. The shape of the unit mimics naturally created openings and contributes to the juxtaposition of forage and cover for the species.

Both action alternatives propose improvements (ground disturbance, facility installation) in recreation facilities at the confluence of Fivemile Creek and Koocanusa Reservoir as well as Yarnell camping area. Both of these areas receive high levels of recreation use and are not currently suitable, relative to exposure to humans, for wolves. These areas are also near State Highway 37 which receives considerable traffic, especially during summer months.

Both action alternatives propose motorized trail access changes in that they convert approximately 36 (Alt 2) to 27 (Alt 3) miles of motorized trails to non-motorized and covert approximately 16 (Alt 2) to 17.6 (Alt 3) miles of seasonally or yearlong restricted roads into an intermittent stored status. Both of these actions would benefit any wolves by lowering the risk of wolf mortality, either accidental or malicious. Contrarily, Alternatives 2 and 3 each propose to convert approximately 1.8 to 1.6 miles of seasonally restricted roads and approximately 13.5 miles of undetermined roads to NFS roads which allow legal use. However, these roads are located along Koocanusa Reservoir where human use has been occurring and any area wolves are likely adjusted and aware of these disturbances. The access conversion should have no additional impacts on any wolves possibly using the area.

The Army COE is proposing to harvest and or slash/burn approximately 421 acres on COE lands included in the PSU boundary. These actions would have largely beneficial effects on ungulate prey winter range on COE lands, including the management of noxious weeds currently outcompeting native bunchgrasses for soil resources.

Cumulative Effects

Summary of the Existing Condition

The combination of past management activities including timber harvests, trail and road construction, prescribed burning as well as natural forest altering occurrences in the PSU have resulted in similar habitat conditions for wolves as previously described under the MIS elk. The cumulative effects on the existing forest cover and prey base have largely been beneficial to the gray wolf, while the associated road/trail construction has likely contributed, at least inadvertently (vehicle collision), to a heightened risk of wolf mortality - facilitating human access. Generally, however, habitat for the gray wolf in the Cripple PSU remains highly suitable, regardless of human use, as is evident by their successful recovery into many adjacent areas.

Effects of Current and Reasonably Foreseeable Actions

Vegetation Management and Fuels Reduction Activities

There are four Forestwide Fuel units (FWF 545(265 ac), FWF 536 (195ac), FWF 52403 (450ac), FWF 589 (25ac)) that were initiated (slashed) under the corresponding EA. The subsequent burning for these units would occur between 2013 and 2015 and may kill individual green trees within these units on the drier end of the burning prescription. This loss however, should be minimal and not result in measurable

impacts to wolf or large ungulate cover.

Neighboring Fortine Ranger District, to the east of the analysis area, has six vegetation projects that may be active concurrently with treatments proposed under this project. These projects total 3360 acres and include: Davis Be Good (124 ac); Trego (673 ac); S. Meadow Fuels (280 ac); N. Meadow Fuels (2095 ac); Little Feet (178 ac) and Elk Twins (10 ac). Large roaming species like wolves and their ungulate prey are more likely to be disturbed by these neighboring activities due to the typical sizes of their home ranges. Wolves and their prey may temporarily avoid (hours to days) these areas while activities are occurring. Because the most critical period for wolves is the denning period (approx. April 1 – mid July), these activities may add to the cumulative effect due to temporal overlap with the denning period. There are however, approximately 26,000, well-distributed acres, within the analysis area that are available for the species as secure habitat as calculated using the Hillis (et al. 1991) method for secure habitat.

The action alternatives, in combination with other current and reasonably foreseeable vegetation related actions including tree planting, precommercial thinning, Christmas tree cutting, wreath bough collection, character wood collection (log furniture), and blowdown salvaging would have minimal impacts on wolf and prey cover due to their limited spatial scope and minimal removal of vegetation. They may cause wolves to temporarily (hours) avoid an area until the human activity has ceased.

Livestock Grazing
Although grazing allotment(s) cover several thousand acres of the PSU, competition between cattle and resident ungulate prey species for forage is not expected to be an issue. Domestic cattle typically utilize forage areas readily available along roadsides and recently harvested areas that have more gentle slopes whereas resident ungulates are more widespread across the landscape. There have been no known incidents of cattle depredation by wolves to date in this PSU. Any future depredation could result in an indirect (management control) loss (mortality) of a wolf or wolves involved.

Noxious Weed Treatment
Weed treatment activities would not lead to any adverse effects on wolf prey species or their habitat because treatment of weeds would actually benefit forage species important to elk and other big game species (USDA Forest Service 1997 p30). Typically, approximately 200 acres are treated within the PSU on an annual basis.

Fire Suppression
In the event of a wildfire, construction of firelines, helispots and safety zones could potentially result in displacing elk and other big game prey from site specific areas until the event is contained. Upon completion of wildfire suppression activities, rehabilitation of these same areas can create micro-foraging areas because these sites are seeded for soil stabilization.

Road Management/Use Activities
Road management actions such as road maintenance and administrative use associated with permit administration, data collection and monitoring of NFS lands are not likely to measurably contribute to the cumulative impact on prey habitat due to their limited scope (time and space). On occasions when high use areas may be impacted, such as calving areas, impacts would be mitigated with design criteria including timing restrictions. Otherwise, elk and other large ungulate prey species would typically simply avoid the disturbance area until human activities terminate, which usually comprises of a few hours.

These activities include the Koocanusa Marina re-paving project (0.9 miles) to occur in the summer or fall of 2013. This action would not result in a loss of cover because the road already exists. Although water restoration projects may temporarily displace wolves and prey species from a localized area, they typically benefit prey species in the long-term by increasing security, providing pulses of foraging when seeded, or by simply stabilizing soils where certain habitat components can remain available.

Recreation Maintenance
Actions such as road, trail or campground maintenance and administrative use associated with permit

administration, data collection and monitoring of NFS lands are not likely to measurably affect elk and other big game prey species. These species would typically simply avoid the disturbance area until human activities terminate, which usually comprises of a few hours.

Special Uses
There are areas previously impacted by special use permits such as mineral material sites (pits quarries, borrow, roadsides), water developments, utility corridors, private land access routes, and outfitter/guide trails/camps, COE monitoring stations, that would continue to be present and utilized. The ground disturbance on resources such as elk winter range, habitat effectiveness and cover, etc. have been included under the existing condition and would have no additional impacts. Any expansion of existing gravel pits would be analyzed for potential impacts on elk at that time.

The Koocanusa Marina plans to expand its camping site system and increase its septic capabilities beginning in 2012 through 2013. These expansions fall within the acreage for which it is already permitted but would add to the cumulative impact from human activities and their effects on elk.

Public Use
Other public uses such as wildlife viewing, berry picking, firewood gathering, camping, snowmobiling, etc. have negligible impacts on wolves and ungulate prey species given their limited scope (time and space). Infra-structure, such as roads and campgrounds, that facilitate these activities have already been accounted for under the existing condition.

Private Property
Private activities such as land clearing, home construction, livestock grazing, etc. are likely to continue on those private lands within the PSU. Therefore, there would likely be a slight impact on wolf/prey cover and security, especially on winter range where most privately owned acres occur. For road construction on private lands, an estimated four acres per mile of cover can be expected to be lost. For home construction, garage, parking, lawn, an estimated 1-2 acres of cover can be estimated to be lost per resident. Because the acres are estimates and unknown, they are not reflected in Table 3.86.

Other Lands
The state of Montana is proposing to regenerate 198 acres and build approximately 0.84 miles (3.4 ac) of road in T31N, R29W, Section 12. These activities would likely result in wolf/prey cover loss and would cumulatively add to those disclosed impacts on NFS and COE lands under Alternatives 2 and 3. Please refer to MIS Elk section for measurement indicators.

Summary of Cumulative Effects
Timber sales and other management projects, such as salvaging, road work and fuels reductions, may have temporary effects on wolves and ungulate prey species. These effects may include avoidance of activity areas, increase in vulnerability during the hunting season, raised stress levels and short-term displacement from key habitats, like foraging areas or rendezvous sites. Although these effects may occur, they are not expected to result in lower prey populations due to the utilization of seasonal design criteria, such as avoidance of the calving season. Contrarily, vegetation management activities can have beneficial effects, once management activities cease, by providing additional and or reconditioned areas of ungulate foraging. Other forest activities such as hiking and berry picking are thought to have minimal impacts to wolves and prey species, typically resulting in temporary (hours) avoidance of an area.

The temporal occurrence of forest uses such as summer activities (camping, hiking, berry picking) versus fall (hunting, firewood cutting) or winter (skiing, snowmobiling) activities, and the scheduling of management actions to avoid key time periods (spring calving and nesting) when wildlife may be more sensitive to human disturbances, allow for the avoidance of measurable cumulative impacts to wolves and ungulate prey species. There may be some situations where isolated or localized cumulative effects may occur, due to an overlap of forest activities, but these situations are typically short in duration, and do not

persist through the lifecycle of any one species, either temporally or spatially.

REGULATORY CONSISTENCY

Kootenai National Forest Plan:

- All alternatives meet KNFP direction for sensitive species (FP Vol 1 II-1 #6) by maintaining appropriate amounts and quality of suitable habitat in order to maintain species viability.
- KNFP direction (Vol. I; II-1; Goal A. 7) is to "Maintain diverse age classes of vegetation for viable populations of all existing native, vertebrate, wildlife species,… in sufficient quality and quantity to maintain viable populations". This direction is met by developing a full range of alternatives which consider both habitat quantity and quality for resident species.
- All alternatives, with their associated Regional Forester approval for the over 40 acre unit request, are consistent with the KNFP (1987) big game standards by meeting FP or best science habitat parameters which in turn maintain available and suitable habitat.

National Forest Management Act:

- The project complies with the 2012 National Forest System Land and Resource Management Planning rule of March 27, 2013, by meeting KNF Land Management Plan direction for big game and by maintaining a full range of available habitats.

STATEMENT of FINDINGS

Alternative 1, due to lack of action, <u>will have no impact direct on the gray wolf or its habitat</u>. Indirectly, this alternative will impact security by not closing 36 miles of currently open motorized trail. This alternative will also depend on natural occurrences to enhance habitat in lieu of prescribed burning etc. which could affect the quality/quantity of ungulate summer and winter ranges.

Alternatives 2and 3 <u>may impact, but will not contribute to a trend toward federal listing or loss of species viability</u> based on the fact that: 1) proposed road and trail access changes increase habitat security within the PSU; 2) mortality risk to the wolf is not expected to measurably increase during proposed activities and would decrease after post-sale activities are completed in-conjunction with an increase in elk security (+6.9 to +5.3%) as described by Hillis et al. 1991; 3) alternatives would not affect known denning/ rendezvous sites; 4) there may be a short-term avoidance of areas of activity however transient use could still continue; 5) alternatives meet forest plan big game management recommendations with Regional approval for some treatment units exceeding 40 acres.

THREATENED, ENDANGERED and PROPOSED SPECIES REGULATORY FRAMEWORK

The Endangered Species Act (ESA) of 1973 declares that all Federal agencies … " utilize their authorities in furtherance of the purposes of this Act by carrying out programs for the conservation of endangered species and threatened species listed pursuant to Section 4 of this Act." The ESA (Section 7) requires federal agencies to ensure that any agency action (any action authorized, funded or carried out by the agency) is not likely to jeopardize the continued existence of any threatened, endangered, or proposed species. Agencies are further required to develop and carry out conservation programs for these species.

As previously disclosed, the National Forest Management Act (NFMA) specifies that the NFS be managed to provide for diversity of plant and animal communities to meet multiple-use objectives. The "specific land area" (scale) for providing diversity is established in the framework as the area covered by a Forest Plan (36 CFR 219.3). The regulations also say that Forests "must ensure well distributed habitat" to provide for viable populations of native and desired non-native plants and vertebrate species (36 CFR 219.19). The NFMA defines a viable population as "... one which has the estimated numbers and distribution of reproductive individuals to insure its continued existence and is well distributed in the planning area." Under the implementation regulations, the Forest is considered the planning area.

In addition, the analysis considers how the action provides for diversity of plant and animal communities based on the suitability and capability of the specific land area in order to meet overall multiple use objectives, and within the multiple use objectives of a land management plan adopted 16 USC 1604 (g)(3)(B).

Species List
A current species list for the KNF was obtained from the U.S. Fish and Wildlife Service (FWS) web site (http://www.fws.gov/montanafieldoffice) on 2/27/2013. The FWS concurred with potential listed species distribution maps and resulting consultation areas for the KNF in 2001 (USDI FWS Wilson). Terrestrial wildlife species status in the influence area of the proposed project is shown in Table 3.97.

Table 3.97 - Threatened and Endangered Wildlife Species: Project Area Status

SPECIES	ESA STATUS	STATUS IN ANALYSIS AREA	COMMENTS
Grizzly Bear	Threatened	K	1 & 2
Canada Lynx	Threatened	K	2
Wolverine	Proposed Threatened	S	Consultation area pending

K = This species is known to occur within the project area.
1 = Analysis Area is outside Recovery Zone or reoccurring use area, or FWS agreed to consultation area.
2 = Analysis area is inside Recovery Zone or reoccurring use area, or FWS agreed to consultation area.

GRIZZLY BEAR

Data Sources and Life History
Grizzly bear population ecology, biology, habitat description and relationships identified by research are described in FWS (1993), the annual progress reports for the Cabinet-Yaak grizzly bear research (Kasworm et al. 1989-2009) and Kasworm and Manley (1988). That information is incorporated by reference. Briefly, grizzly bears are habitat generalists, using a variety of habitats including the coniferous forests of northwest Montana and north Idaho. Habitat is generally dictated by food availability and distribution, as well as security from human disturbance and mortality. Because grizzly bears have large home ranges, large areas of habitat are required. Grizzlies occupy low-elevation riparian areas, snow chutes and meadows in the spring and late fall, and move up to higher sub-alpine forests in the summer, early fall and winter. Excavated dens, often above 6,000 feet, are entered after the first snowfall and occupied for four to five months. A majority of their diet is composed of vegetation (forbs, sedges, grasses, roots, berries, pine nuts), but also includes fish, rodents, ungulates and insects. Grizzly bear occurrence data comes from recent District wildlife observation records, Forest historical data (NRIS Wildlife), and other agencies (FWS, MFWP).

Bounds of Analysis
Establishment and Appropriateness of Cumulative Effect Boundary
By 2002, agency biologists recognized that grizzly bears were occurring and sometimes living in areas outside of established grizzly bear recovery zones and warranted some level of management consideration (Wittinger, unpubl. rept., October 9, 2002; Wittinger, unpubl. rept. May 13, 2003).

In March of 2003, the Kootenai National Forest, Lolo National Forest and Idaho Panhandle National Forest responded to this new information in cooperation with the FWS. Each Forest had to determine an estimate of bear numbers, analyze habitat conditions relative to linear open and total road densities on eight very large analysis areas (Bears Outside the Recovery Zone or “BORZ” polygons), analyze food attractant and storage problems in each analysis area, and evaluate conflicts between grizzly bear and livestock grazing in each area. In addition, the analysis had to display all steps to minimize “incidental take” based on existing management direction. At that time, the Tobacco BORZ delineation (in which the Cripple PSU is a portion) included lands east of Koocanusa Reservoir, west of Highway 93, north on NFS lands nearly to the Town of Eureka and south to the boundary of the Flathead NF.

The 2009 reanalysis of the KNF BORZs resulted in slight boundary changes to the previously existing Tobacco BORZ. These changes were based on the latest grizzly bear use information for the KNF broken down into 6th order HUC polygons. For the Cripple PSU, this boundary change reduced the number of acres within the Tobacco BORZ from 20,283 to 18,428 acres (see associated map in Project File). Therefore, the analysis boundary for the East Reservoir Project impacts to individual grizzly bears and their habitat is the Cripple PSU or East Reservoir project area. The boundary for cumulative effects and making the effects determination is the updated Tobacco BORZ polygon (USFS 2009; Grizzly Bear Access Amendment Level 1 Meeting).

Grizzly Bear Habitat Analysis Framework
Analysis Elements
The 2011 biological opinion (BO) on the KNFP Amendments for Motorized Access Management within the Selkirk and Cabinet-Yaak Recovery Zones on the Kootenai, Idaho Panhandle, and Lolo National Forests includes standards to conserve grizzly bear habitat in BORZ polygons – or areas outside of the recovery zones identified as having recurring grizzly bear use (BA 2010; see also Appendix A1 of BO). Paraphrased and abbreviated, the standards include:

i. No permanent increases in the total linear miles of "open roads" and "total roads" on National Forest System lands in any individual BORZ area above baseline conditions…
ii. Potential increases in linear miles of open or total roads must be compensated…
iii. There would be provisions for temporary increases in linear miles for projects…
iv. Scheduling considerations in future timber sale planning to avoid concurrent…

These analysis elements, in their entirety, are disclosed and addressed under the Environmental Consequences "Effect" section in addition to potential impacts from livestock grazing and food attractants.

Habitat Selection
Mace et al. (1996) and Mace and Waller (1997), point out the importance of other habitat components as determinants of grizzly bear habitat selection. Specifically, their data emphasized that habitats were used primarily because of their attractiveness as a food source and that displacement from roads occurred as a subsidiary element of grizzly bear habitat use (e.g., spring habitat selection near roads in Mace et al. 1996, and Waller et al. unpublished). In addition, food sources differ between the ecosystems. The Northern Continental Divide Ecosystem (NCDE) provides army cutworms and whitebark pine seeds, which are two food sources either not present or not found in large quantity in the Selkirk/Cabinet-Yaak Ecosystem (SCYE). The physical location of these food sources contributes to habitat selection, which in the case of the NCDE study resulted in bears selecting higher elevation areas (typically non-roaded or Core areas) where these foods are found. There is very little habitat for these food sources within the Tobacco BORZ. McGuire and Davis Mountain areas, within this BORZ, likely have very modest offerings of these grizzly bear food resources.

Habitat Connectivity/Linkage/Fragmentation
The FWS in their 2011 BO describe the importance of habitat connectivity or linkage for wildlife including the grizzly bear. Without this connectivity, species such as the grizzly bear, can be hindered physically (i.e. fitness and fecundity), demographically and genetically (diversity/health). Habitat linkage or fragmenting factors that the FS can address include the presence of highways, railways, forest roads, recreation developments and or use, and forest cover. These factors are addressed under the East Reservoir Project based on their presence in the analyses area (BORZ) for the bear.

Land Uses versus Bear Needs
The IGBC Guidelines (1986) applicable to the Tobacco BORZ portions in Management Situation 2 (MS 2) state: *Management decisions will accommodate demonstrated grizzly populations and/or grizzly habitat use in other land use activities if feasible, but not to the extent of exclusion of other uses* (IGBC Guidelines p4). Management Situation 2 lands are those, without distinct grizzly population centers, lack

high quality habitat, and unnecessary for survival and recovery of the species, or the need has not yet been determined but habitat resources may be necessary (USDI 1993). The IGBC guidelines define a feasible accommodation as: *one which is compatible with (does not make unobtainable) the major goals and/or objectives of other uses*. The guidelines do not provide a specific definition of "compatible" however the intent of these provisions is made clear by the discussion in the IGBC guidelines regarding FS Grizzly Bear management policy: *The FS will manage habitats essential to bear recovery for multiple land use benefits, to the extent these land uses are compatible with the goal of grizzly recovery. Land uses which cannot be made compatible with the goal of grizzly recovery, and are under FS control, will be redirected or discontinued. Management guidelines and objectives, the cumulative effects process, and goals for habitat capability and mortality will be used to guide activities which are compatible with grizzly bear recovery. It is also the policy of the Forest Service to facilitate recreation use in occupied grizzly habitat to the extent such levels or use are compatible with both human safety and grizzly recovery objectives* (IGBC Guidelines p2). Thus, it is apparent that the IGBC Guidelines recognize the multiple use nature of National Forest management. Furthermore, it is apparent that land uses which are, or can be made, compatible with grizzly bear recovery do not "compete" even if there is an impact on individual bears. Appendix 8 of the KNFP incorporates management direction to meet the intent of the IGBC direction.

AFFECTED ENVIRONMENT/EXISTING CONDITION

Grizzly bear reoccurring use areas outside the recovery zones (BORZ polygons) have been identified (USFS 2009 Grizzly Bear Access Amendment Level 1 Meeting) and in their 2011 BO, the FWS concurred with the existing motorized access conditions for areas of bear occupancy outside the recovery zones. These conditions were determined and established by the 2010 Level One Team (Access Amendment). The SCYE BORZ were re-evaluated by a multi-agency group of biologists in 2009 and linear miles of open and total road were used to document the existing motorized baseline because they are more easily communicated, monitored and calculated than road densities (Allen 2011). Table 3.98 displays the current condition of the Tobacco BORZ as currently defined.

Table 3.98 - Cumulative Baseline Condition of Tobacco BORZ

BORZ NAME	GRIZZLY BEAR ECOSYSTEM	TOTAL SIZE (acres)	NFS[1] LANDS (acres)	TOTAL LINEAR MILES of ROADS on NFS LANDS	TOTAL LINEAR MILES of OPEN ROADS on NFS LANDS
Tobacco	Between SCYE and NCDE	287,240	266,947	1,124	867

[1]National Forest System Lands

The project is also partially within Grizzly Bear MS 2 and 3 as defined in the Grizzly Bear Recovery Plan (1993). Briefly, MS 2 lands are those where grizzlies may occur although they do not contain high quality habitat nor are they home to grizzly population centers. Grizzly bear needs are not the top priority for management of these lands. MS 3 lands are those that do not contain suitable grizzly bear habitat and their use is discouraged although grizzlies may occur infrequently. Examples of MS 3 are towns, campgrounds and other residential areas. Approximately 6,917 acres of the East Reservoir project area is within MS 2 lands with another 523 acres within MS 3 lands. The remainder of the Cripple PSU is considered unoccupied habitat.

Grizzly bear sightings have been sporadic within the Cripple PSU and East Reservoir analysis area. Table 3.99 shows documented sightings/use from the past 15 plus years. The Cripple PSU is not known to be used as grizzly bear denning habitat based on known collared grizzly bears. In 2009-2010, the limited number of credible observations within Cripple Horse Creek HUC 6 resulted in this area being re-categorized as unoccupied habitat. In turn, this re-categorization resulted in the size of the Tobacco BORZ being reduced by 4805 acres. A credible observation is clearly defined in Kasworm et al. 2011, and ranked 1 through 5 according to a rating system describing the experience level of an observer, use of visual aids (binoculars, scopes) at the time of the observation, and presence of other evidence (tracks, photo taken, hair).

Additionally, this portion of the Cripple PSU lacks other evidence of grizzly bear use / occupation such as captures, mortalities, documented females with cubs, cattle depredation, and complaints of human encounters on private lands. Similarly, Libby District personnel spent multiple days in the area conducting reconnaissance for various resources, including wildlife. There were no reports of grizzly encounters during this three year process.

Table 3.99 - Historical Grizzly Bear Use of Cripple PSU

6TH CODE HUC	GRIZZLY USE DETAILS	RECURRING USE AREA
Fivemile Creek	1986 sighting of female w/cubs; 2003-04 radio collared female; linkage area	Yes, and included in Tobacco BORZ Polygon
Warland Creek	No data	No
Cripple Horse Creek	1969 & 1971 sightings; 2005 sighting	No
Canyon Creek	No data	No
Dunn Creek	No data	No

There are four grazing allotments in the Cripple PSU including Fivemile, Warland, Cripple Horse and Canyon Creek. The latter two allotments (Cripple Horse and Canyon Creek) have been closed through the administrative closure process due to declining transitory range, lack of demand and riparian area concerns. Warland has been inactive for five years but has renewed interest from a local rancher who wishes to run 22 cow/calf pairs. A decision on activating this allotment is pending line officer approval. Cripple Horse and Canyon Creek have been inactive for over 10 years. Fivemile is an active allotment that supports 17 cow/calf pair with a grazing season of June 1 thru October 15. Much of the grazing is on private land owned by the permit holder along Fivemile Creek and upland areas adjacent to Blue Sky Road #6271.

There are developed campgrounds within the East Reservoir analysis area or Cripple PSU. One of the campgrounds is on NFS lands however managed by concessionaires. Presently, the campground/marina does not have bear resistant garbage containers but this situation would be changing due to the new KNF mandatory food storage order. Additionally, the Army COE operates the Dunn Creek Flats campground within the PSU. Currently this campground does not have bear-resistant containers however, the COE plans to change to resistant containers in the near future (Kaiser email 2011). There is one other semi-developed camping area along Koocanusa Reservoir within the Cripple PSU, however, this area is managed as a Pack it In – Pack it Out camping facility.

Selkirk Cabinet-Yaak Ecosystem Population Information and its Influence on the Tobacco BORZ

Habitat conditions in the nearby recovery zone have been improving steadily since 1987 as documented by Summerfield et al. (2004), and the annual KNFP Monitoring Reports (monitoring item C7). Copies are located in the Supervisors Office in Libby, MT. The minimum population estimate for bears for the Cabinet-Yaak recovery zone has increased to 42 bears in 2008 based on current and previous captures and sightings of unique individuals (Kasworm et al. 2010). Table 3.100 summarizes mortality information for the CYRZ (Cabinet –Yaak Recovery Zone).

<u>There is an apparent decreasing trend in mortalities occurring on NFS lands during the three time periods delineated for Table 3.100</u>. This is true both in terms of the average number of bears killed per year among time periods, and the percentage of human-caused mortality within each time period. For the period 1999-2008, 19% of the total number of human-caused mortalities occurred on NFS lands. An estimated 82% of mortalities occurred on non-NFS lands or in Canada. Additionally, between 1984 and 2009, there were no human-caused grizzly bear mortalities within the Tobacco BORZ (W. Kasworm pers. comm. with Lydia Allen, 2010); however there were five mortalities in 2011 though not within the Tobacco BORZ (dated 5/2012). Two of the mortalities resulted from hunter misidentification (adult male and sub-adult male; inside CYE Recovery Zone); two of unknown causes (unknown sex and age; inside CYE; one under investigation) and one self-defense kill in November 2011 (Kasworm IGBC meeting

notes, 5/2012).

Causes of grizzly bear mortality have generally been due to factors beyond FS control (e.g., train collision, management removal due to food attractant on private land, hunter mistaken identity or defense of life, and illegal kill by a human).

Table 3.100 - History of Known Grizzly Bear Mortalities within-and-around the Cabinet-Yaak Recovery Zone, by Time Period and Land Ownership
(K. Annis pers. comm. 2010, W. Kasworm pers. comm. 2010)[6]

TIME PERIOD	KNOWN GRIZZLY BEAR MORTALITIES TOTAL #/AVE # KILLED PER YEAR		HUMAN-CAUSED MORTALITIES BY LAND OWNERSHIP TOTAL #/AVE # KILLED PER YEAR (% of TOTAL # of HUMAN-CAUSED MORTALITIES)[1]		
	OVERALL	HUMAN-CAUSED	NFS LANDS	NON-NFS LANDS	CANADA[2]
1982-1986	4/0.66	3/0.60	3/0.60 (100%)[3]	0/0 (0 %)	0/0 (0 %)
1987-1998	12/1.00	9/0.75	5/0.42 (56%)[4]	1/0.08 (11%)[5]	3/0.25 (33%)
1999-2009	37/2.91	26/2.36	5/0.46 (19%)	16/1.46 (62%)	5/0.46 (19%)
TOTALS	53/1.89	38/1.36	13/0.34 (34%)	17/0.61 (45%)	8/0.29 (21%)

[1] Percentages are useful for comparing *within time periods only*, due to differences in the length of time represented by each of three time periods.
[2] Includes private and public lands. The CYRZ grizzly bear population extends into Canada.
[3] Includes one mortality that occurred outside of the CYRZ. [4] Includes two mortalities that occurred outside of the CYRZ.
[5] Includes one (1) mortality that occurred outside of the CYRZ [6] Table has not been updated with 2011-12 data.

A comprehensive program to minimize human-caused grizzly bear mortalities involves many elements, and the Forest is actively pursuing these opportunities and partnering with other agencies (2010 IGBC Accomplishment Report).

On the KNF, there has been an increase in bear resistant garbage containers in developed campgrounds and a Pack In/Pack Out Policy for all other campgrounds and dispersed recreation sites. Many county refuse sites are being fenced to keep bears from attractants. For instance, just north of the East Reservoir analysis area, the KNF campgrounds now contains bear-resistant garbage containers. Additionally, in June 2011, the KNF issued a mandatory food storage order to assist in reducing human-bear interactions which can lead to habituation of bears to human foods and sometimes bear removal from the ecosystem.

Public information efforts are also ongoing to encourage people to live in a way that is more compatible with the needs and behaviors of bears. Montana has instituted a mandatory black bear hunter testing and certification program to help educate hunters in distinguishing bear species and reducing mistaken identity. The KNF has installed signs along popular roads to inform people that they are in grizzly bear habitat and they include grizzly bear identification information.

On the KNF since 1987, wheeled motorized vehicle access on open roads has decreased (USDA Forest Service 2009c). In 1987, there were 6,200 miles of road (forestwide inside and outside the grizzly bear recovery zone) of which 73% (4,530 miles) were open to wheeled motorized vehicle use during the bear year. In 2008, there were 7,886 miles of road (inside and outside the grizzly bear recovery zone) of which only 36% (2,856 miles) were open to wheeled motorized vehicle use during the bear year. This results in a difference of 1,674 miles of roads open to wheeled motorized vehicle use between 1987 and 2008. In addition, since 2002, the total miles of road on the landscape have declined. In 2002, there were 7,954 miles of road and in 2008 the total was 7,886 miles, which results in a difference of 68 miles (ibid). Summerfield et al. (2004) also demonstrated reduced wheeled motorized vehicle access across the Cabinet- Yaak Recovery Zone.

In the KNF portion of the Cabinet-Yaak Recovery Zone as a whole, the average percent of a Bear Management Unit (BMU) with open road density greater than one mile per square mile has decreased (improved) from 31 to 30% since the 2004 Access Amendment (USDA Forest Service 2009c). The

average percent of a BMU with total road density greater than two miles per square mile has held steady at 25% (ibid).

Since Core area was first implemented in 1998, the average percent Core area in a BMU across the KNF portion of the recovery zone has increased (improved) from 52 to 60%(not weighted) (USDA Forest Service 2002a; 2009c).

All of these efforts should assist in keeping available habitat within the Cabinet-Yaak Recovery Zone more compatible for grizzly bears making them less likely to venture onto adjacent lands (BORZ), especially private lands. Currently, based on the movements of radio-collared grizzly bears, the NCDE appears to have more influence on grizzly bear use of the Tobacco BORZ than does the CYRZ. This is likely due to better habitat connectivity between the NCDE and the Tobacco BORZ than the CYRZ and the Tobacco BORZ given the presence of the Kootenai River, Koocanusa Reservoir and State Highway 37 located physically between the Tobacco BORZ and the CYRZ.

ENVIRONMENTAL CONSEQUENCES

Analysis Elements for Bears Outside Recovery Zone (BORZ) (18,428 ac)

As stated previously, the proposed project is partially in the Tobacco BORZ polygon (USFS 2009; Grizzly Bear Access Amendment Level 1 Meeting) and grizzly bear MS 2. Bear activity in the Cripple PSU portion of this BORZ polygon was previously discussed and MS 2 defined. The FWS has identified three factors falling under FS jurisdiction that contribute to "taking" (ESA Section 9) of grizzly bears that apply in these areas. They are: 1) access management; 2) food attractants (human and livestock food storage and garbage); and 3) livestock presence. Additionally, under access management, there are four standards that need to be addressed relative to the cumulative baseline condition for the Tobacco BORZ disclosed in Table 3.98.

The 2011 BO on the KNFP Amendments for Motorized Access Management within the Selkirk and Cabinet-Yaak Recovery Zones on the Kootenai, Idaho Panhandle and Lolo National Forests includes standards to conserve grizzly bear habitat in BORZ polygons – or areas outside of the recovery zones identified as having recurring grizzly bear use (BA 2010; see also Appendix A1 of BO.). In summary, the standards and subsequent responses include:

i. No permanent increases in the total linear miles of "open roads" and "total roads" on NFS lands in any individual BORZ area above baseline conditions, except in cases where the Forests lacks discretion to prevent road building across national forest lands due to legal or other obligations (examples include, but are not limited to, ANILCA access claims, identification of RS2477 thoroughfares, etc.). *The East Reservoir Project does not propose any permanent increase in either linear open or total road miles above baseline conditions with a net reduction of 0.3 (Alt 2) to 1.0 (Alt 3) miles of linear road and is therefore consistent with the 2011 Access Amendment and subsequent BO. Outside the BORZ, the project would result in the reduction of approximate 36 (Alt 2) to 27 (Alt 3) linear open miles of motorized trail, storage of 16(Alt 2) to 17.6 (Alt 3) linear total miles of road as well as decommissioning approximately 12 miles of road (from two different categories), therefore improving habitat conditions for any grizzly bears that may wander outside to surrounding areas.*

ii. Potential increases in linear miles of open or total roads must be compensated for with in-kind reductions concurrently or prior to such increases. *This standard is not applicable to the East Reservoir Project because no net increase in linear miles of road, open or restricted would result from the project (see standard one). Roads utilized for administrative purposes (e.g. timber hauling, monitoring, etc.) but are not open to the general public are not considered "open," and do not re-categorize linear total road miles to linear open road miles. Under Alternative 2, the East Reservoir Project has a cumulative reduction of 0.3 miles of linear total road miles following implementation. Similarly, Alternative 3 has a cumulative reduction of 1.0 miles of linear total road miles following implementation.*

iii. There would be provisions for temporary increases in linear miles for projects but also measures to minimize the impacts of such increases, such as seasonal restrictions of public use to the June 16 – August 31 period. *Any public use, such as personal firewood gathering, subsequent to East Reservoir Project activities, would adhere to agreed upon timing restrictions during the active grizzly bear year season.*

iv. Scheduling considerations in future timber sale planning to avoid concurrent disturbance in multiple adjacent watersheds. *Disturbance of watersheds would be designed and scheduled, temporally and spatially, as such to avoid "activating" adjacent watershed with the project area, defined as the Cripple PSU and managed by FS sale administrator(s).*

Other Disturbance Sources of the East Reservoir Project within the Tobacco BORZ

The FWS has identified other factors (within recovery zones, 2011 BO) falling under FS jurisdiction that can contribute to the risk of grizzly bear mortality which are also present within the Tobacco BORZ. These factors are analyzed in the following paragraphs. Bear activity in the Cripple PSU portion of this BORZ polygon was previously discussed.

Vegetation Treatment

The point source disturbances from timber harvest actions inside the BORZ (all treatments buffered by 0.25 miles) may temporarily displace grizzly bears from approximately 10,742 acres during the period of activity that could occur intermittently over several years. However, only a portion of these acres would be unavailable at any given time depending on how the treatment units are divided into timber sales, which would not be active simultaneously (Standard iv).

For timber regeneration harvest in Montana, the maximum cut is defined as 40 acres (36 CFR Part 219.27 (d)(2)). Alternative 2 includes units that would result in openings greater than 40 acres (Units 147-150; 73T; 188; 75; 80; 40). This strategy may result in openings that may not be fully utilized by grizzlies as foraging areas, however, creating these openings reduces over edge effect and fragmentation that would occur with greater number of openings of lesser acreage. Additionally, stringers and groups of trees would be left within the units to provide screening and minimize the effect of the openings when possible. Unit #62 (seedtree prescription) was designed for various wildlife species like grizzlies and other large bodied mammals, to maximize forage potential within summer habitat while maintaining a 600 feet to cover standard of the 1987 KNFP. This strategy allows prey species, like ungulates, to utilize both forage opportunities along the unit's edge and interior without the need to venture to far from forest cover. The shape of the unit mimics naturally created openings and contributes to the juxtaposition of forage and cover for the species.

Road Use/Timber Hauling

During hauling on restricted roads, an estimated 8,000 acres would be "unavailable" to grizzly bears based on utilizing 25 miles of roads for timber hauling purposes at any given time. The range-of-effects of these linear miles of open and total roads were analyzed within the 2011 BO as part of the baseline condition for the Tobacco BORZ (Table 3.98). The East Reservoir Project would not affect the benchmarks set for these analysis elements and therefore not increase the risk of grizzly bear mortality within the Tobacco BORZ.

Livestock Grazing

Livestock are present in the Tobacco BORZ polygon and more specifically in Fivemile Creek of the Cripple PSU. Recent use has been averaging 17 cow/calf pairs, with 17 pairs allotted. Most importantly, to date, there have been no reports of cattle depredation by grizzly bears within the Fivemile range allotment. The 2011 BO disclosed, that livestock grazing has been decreasing on the KNF since 1987 with no reports of cattle loss due to grizzly bears. The East Reservoir Project falls within the range-of-effects analyzed by the 2011 BO because the project does not propose any changes to the current allowable cow/calf numbers in the Fivemile Creek allotment nor expansion of the allotment. As previously stated, there is renewed interest in the Warland Allotment, however the decision to allow cattle

grazing pending until the request can be further evaluated.

Food Attractants
Food attractants are present in the Tobacco BORZ polygon and inside the Cripple PSU. Area food attractants include two community garbage collection sites with several bear resistant dumpsters and domestic livestock (cattle, llamas, horses) on private lands, in addition to the range allotment previously mentioned. To date there have been no documented problems with grizzly bears related to these attractants on NFS lands. There have been occurrences of bears attracted to chickens, swine and garbage immediately adjacent to the Tobacco BORZ on private lands. Management of attractants on private lands are outside of FS control, however local FS representatives work cooperatively with State wildlife personnel to inform private land owners on how to live compatibly with grizzly bears. Additionally, most recently (2011), the KNF has issued a mandatory food storage order (FSO) for all NFS lands, which would assist in maintaining the positive growth trend for the Cabinet-Yaak grizzly bear population and help mitigate some of the less favorable conditions (e.g. greater potential for human encounters; private lands; miles of linear open road) for grizzly bears outside of the CYRZ. This FSO is automatically included in all permits and contracts issued and administered by the KNF. Similarly, the FSO is applicable to and enforceable within all KNF recreation facilities.

Recreation
Recreation uses on the KNF is another factor disclosed by the 2011 BO that can affect the ability of grizzly bears to live and reproduce within the CYRZ but may apply to the Tobacco BORZ. The East Reservoir Project does include, under all action alternatives, improvements (ground disturbance, facility installation) in recreation facilities at the confluence of Fivemile Creek and Koocanusa Reservoir as well as Yarnell camping area. Both of these areas receive high levels of recreation use and are not currently suitable, relative to exposure to humans, for grizzly bears. These areas are also near State Highway 37 which receives considerable traffic, especially during summer months.

Habitat Connectivity
The East Reservoir Project would not result in habitat conditions unfavorable to grizzly bear dispersal and general movement across the surrounding landscape. The project maintains high levels (78.0% of analysis area defined as Cripple PSU; Alt 2 worst case scenario) of movement cover based on calculation for large ungulates. The project is consistent with the emphasis placed on this analysis element in the 2011 BO in that movement cover is maintained in all directions, except west. The East Reservoir analysis area is adjacent to Koocanusa Reservoir, which, may or may not impede grizzly bear dispersal to available habitat west toward the Selkirk Cabinet-Yaak Ecosystem.

Direct and Indirect Effects – Outside Tobacco BORZ (74,116 ac)

Effects of Timber Harvest Activities (includes felling through loading)
Timber harvest activity in the remainder of the Cripple PSU would not affect grizzly bears because the activities would be outside of the Tobacco BORZ polygon and there has been little to no bear use documented in these drainages for 15 or more years with the exception of one possible 2005 sighting.

The COE is proposing to harvest and or slash/burn approximately 421 acres on COE lands included in the PSU boundary. These actions would have largely beneficial effects on ungulate prey winter range on COE lands, including the management of noxious weeds currently outcompeting native bunchgrasses for soil resources. These lands are also outside of the Tobacco BORZ.

Effects of Road Construction and Use (includes hauling and all other types of road use)
Road construction and use in the remainder of the Cripple PSU would not affect grizzly bears because the activities would be outside of the BORZ polygon and there has been little to no bear use documented in these drainages for 15 or more years with the exception of one possible 2005 sighting. All roads constructed would have a gate (or other restriction device) installed when they are built and public access to the roads would be restricted yearlong.

Additionally, all action alternatives propose motorized trail access changes in that they convert approximately 36 (Alt2) to 27 (Alt 3) miles of motorized trails to non-motorized and covert approximately 16 to 17.6 miles of seasonally or yearlong restricted roads into an intermittent stored status. Although most of these trails and roads are outside of occupied grizzly bear habitat, both of these actions would benefit any unexpected use by lowering the risk (via human encounters) of mortality, either accidental or malicious. These actions would also benefit ungulate prey species due to increase security value on spring and summer ranges. Contrarily, Alternatives 3 and 4 each propose to convert approximately 1.8 to 1.6 miles of seasonally restricted roads and approximately 13.5 miles of undetermined roads to NFS roads which allow legal use. However, these roads are located along Koocanusa Reservoir and outside of occupied habitat where high levels of human use has been occurring for years and grizzlies are unlikely to utilize. The access conversion should have no measurable impacts on any grizzlies possibly using the area.

Other Potential Disturbance Sources

Helicopter use associated with prescribe burning treatments would be scheduled spatially and temporally throughout the PSU so not to impact any specific areas more than a day or two at a time and to avoid affecting large areas of seasonal-use wildlife ranges. Flight paths would be from the valley floor up over the burn area(s). The helispot, to be located outside the Tobacco BORZ, would temporarily displace bears, if present, from approximately 402 acres (with one-mile buffer), though not mutually exclusive from acres affected by the helicopter flight path(s) which is estimated to range between 5,000 and 25,000 acres depending upon size of burn unit, distance to unit and implementing a one-mile disturbance buffer around flight path. However, the flight path(s) is located both within and outside the Tobacco BORZ. Again, grizzly bear presence in the majority of the Cripple PSU has not been documented in the last 15 years, so no effects would result from these management activities outside the BORZ.

The proposed project does not currently involve livestock in the Warland, Cripple Horse, Canyon or Dunn drainages; so no effects from livestock operations would occur under the East Reservoir Project within lands in unoccupied habitat.

Although no grizzly bears occur in the remainder of the Cripple PSU (74,116 ac), poor sanitation practices can lure grizzly bears into an area in search of food. The timber sale or stewardship contract(s) would include the 2011 KNF Food Storage Order in its entirety and require contractors to maintain a clean work area and store attractants in a bear-safe manner.

Summary of Effects for Unoccupied Habitat

Alternative 1would have no effect on grizzly bears or their habitat due to the lack of action. Alternatives 2 and 3 would have no direct or indirect effects to grizzly bears due to limited and /or lack of occupancy by the species as disclosed above in Table 3.99.

Cumulative Effects

Summary of the Existing Condition

The Cripple PSU has had minimal management activities in the last 15 years (Table 3.1). These projects treated approximately 3.2% of the PSU with a variety of harvest types: sanitation salvage, clearcut with reserves, shelterwood and seed tree. Past harvests in the area are listed in Table 3.2 of this document. The harvests of the past projects are now complete and the result of this management is a landscape that is a mosaic of various stages of succession or pulses of high quality food sources. This existing condition is now providing forage opportunities for grizzly bear in the form of huckleberries, herbs, big game and some white bark pine.

However, the road construction that typically facilitated timber harvest has contributed negatively to the cumulative effect of management actions on grizzly bears. Roads built for timber harvesting and to access previously non-roaded forests have provided for easier human access, sometimes motorized, which directly (vehicle collision) and indirectly (illegal take; displacement into unsuitable or unavailable habitat

where bears find conflict) have resulted in grizzly bear mortalities over time. Open road densities have dramatically dropped in the past several years as a result of closing roads through decisions intended to facilitate grizzly bear recovery. The habitat parameters incorporated the effects of these past and ongoing activities as displayed in the existing condition (or before the activity).

Effects of Current and Reasonably Foreseeable Actions

Vegetation Management and Fuels Reduction Activities

There are four Forestwide Fuel units (FWF 545(265 ac), FWF 536 (195ac), FWF 52403 (450ac), FWF 589 (25ac)) that were initiated (slashed) under the corresponding EA. The subsequent burning for these units would occur between 2013 and 2015 and may kill individual green trees within these units on the drier end of the burning prescription. This loss however, should be minimal and not result in measurable impacts to the bear or large ungulate cover.

Neighboring Fortine Ranger District, to the east of the analysis area, has six vegetation projects that may be active concurrently with treatments proposed under this project. These projects total 3,360 acres and include: Davis Be Good (124 ac); Trego (673 ac); S. Meadow Fuels (280 ac); N. Meadow Fuels (2095 ac); Little Feet (178 ac) and Elk Twins (10 ac). Large roaming species like grizzly bears are more likely to be disturbed by these neighboring activities due to the typical sizes of their home ranges. Grizzlies may temporarily avoid (hours to days) these areas while activities are occurring. Because two of the most critical periods for grizzlies are the spring and fall foraging periods (approx. April 1 to June 30 and mid-Sept thru November, especially when cubs are present), these activities may add to the cumulative effect due to temporal overlap with the these periods. There are however, approximately 26,000, well-distributed acres, within the analysis area that are available for the species as secure habitat as calculated using the Hillis (et al. 1991) method for secure habitat (see Elk MIS). Additionally, the majority of the analysis area (roughly 74,000 acres) is outside of known occupied grizzly bear habitat.

The action alternatives, in combination with other current and reasonably foreseeable vegetation related actions including tree planting, precommercial thinning, Christmas tree cutting, wreath bough collection, character wood collection (log furniture) and blowdown salvaging (Pg. 3-5) would have minimal impacts on grizzly bear forage/cover due to the scale of these activities and the scattered occurrence across the Libby Ranger District. These projects may result in short-term avoidance of the immediate area while humans are present.

Livestock Grazing

Although grazing allotment(s) cover several thousand acres of the PSU, competition between cattle, bears and resident ungulate prey species for forage is not expected to be an issue. Domestic cattle typically utilize forage areas readily available along roadsides and recently harvested areas that have more gentle slopes whereas resident ungulates are more widespread across the landscape. There have been no known incidents of cattle depredation by grizzly bears to date in this PSU.

Noxious Weed Treatment

Weed treatment activities would not lead to any adverse effects on grizzlies or their habitat because treatment of weeds would actually benefit forage species important to bears and other mammal species (USDA Forest Service 1997 p30). Typically, approximately 200 acres are treated within the PSU on an annual basis.

Fire Suppression

In the event of a wildfire, construction of firelines, helispots and safety zones could potentially result in displacing grizzly bears from site specific areas until the event is contained. Upon completion of wildfire suppression activities, rehabilitation of these same areas can create micro-foraging areas because these sites are seeded for soil stabilization. Wildfire suppression in areas lacking multi-story forest stands, especially those adjacent to open motorized traffic, would be beneficial to the bear by maintaining cover and summer resting habitat.

Road Management/Use Activities
Road management actions such as road maintenance and administrative use associated with permit administration, data collection and monitoring of NFS lands are not likely to measurably contribute to the cumulative impact on grizzly foraging habitat along road edges, due to their limited scope (time and space). These activities would not impact denning habitat by avoidance.

These activities include the Koocanusa Marina repaving project (0.9 miles) to occur in the summer or fall of 2013. This action would not result in a loss of cover because the road already exists. Although water restoration projects may temporarily displace grizzly bears and prey species from a localized area, they typically benefit prey species in the long-term by increasing security, providing pulses of foraging when seeded, or by simply stabilizing soils where certain habitat components can remain available.

Recreation Maintenance
Actions such as site or trail maintenance and administrative use associated with permit administration, data collection and monitoring of NFS facilities are not likely to measurably affect grizzlies and their ungulate prey species. These species would typically simply avoid the disturbance area until human activities terminate, which usually comprises of a few hours. Also refer to road management activities, previously discussed.

Special Uses
There are areas previously impacted by special use permits such as mineral material sites (pits quarries, borrow, roadsides), water developments, utility corridors, private land access routes, and outfitter/guide trails/camps, COE monitoring stations, that would continue to be present and utilized. The ground disturbance on resources such as grizzly bear forage areas, denning, cover, etc. have been included under the existing condition and would have no additional impacts. Any expansion of existing gravel pits would be analyzed for potential impacts on grizzlies at that time.

The Koocanusa Marina plans to expand its camping site system and increase its septic capabilities beginning in 2012 through 2013. These expansions fall within the acreage for which it is already permitted but would add to the cumulative impact from human activities and their effects on grizzly bears and prey species. Although currently outside occupied habitat, the marina would be required to adhere to the 2011 KNF Food Storage Order which would mitigate any potential increase in risk of human-bear interactions.

Public Use
Other public uses such as wildlife viewing, berry picking, firewood gathering, camping, snowmobiling, etc. have negligible impacts on grizzly bears and ungulate prey species given their limited scope (time and space) and largely non-consumptive nature. Infra-structure, such as roads and campgrounds, that facilitate these activities have already been accounted for under the existing condition.

Private Property
Private activities such as land clearing, home construction, livestock grazing, etc. are likely to continue on those private lands within the PSU. Therefore, there would likely be a slight impact on grizzly/prey cover and security, especially on winter range where most privately owned acres occur. For road construction on private lands, an estimated four acres per mile of cover can be expected to be lost. For home construction, garage, parking, lawn, an estimated 1-2 acres of cover can be estimated to be lost per resident. Because the acres are estimates and unknown, they are not reflected in Table 3.86.

Other Lands
The state of Montana is proposing to regenerate 198 acres and build approximately 0.84 miles (3.4 ac) of road in T31N, R29W, Section 12. These activities would likely result in bear/prey cover loss and would cumulatively add to those disclosed impacts on NFS and COE lands under Alternatives 2 and 3. Refer to MIS Elk Section for measurement indicators.

Summary of Cumulative Effects

The action alternatives of this project were designed to meet grizzly bear standards and guidelines. Cumulatively, the potential exists to displace grizzly bears to areas not affected by the activities, but these projects are not expected to contribute cumulatively to bear mortalities given that no new permanent open roads would be constructed within the PSU and the project's compliance with the 2011 BO on KNFP Amendments for Motorized Access Management within the Selkirk and Cabinet-Yaak Recovery Zones on the Kootenai, Idaho Panhandle and Lolo National Forests. Additionally, the action alternatives, in combination with the baseline conditions and reasonably foreseeable projects would improve the overall ungulate security habitat, as defined by Hillis et al. 1991, from 28% to 35 or 33%. This increase in ungulate security can easily be translated to an increase security for any grizzly bears moving through or utilizing, at least intermittently, the PSU.

REGULATORY CONSISTENCY

Kootenai National Forest Plan:

- The project complies with KNFP direction on Threatened and Endangered species that applies to the grizzly bear (FP II-1 #s 5, II-22).
- All alternatives are consistent with KNFP direction to maintain diverse age classes of vegetation for viable populations (FP II-1 #7) by maintaining appropriate amounts and quality of suitable habitat in order to maintain species viability based on best science. By meeting this FP direction, the project maintains suitable habitat for forage/prey species of the bear.

Endangered Species Act:

- The project is consistent with the Endangered Species Act as evidenced through consultation with the FWS and receipt of concurrence and by compliance with the 2011 BO on KNFP Amendments for Motorized Access Management within the Selkirk and Cabinet-Yaak Recovery Zones on the Kootenai, Idaho Panhandle and Lolo National Forests.

National Forest Management Act:

- The project complies with the 2012 National Forest System Land and Resource Management Planning rule of March 27, 2013, by meeting KNF Land Management Plan direction for this habitat resource.

STATEMENT of FINDINGS for UNOCCUPIED HABITAT

Alternative 1 *would have no effect* (direct or indirect) on grizzly bears or their habitat due to the lack of action. Known cumulative actions from other agencies are outside of the Tobacco BORZ and will have *no effect* on the bear.

Alternatives 2 and 3 *would have no direct or indirect effects* to grizzly bears due to limited and /or lack of occupancy by the species as disclosed above in Table 3.99.

STATEMENT of FINDINGS for GRIZZLY BEARS within the TOBACCO BORZ

Alternative 1, due to lack of action, *will have no affect* on the grizzly bear or its habitat.

Alternatives 2 and 3 *may affect, are not likely to adversely affect the grizzly bear*. This determination is based on: 1) although the existing condition of the Tobacco BORZ is considered to have adverse effects on grizzly bears, the East Reservoir Project activities fall within the range-of-effects analyzed in the programmatic BO for the 2011 Forest Plan Amendments for Motorized Access Management within the Selkirk and Cabinet-Yaak Grizzly Bear Recovery Zones and therefore, in itself, is not likely to contribute to the loss of grizzly bears from the Tobacco BORZ; 2) helicopter use associated with the this project is consistent with the management strategies found in the Guide to Effects Analysis of Helicopter Use in Grizzly Bear Habitat (2009) that are not likely to adversely affect grizzly bears; helicopter activities would not prohibit bears from using the area during any period of biological importance such as breeding, late fall foraging (hyperphagia), or denning; 3) the East Reservoir Project does not change the livestock management of the Tobacco BORZ; 4) project activities would not result in an increase in food attractants

and would comply with the 2011 KNF Food Storage Order; 5) the project would not result in measurable increases in recreation use of the Tobacco BORZ based on limited improvements; and 6) the project does not involve changes to any type of mining activities within the Tobacco BORZ and would not result in habitat fragmentation between grizzly bear ecosystems, SCYE and NCDE.

CANADA LYNX

Data Sources, Methods, Assumptions, Bounds of Analysis

Lynx population ecology, biology, and habitat description and relationships are described in Ruggiero et al. (2000) and Ruediger et al. (2000). That information is incorporated by reference. In addition, the final lynx listing rule (Clark 2000) gives population and habitat status on a national scale. The most recent lynx distinct population segment status is found in the Biological Opinion (BO) on the effects of the Northern Rocky Mountains Lynx Amendment (USFWS 2007c). Lynx occurrence data comes from Forest historical records (NRIS Wildlife, RMRS), and other agencies (MNHP, MFWP, FWS).

The Final EIS for the Northern Rockies Lynx Management Direction (Lynx Amendment) was completed in March 2007 with the ROD signed March 23, 2007. This decision amends the 1987 KNFP by providing lynx habitat management objectives, standards and guidelines. The decision replaces the interim application of the Lynx Conservation Assessment and Strategy (LCAS). The direction provided in the Lynx Amendment is applied to lynx habitat at the Lynx Analysis Unit (LAU) scale. In compliance with the LCAS, the KNF delineated 47 LAUs that approximate a lynx home range size. Forestwide lynx habitat was mapped in compliance with LCAS project planning Standard #1 and that map will be updated to reflect the lynx habitat terminology from the Lynx Amendment.

On February 28, 2008 the FWS issued a proposed rule revising critical lynx habitat. Then, on February 25, 2009, the FWS issued their final rule in the Federal Register (Vol. 74, No. 36; pp. 8615-8702) to revise the critical habitat designation for the lynx in the United States. The finding delineates lynx critical habitat units and subunits across the lower 48 states from Maine to Washington. Based on these maps, the Cripple PSU falls within Subunit #10 within the Northern Rocky Mountains (NRM) Critical Habitat Unit #3. In addition to the critical habitat delineation, the proposal of the FWS also identified the primary constituent element for lynx, defined as: “boreal forest landscapes supporting a mosaic of differing successional forest stages,” containing the following sub-elements: snowshoe hares and their preferred habitat, adequate winter snow conditions, denning habitat with abundant coarse woody debris, and ‘matrix’ habitat which facilitates lynx movement and dispersal and connects areas of suitable habitat.

The effects analysis follows the standards and guidelines established in the Lynx Amendment. ***Only the standards and guidelines applicable to the proposed project are analyzed, and they are only applied to lynx habitat on Federal lands (in compliance with the ROD).*** Lynx habitat, in impacted LAU(s), was mapped using the timber stand database version of the KNF model. Connectivity was evaluated by visually examining lynx habitat and past management activities to determine possible movement areas and potential areas where lynx travel may be hindered. Ridge lines and draws were considered high value movement areas.

The scale for direct and indirect effects analysis is the impacted LAU(s) as determined by life history needs of the species, and includes adjacent LAUs for connectivity effects.

AFFECTED ENVIRONMENT/EXISTING CONDITION

On March 24, 2000 the FWS listed the contiguous U.S. distinct population segment of the Canada lynx as threatened (Clark 2000). National population and habitat status descriptions in that document are incorporated by reference. There are three occurrences (MFWP) of lynx found in the historical records that are within the Cripple PSU.

Currently, the Cripple LAU (14511) meets the Lynx Amendment standards (USDA Forest Service 2007). See Map Section of this document for LAU map.

Lynx habitat in the impacted LAU was modeled in terms consistent with the Lynx Amendment. Table 3.101 displays the current lynx habitat conditions in the PSU.

Table 3.101 - Lynx Habitat by LAU in the Cripple PSU

LAU #	LAU / LYNX HABITAT in LAU (acres)\1	UNSUITABLE HABITAT acres/(%)\2	HABITAT CHANGED to UNSUITABLE Over PAST 10 YEARS by TIMBER MANAGEMENT with REGENERATION HARVESTS acres/(%) \3	# of ADJACENT LAUs that EXCEED 30% LYNX HABITAT in an UNSUITABLE CONDITION
14,511	55,789 / 30,463	1,233 / 4.0%	511 / 1.7%	0

\1 Acres do not include 'matrix' stands which are considered unavailable as winter snowshoe hare habitat but are considered suitable for lynx habitat connectivity

\2 These acres are lynx habitat that currently do not provide sufficient vegetation quantity or quality (height) to be used by snowshoe hare and lynx. No additional regeneration harvest allowed if more than 30% of lynx habitat in an LAU is in a stand initiation structural stage that does not provide winter snowshoe hare habitat.

\3 Percent is the percent of total LAU acres that provide lynx habitat (suitable + unsuitable acres). No more than 15% of lynx habitat on NFS lands in an LAU may be changed by regeneration harvest in a 10 year period.

There are no identified linkage corridors (USDA Forest Service 2004 Figure 1-1; USDA Lynx Taskforce 1997a) in the Cripple PSU or potentially impacted LAUs or adjacent LAUs.

ENVIRONMENTAL CONSEQUENCES

Direct and Indirect Effects

Objectives, Standards, Guidelines Applicable to ALL Management Projects in Lynx Habitat

Objective ALL 01: Maintain or Restore Lynx Habitat Connectivity in and Between LAUs and in Linkage Areas.

The East Reservoir project would serve to re-initiate several areas of general lynx habitat (stem exclusion) no longer providing foraging opportunities. Stand re-initiation, while impacting movement or travel habitat in the short-term would greatly benefit snowshoe hares 5 to 50 years following management treatments. None of the alternatives would affect the ability of the lynx to move in and between LAUs or established linkage areas.

For timber regeneration harvest in Montana, the maximum cut is defined as 40 acres (36 CFR Part 219.27 (d)(2)). Action alternative 2 includes units (Units 147-150; 73T; 188; 75; 80; 40) that would result in openings greater than 40 acres. This could result in openings that may not be fully utilized by lynx and snowshoe hare as foraging areas. Creating these openings reduces over edge effect and fragmentation that would occur with greater number of openings of lesser acreage. Additionally, stringers and groups of trees would be left within the units to provide screening and minimize the effect of the openings, when possible. The effect on cover would likely alter the foraging behavior of hare and lynx for approximately ten years (summer foraging) to 30 years (winter foraging) unit adequate cover has been re-established in the interiors of these units. Unit #62 (seedtree prescription), however, was designed for various wildlife species like lynx and other large bodied mammals, to maximize forage potential within summer habitat while maintaining a 600 feet to cover standard of the 1987 KNFP. This strategy allows prey species, like snowshoe hare, to utilize both forage opportunities along the unit's edge and interior without the need to venture to far from forest cover. The shape of the unit mimics naturally created openings and contributes to the juxtaposition of forage and cover for the species.

All action alternatives propose motorized trail access changes in that they convert approximately 36 (Alt 2) to 27 (Alt 3) miles of motorized trails to non-motorized and covert approximately 16 (Alt 2) to 17.6 (Alt 3) miles of seasonally or yearlong restricted roads into an intermittent stored status. Both of these actions would benefit any lynx by lowering the risk of mortality, either accidental or malicious. Contrarily, Alternatives 2 and 3 each propose to convert approximately 1.8 to 1.6, respectively, miles of

seasonally restricted roads and approximately 13.5 miles of undetermined roads to NFS roads which allow legal use. However, these roads are located along Koocanusa Reservoir where human use has been occurring and outside of suitable lynx habitat. The access conversion should have no additional impacts on any lynx possibly using the area during winter.

Projects Must Maintain Habitat Connectivity in and LAU and/or Linkage Area.
This standard is met because there are no permanent developments within the associated LAU. Habitat connectivity within the impacted LAU is very good and connectivity with other LAUs is good to the north, south and east. Koocanusa Reservoir and low elevation/non-habitat are adjacent to the west.

There are no identified linkage corridors (USDA Forest Service 2004: Figure 1-1; KNF Lynx Taskforce 1997: 6) in or adjacent to the Planning sub-unit or potentially impacted LAUs.

Guideline ALL G1: Methods to Avoid or Reduce Effects on Lynx should be used when Constructing or Reconstructing Highways or Forest Highways Across Federal Land. Methods Could Include Fencing, Underpasses or Overpasses.
No highway or Forest highway construction or reconstruction activities are planned, therefore this guideline does not apply.

Standard LAU S1: Changes in LAU Boundaries shall be Based on Site-Specific Habitat Information and After Review by the Forest Service Regional Office.
No changes in LAU boundaries are proposed, therefore this standard does not apply.

Objectives, Standards and Guidelines Applicable to Vegetation Management Projects in Lynx Habitat within LAUs

Standard VEG S1: If more than 30% of the lynx habitat in the LAU is currently in a stand initiation structural stage that does not yet provide winter snowshoe hare habitat, no additional habitat may be regenerated by vegetation management projects. Exception: Fuel treatment projects in the WUI, as defined by HFRA, subject to the following limitation - fuel treatment projects in the WUI that do not meet Standards VEG S1, S2, S5 and S6 shall occur on no more that 6% (cumulatively) of lynx habitat on each National Forest. In addition, fuel treatment projects may not result in more than three adjacent LAUs exceeding this standard. For fuel treatment projects in the WUI, see guideline VEG G10.

Table 3.102 displays how the impacted LAU meets or exceeds the 30% standard.

Table 3.102 - % Habitat Not Providing Winter Snowshoe Hare Habitat within Impacted LAU

LAU	ALTERNATIVE 1	ALTERNATIVE 2	ALTERNATIVE 3
14511	4.0	8.3	7.0

The proposed activities would increase the existing level of lynx habitat not providing snowshoe hare winter habitat in one LAU. In LAU 14511, 2,944 acres (834 modeled as multi-story but were found to be stem-exclusion in field surveys; 1,638 matrix; 435 stand initiation (were found to be above hare foraging height); 37 ac (stem-exclusion) would be converted to unsuitable for winter snowshoe hare habitat by Alternative 2. Alternative 3 would alter 574 acres modeled as multi-story but were found to be stem-exclusion in field surveys; 1,581 matrix; 286 stand initiation (were found to be above hare foraging height); 29 ac (stem-exclusion) for a total of 2470 acres. Both action alternatives meet (better than) the VEG S1 standard.

Standard VEG S2: Timber Management Projects shall not Regenerate more than 15% of Lynx Habitat On NFS Lands within a LAU within a 10-Year Period. The same exception described in standard VEG 01 for fuels projects in the WUI applies to this standard.

This standard is met in the affected LAU. Table 3.103 provides a comparison, by alternative, of how the

impacted LAU complies with this standard.

Table 3.103 - % Regeneration Harvest in Lynx Habitat in the Last 10 years in Impacted LAU

LAU	ALTERNATIVE 1	ALTERNATIVE 2	ALTERNATIVE 3
14511	1.7	6.0	4.6

Standard VEG S5: Precommercial Thinning Projects that Reduce Snowshoe Hare Habitat may Occur from the Stand Initiation Structural Stage Until the Stands No Longer Provide Winter Snowshoe Hare Habitat Only:

1. Within 200 feet of administrative sites, dwellings or outbuilding; or
2. For research studies or genetic tree tests evaluating genetically improved reforestation stock; or
3. Based on new information that is peer reviewed and accepted by the regional level of the Forest Service and state level FWS, where a written determination states:
   a. that a project is not likely to adversely affect lynx; or
   b. that a project is likely to have short-term adverse effects on lynx or its habitat, but would result in long-term benefits to lynx and its habitat; or
4. For conifer removal in aspen, or daylight thinning around individual aspen trees, where aspen is in decline; or
5. For daylight thinning of planted rust-resistant white pine where 80% of the winter snowshoe hare habitat is retained; or
6. To restore white bark pine.

Exceptions 2 through 6 shall only be utilized in LAUs where standard VEG S1 is met.

Alternative 2 meets Standard VEG S5 by utilizing the exception of the Lynx Amendment for daylight thinning around white bark pine or planted rust-resistant white pine. Under this exception, Alternative 2 would precommercial thin a total of approximately 212 acres out of 1,060 acres within lynx habitat in the stand initiation stage or winter snowshoe hare foraging habitat as well as lynx summer foraging or unsuitable winter snowshoe hare foraging habitat. Fuels reduction thinning within the WUI is not applicable to this project because all precommercial thins within the WUI are outside of suitable lynx habitat.

Alternative 3 meets Standard VEG S5 as it does not propose any precommercial thinning within LAU 14511, nor does it utilize the exception for thinning around white bark pine or planted rust-resistant white pine as allowed by the Lynx Amendment. Fuels reduction thinning within the WUI is not applicable to this project because all precommercial thins within the WUI are outside of suitable lynx habitat.

Standard VEG S6: Vegetation Management Projects that Reduce Snowshoe Hare Habitat in Multi-Story Mature or Late-Successional Forests may Occur Only:

1. Within 200 feet of administrative sites, dwellings, outbuildings, recreation sites and special use permit improvements, including infrastructure within permitted ski area boundaries; or
2. For research studies or genetic tests evaluating genetically improved reforestation stock; or
3. For incidental removal during salvage harvest (e.g. removal due to location of skid trails).

Exceptions 2 and 3 shall only be utilized in LAUs where standard VEG S1 is met**.**

Both action alternatives would reduce the amount of suitable lynx habitat with LAU 14511 as shown in Table 3.104. The East Reservoir proposed treatment units within the LAU were reviewed (horizontal cover measured) with respect to Vegetation Standard 6, which prohibits reduction of snowshoe hare habitat within multi-story mature and late-successional forest. The purpose of this standard is to assist in maintaining lynx winter foraging habitat considered by lynx biologists to be critical in perpetuating viable lynx populations.

For Alternatives 2 and 3, each treatment unit was surveyed (Region 1 Horizontal Cover Guidance of June

5, 2008 and professional judgment) and photographed for the Project File and were categorized as either contributing to lynx winter foraging habitat (mature multi-story) and should be dropped from treatment activities, mature stem-exclusion stands in which timber harvesting would improve winter foraging in the future (~15 years), non-lynx habitat within an LAU, or as simply general lynx (matrix) habitat where treatments can occur when meeting Vegetation Standards 1 and 2.

After field review of the proposed treatment units, all of the units contributing to the final drafts for Alternatives 2 and 3, within lynx habitat, were approved for implementation based on the rationales listed previously and their compliance with the Lynx Amendment.

A list of the proposed treatment units located within the Cripple LAU, their associated photo identification numbers, and their assigned management status related to lynx habitat standard Vegetation Standard 6, is available in the Project File for this analysis. Lynx Analysis Unit 14511 meets VEG S1 (30%) also, as shown in Table 3.102.

Table 3.104 - Multi-Story Mature or Late Succession Forest Snowshoe Hare Habitat Impact Summary

ALT #	LAU #	ACRES of MULTI-STORY MATURE and LATE SUCCESSIONAL FORESTS	ACRES of VEGETATION MANAGEMENT	EXCEPTION(S) APPLIED	IS STANDARD VEG S1 BEING MET (Y/N)
1	14511	17,053	0	N/A	Y
2	14511	16,219	834	*	Y
3	14511	16,479	574	*	Y

***Note:** Timber harvest is allowed in areas that have potential to improve winter snowshoe hare habitat but presently have poorly developed under stories that lack dense horizontal cover (e.g. uneven-aged management systems could be used to create openings where there is little under story so that new forage can grow).

Objectives VEG 01, 02, 03 and 04: Both action alternatives utilize timber harvest and prescribed fire in general lynx habitat. Given the current condition of these stands having either poorly developed understories or having been previously harvested and having little lodgepole pine component, managing these stands would provide hundreds of acres for lynx foraging in approximately 10 to 15 years. The mosaic designs of the proposed treatment units, as well as the size, would also assist in creating large blocks (~40ac) of forest that would provide future interior habitat for connectivity and foraging.

Guidelines VEG G1, G4, G5, G10 and G11
Both action alternatives comply with VEG G1. Likewise, all action alternatives comply with VEG G4 because prescribed fire would only be used to reduce fuel loading and prepare the forest floor for planting and natural regeneration. Alternatives 2 and 3 comply with VEG G5 because multiple acres (over 49%) would remain in the LAU suitable for the alternative prey species, red squirrel. Both VEG G10 and 11 are met in that fuel treatment projects in the WUI do not overlap with suitable lynx habitat and VEG 11 because there is no lack of lynx denning habitat within the LAU.

The COE is proposing to harvest and or slash/burn approximately 421 acres on COE lands included in the PSU boundary but outside of LAU 14511 and suitable lynx habitat, therefore they will have no affects to lynx.

Objectives and Guidelines Applicable to Livestock Management Projects in Lynx Habitat Within LAUs
Objective GRAZ 01:
The project does not include any changes in current livestock management activities. This objective does not apply.

Guidelines GRAZ G1, G4, G5, G10 and G11
The project does not include any changes in current livestock management activities. This objective does

not apply.

Objectives and Guidelines Applicable to Human Use Projects in Lynx Habitat Within LAUs

Objectives HU 01, 02, 03, 04, 05 and 06:
Objectives HU 1 thru 6 are not applicable to this project. While all action alternatives propose improvements (ground disturbance, facility installation) in recreation facilities at the confluence of Fivemile Creek and Koocanusa Reservoir as well as Yarnell camping area, both areas are outside of LAU 14511 and suitable lynx habitat.

Alternatives 2 and 3 would actually benefit the lynx by changing the acceptable use of 36 to 27 miles (respectively) of trail from motorized to non-motorized and covert approximately 16 to 17.6 miles of seasonally or yearlong restricted roads into an intermittent stored status. Both of these actions would benefit any lynx by lowering the risk of mortality, either accidental or malicious.

Contrarily, Alternatives 2 and 3 each propose to convert approximately 1.8 to 1.6 miles (respectively) of seasonally restricted roads and approximately 13.5 miles of undetermined roads to NFS roads which allow legal use. However, these roads are located along Koocanusa Reservoir outside of LAU 14511 and suitable lynx habitat.

Guidelines HU G1 through G12:
Guidelines HU G1 thru G12 are not applicable to this project. Alternatives 2 and 3 do propose to construct 9.3 to 8.1 miles (respectively) of new permanent roads; however, the roads are either outside of identified lynx habitat or would not impact habitat connectivity as designed. The temporary roads (4.3 to 4.1 miles) would be expected to have short-term impacts on lynx by possibly disrupting local movement patterns or use of a local area, however, HU G7 in only applicable to permanent roads.

Objectives, Standards and Guidelines Applicable to ALL Projects in Linkage Areas, Subject to Existing Rights

Objective LINK 01:
There are no known land purchase opportunities available within the LAU; therefore this objective does not apply.

Standard LINK S1:
When highway or forest highway construction or reconstruction is proposed in linkage areas, identify potential highway crossings.

The project does not involve construction or reconstruction of a highway or forest road; therefore this standard does not apply.

Guidelines LINK G1 and G2:
The project does not involve the sale or exchange of NFS lands; therefore guideline LINK G1 does not apply. Neither does it involve livestock grazing in shrub-steppe habitats, so guideline LINK G2 does not apply.

Cumulative Effects
Summary of the Existing Condition
The existing condition of Canada lynx habitat has been cumulatively affected by past management actions and natural occurrences similar to those effects on grizzly bear and wolf habitat. Vegetation altering events, whether man-caused or naturally occurring, have been largely beneficial for lynx in that they have provided cycles of foraging habitat scattered fairly evenly across the PSU and intermingled with other habitat elements necessary for lynx survival. But, like with the grizzly bear and gray wolf, roads and trails constructed to facilitate timber harvesting and other forest management activities have made it easier for

humans to access habitats that were once more remote. This increase in access can, in turn, result in an increase in the risk of lynx mortality through vehicle collision, illegal taking or poaching, incidental trapping and malicious killing. Outside of natural causes of death or habitat alteration, an increase in human motorized access and associated events such as those listed previously, have likely had the greatest cumulative impact on the Canada lynx. This situation is evident by the amount of secure habitat demonstrated under MIS elk.

Effects of Current and Reasonably Foreseeable Actions

Vegetation Management and Fuels Reduction Activities

There are four Forestwide Fuel units (FWF (265 ac), FWF 536 (195ac), FWF 52403 (450ac), FWF 589 (25ac)) that were initiated (slashed) under the corresponding EA. The subsequent burning for these units would occur between 2012 and 2014 and may kill individual green trees within these units on the drier end of the burning prescription. This loss however, should be minimal and not result in measurable impacts to lynx because these burns are on ungulate winter range (non-habitat within an LAU) and or outside of LAU 14511.

Neighboring Fortine Ranger District, to the east of the analysis area, has six vegetation projects that may be active concurrently with treatments proposed under this project. These projects total 3360 acres and include: Davis Be Good (124 ac); Trego (673 ac); S. Meadow Fuels (280 ac); N. Meadow Fuels (2095 ac); Little Feet (178 ac) and Elk Twins (10 ac). Large roaming species like lynx, wolves, and grizzly bears are more likely to be disturbed by these neighboring activities due to the typical sizes of their home ranges. Lynx may temporarily avoid (hours to days) these areas while activities are occurring. Because one of the most critical periods for lynx is the denning period (approx. May – early July), these activities may add to the cumulative effect due to temporal overlap with the denning period. Winter foraging is another critical period for lynx, especially when kittens are present. Proposed activities would avoid spatial overlap with winter foraging habitat because any winter treatments would occur on ungulate winter range and outside of lynx habitat. There are however, approximately 26,000, well-distributed acres, within the analysis area that are available for the species as secure habitat as calculated using the Hillis (et al. 1991) method for secure habitat (see Elk MIS). Additionally, all adjacent LAUs to the analysis area meet (or are better than) Vegetation Standard 1, as previously defined providing both secure habitat and landscape connectivity between various lynx habitats.

The action alternatives, in combination with other current and reasonably foreseeable vegetation related actions including tree planting, precommercial thinning, Christmas tree cutting, wreath bough collection, character wood collection (log furniture), and blowdown salvaging would have minimal impacts on lynx due to their limited spatial scope and minimal removal of vegetation. They may cause lynx to temporarily (hours) avoid an area until the human activity has ceased.

Livestock Grazing

Although grazing allotments cover several thousand acres of the PSU, competition between cattle and the snowshoe hare (primary prey species for lynx) for forage is not expected to be an issue. Domestic cattle typically utilize forage areas readily available along roadsides and recently harvested areas that have more gentle slopes whereas snowshoe hares are more widespread across the landscape and heavily within thick stands of conifer regenerations.

Noxious Weed Treatment

Weed treatment activities would not lead to any adverse effects on lynx prey species or their habitat because treatment of weeds would actually benefit forage species important to hares and other small mammal species (USDA Forest Service 1997 p. 30). Typically, approximately 200 acres are treated within the PSU on an annual basis.

Fire Suppression

In the event of a wildfire, construction of firelines, helispots and safety zones could potentially result in

displacing lynx and their prey from site specific areas until the event is contained. Upon completion of wildfire suppression activities, rehabilitation of these same areas can create micro-foraging areas because these sites are seeded for soil stabilization. Wildfire suppression in areas lacking multi-story forest stands would be beneficial to lynx by maintaining winter forage and denning habitat.

Road Management/Use Activities
Road management actions such as road maintenance and administrative use associated with permit administration, data collection and monitoring of NFS lands are not likely to measurably contribute to the cumulative impact on lynx/hare foraging habitat along road edges, due to their limited scope (time and space). These activities would not impact winter foraging or lynx denning habitat by avoidance.

These activities include the Koocanusa Marina re-paving project (0.9 miles) to occur in the summer or fall of 2013. This action would not result in a loss of cover because the road already exists and is outside of the LAU. Although water restoration projects may temporarily displace lynx and prey species from a localized area, they typically benefit prey species in the long-term by increasing security, providing pulses of foraging when seeded, or by simply stabilizing soils where certain habitat components can remain available.

Recreation Maintenance
Actions such as road, trail, or campground maintenance and administrative use associated with permit administration, data collection and monitoring of NFS lands are not likely to measurably affect lynx and snowshoe hare. These species will typically simply avoid the disturbance area until human activities terminate, which usually comprises of a few hours.

Special Uses
There are areas previously impacted by special use permits such as mineral material sites (pits quarries, borrow, roadsides), water developments, utility corridors, private land access routes, and outfitter/guide trails/camps, COE monitoring stations, that would continue to be present and utilized. The ground disturbance on resources such as lynx foraging or denning habitat, where present, have been included under the existing condition and would have no additional impacts due to lack of expansion. Any expansion of existing gravel pits, within LAU 14511 would be analyzed for potential impacts on lynx at that time.
The Koocanusa Marina plans to expand its camping site system and increase its septic capabilities beginning in 2012 through 2013. These expansions fall within the acreage for which it is already permitted and would not impact lynx because they are outside of LAU 14511 and suitable habitat.

Public Use
Other public uses such as wildlife viewing, berry picking, firewood gathering, camping, snowmobiling, etc. have negligible impacts on lynx and hares given their limited scope (time and space) and largely non-consumptive nature. Infra-structure, such as roads and campgrounds, that facilitate these activities have already been accounted for under the existing condition.

Private Property
Private activities such as land clearing, home construction, livestock grazing, etc. are likely to continue on those private lands within the PSU. However, these lands are low in elevation and outside of suitable lynx habitat and would not affect this species.

Other Lands
The state of Montana is proposing to regenerate 198 acres and build approximately 0.84 miles (3.4 ac) of road in T31N, R29W, Section12. These activities are also outside of LAU 14511 and suitable lynx habitat and will result in no effects on this species.

Summary of Cumulative Effects
Timber sales and other management projects, such as salvaging, road work and fuels reductions, may have temporary effects on lynx and associated prey species. These effects may include avoidance of

activity areas and alteration of matrix (travel). Although these effects may occur, they are not expected to result in lower prey populations due to the poorly developed habitat conditions currently existing where vegetation treatments are proposed. Contrarily, vegetation management activities can have beneficial effects, once management activities cease, by providing additional and or reconditioned areas lynx foraging (hare habitat).

The temporal occurrence of forest uses such as summer activities (camping, hiking, berry picking) versus fall (hunting, firewood cutting) or winter (skiing, snowmobiling) activities, and the scheduling of management actions to avoid key time periods (denning) when lynx may be more sensitive to human disturbances, allow for the avoidance of measurable cumulative impacts to lynx and primary prey species. There may be some situations where isolated or localized cumulative effects may occur, due to an overlap of forest activities, but these situations are typically short in duration, and do not persist through the lifecycle of the species, either temporally or spatially.

REGULATORY CONSISTENCY

Kootenai National Forest Plan:

- Alternatives 1, 2, and 3 comply with KNFP direction on T&E species that applies to the Lynx (FP II-1 #7 II-22) and the Lynx Amendment by meeting vegetation standards for habitat elements designated critical for perpetuation of the species as disclosed in the analysis.
- All alternatives are consistent with KNFP direction to maintain diverse age classes of vegetation for viable populations (FP II-1 #7) by maintaining appropriate amounts and quality of suitable habitat in order to maintain species viability based on best science. By meeting this KNFP direction, the project maintains suitable habitat for primary prey species of the Canada lynx.

Endangered Species Act:

- The project is consistent with the Endangered Species Act as evidenced through consultation with the FWS and receipt of concurrence (pending).

National Forest Management Act:

- The project complies with the 2012 National Forest System Land and Resource Management Planning rule of March 27, 2013, by meeting KNF Land Management Plan and the Northern Rocky Mountain Lynx Management Direction.

STATEMENT of FINDINGS

Alternative 1, due to a lack of action, will have no effect (direct) on lynx. Known cumulative actions from other agencies are outside of the lynx habitat (LAU 14511) and will have *no effect* on the lynx. With continued fire suppression, however, Alternative 1 could indirectly reduce the amount of early successional foraging habitat for snowshoe hares due to the lack of vegetation disturbance overtime.

Alternatives 2 and 3 *may affect, are not likely to adversely affect the lynx*. Likewise, Alternatives 2 and 3 *may affect, are not likely to adversely affect designated critical lynx habitat*. This determination is based on the facts that: 1) these alternatives of the East Reservoir DEIS comply with all standards, guidelines, and objectives of the Northern Rockies Lynx Management Direction Record of Decision and its activities fall within the scope of those analyzed in the subsequent Biological Opinion (2007), more specifically, the project would not result in habitat conditions that would cumulatively contribute to the low level of species loss estimated by the 2007 BO; 2) these projects do not involve any activities that may result in increased areas of snow compaction, nor permanent loss of lynx habitat; and 3) although this project would temporarily affect the primary constituent sub-element, 'matrix' habitat and stem-exclusion stands, it meets ALL S1 standards, therefore maintaining habitat connectivity within and between associated LAUs. Additionally, the project would not remove or significantly alter any of the other primary constituent sub-elements including: space; nutritional or physiological requirements; cover or shelter; breeding or rearing sites; or habitats protected from disturbance that represent historic, geographical, and

ecological distribution of the species.

WOLVERINE

Data Sources, Methods, Assumptions, Bounds of Analysis

Wolverine population ecology, biology, habitat description and relationships identified by research are described in Banci (1994) and Butts (1992). That information is incorporated by reference.

Generally, their habitat is described by the FWS as high elevation alpine and boreal forests that are cold and receive sufficient winter precipitation to reliably maintain deep persistent snow into late spring and early summer (http://montanafieldoffice.fws.gov).

On December 14, 2010, the FWS published their 12 month finding on a petition to list the wolverine as endangered or threatened under ESA in the Federal Register (Vol. 75, No. 239, p. 78030). The FWS determined that the listing of the wolverine was warranted but precluded due to higher priorities and added the wolverine to its candidate species list. However, on February 1, 2013, FWS announced that the agency proposes to list the species as "threatened" under ESA and that it will receive public comments for 90 days or May 6, 2013. A threatened species is defined as "any species that is likely to become an endangered species within the foreseeable future throughout all or a significant portion of its range. The listing would protect the wolverine as a threatened species in the contiguous (or lower 48) states as a distinct population segment (DPS) under the ESA. A DPS is a portion of a vertebrate species that is geographically discrete from the rest of its kind and also is significant to its survival."

Wolverine occurrence data comes from recent District wildlife observation records and Forest historical data (NRIS Wildlife) and other agencies (MFWP). Because wolverines are habitat generalist, except for denning habitat, only wolverine denning habitat was modeled using TSMRS vegetation data and filtered through various queries based on referenced literature (see process document-wildlife, Project File). The analysis boundary for project impacts and cumulative effects to individuals and their habitat is the Cripple PSU based on the resources needs (denning, foraging) of the species. The boundary for determining trend or viability is the Kootenai National Forest (KNF) due to the mobility of the species and gene dispersal.

AFFECTED ENVIRONMENT/EXISTING CONDITION

Wolverine observation and monitoring data indicates that there have been a few documented occurrences of wolverines within the Cripple PSU and Johnson (1999) shows wolverine presence confirmed in seven of the eight planning units on the KNF. The latest documented occurrence from Libby District data is dated 1994.

Reudiger (1994) shows the KNF as a primary habitat area for wolverine. Following the identification process outlined in Reudiger (Ibid), the Koocanusa Planning Unit (major drainage) is assigned as a secondary wolverine conservation area (Johnson 2004a). The Cripple PSU is considered to be minimal quality wolverine habitat area (Ibid). While Johnson (1999) modeled (Heinz 1997) about 12,000 acres of wolverine denning habitat on the Forest, this analysis focused on areas that typically carry snow cover until May 15 as described in Copeland et al. (2010) where denning and rearing of wolverine kits would occur. Modeling wolverine potential denning habitat, according to Copeland et al. (2010) identifies 9,546 acres of potential denning habitat (area of snow cover until May 15) in the Cripple PSU. These acres are shown in Table 3.105.

ENVIRONMENTAL CONSEQUENCES

Table 3.105 summarizes the cumulative changes in denning habitat acres due to each alternative.

Table 3.105 - Wolverine Potential Denning Habitat – Cumulative Changes

	EXISTING	ALT	ALT	ALT

	CONDITION	1	2	3
*Denning Habitat Acres – Cripple PSU (acres/+/-% change)	9,546 0	9,546 0	8,716 (-612, -6.4%)	9,420 (-263, -0.3%)
Denning Habitat Acres - Forestwide (acres/+/-% change)	467,738 0	467,738 0	467,126 (-612, -0.13%)	467,475 (-263, -0.06%)

* Data source: KNF TSMRS model; acres of habitat that may hold snow cover until May 15 based on findings of Copeland et al. 2010.

ALTERNATIVE 1 (No-Action)
Direct and Indirect Effects
Alternative 1 would have no direct effects on the wolverine or its habitat based on the lack of action. Any benefits to prey species, such as the marmot, would originate from natural disturbances.

ALTERNATIVES 2 and 3
Direct and Indirect Effects
Each of the action alternatives would alter anywhere from 263 to 612 acres of potential wolverine habitat, as defined, depending upon the alternative (Table 3.105). These vegetative changes would result from a combination of timber harvest, thinning and prescribed burns. Many papers (Joslin and Youmans 1999; Witmer et al. 1998; Copeland 1996; Weaver et al. 1996; Thomas 1995; Butts 1992) show that the wolverine is sensitive to human presence, which indicates that it is highly likely they would be displaced during project activities. Displacement distances, due to human activity, vary but in general the biggest impact for most species is shown to occur out to 0.25 to 0.33 miles or the nearest ridgeline (Christensen & Madel 1982; Schirato 1989; Frederick 1991; Grant et al. 1998; Austin 1998). Distances can be farther depending on type of disturbance (e.g. helicopter flying and use of explosives - USFS 1988, Interagency Grizzly Bear Committee (IGBC) 1990; OHV in open country - Bury 1983, may displace animals up to one mile). Displacement distance for the proposed burn units is estimated to be one mile. For Unit FW51103, which represents a large prescribed fire unit surrounded by the most wolverine habitat, implementation could result in displacement of wolverine from approximately 5,362 acres (given 1 mile disturbance via helicopter). Similarly, Unit 319, which represents a modest timber harvest unit (17 ac), would make 251 acres temporarily unavailable to wolverine given a 0.25 mile disturbance influence. It is important to note that all of the proposed treatment units would not be active at the same time. The calculations represent the worst case scenario from individual units, which, is typically the level of implementation. The most critical period for wolverine is denning (December 1-April 30). No project activities are allowed within one-half mile of potential denning habitat during this time frame, however this is typically not an issue because the high elevation snows of wolverine denning habitat prevents most vegetation management during the denning period.

The proposed activities for both action alternatives do maintain or move the wolverine habitat toward the desired secondary quality (as previously defined) condition in the Koocanusa drainage by providing habitat for a variety of prey species. The Cripple PSU would continue to provide a modest or minimal habitat quality condition. Wolverines are likely to continue using the available habitat. Areas of mapped wolverine habitat that receive timber harvests (especially regeneration), thinning, burning and road construction, may accumulate higher levels of snow during the winter due to less overstory. However, these same areas would be more exposed and may lose their snow quicker in the spring. Other than this type of affect, the proposed alternatives are not expected to have any other impacts on the snow element of wolverine habitat.

The Cripple PSU adds a range of approximately 9.3 (Alt 2) to 8.1 (Alt 3) miles of new road construction and approximately 4 miles of temporary road construction/reconstruction within the entire PSU, depending upon the alternative. These roads would be available to both hikers and horse riders upon completion of the activities. This increase in forest access may increase the risk of mortality via incidental trapping for other furbearers because wolverines are known to be easily trapped. The increase in human presence is unlikely to have measurable disturbance impacts outside of the denning season or in the

absence of mechanized transportation (ATVs, snowmobiles, motorcycles, helicopters, etc.)

Contrarily, both action alternatives propose motorized trail access changes in that they convert approximately 36 (Alt 2) to 27 (Alt 3) miles of motorized trails to non-motorized and covert approximately 16 to 17.6 miles of seasonally or yearlong restricted roads into an intermittent stored status. Both of these actions are likely to result in beneficial effects for wolverine by reducing motorized access (risk of mortality) which can facilitate trapping for furbearers. Alternatives 2 and 3 also propose to convert approximately 1.8 to 1.6 miles of seasonally restricted roads and approximately 13.5 miles of undetermined roads to NFS roads which allow legal use. Although this is a legal access change, additional impacts to wolverine, their primary prey (marmot) or their habitat is unlikely because these roads are along Koocanusa Reservoir and away from potential habitat.

No alternative proposes any changes to the current allowable over snow vehicle use areas and routes. The current use of snowmobiles in the PSU is considered light (Jeresek 2011 email) and there are no proposed activities of this project that would result in measurable impacts to wolverine or their habitat. Generally, frequent use by snowmobiles in previously seldom used areas may cause wolverine to abandon a den and leave the area. However, information on the effects of snowmobiles on species like the wolverine is lacking and largely supported by similar data gathered for grizzly bears or from data related to wolverine trapping. Other effects of snowmobiles on wolverines may include increased metabolism and heart rates (stress) therefore affecting the overall health of the animal during adverse winter conditions when stored energy is vital to survival.

Other recreation improvements proposed under this project are either in areas of existing high human use such as along open road systems or at existing trailheads, or out of wolverine denning habitat, etc. None of the action alternatives propose any new recreation facilities which may impact or reduce wolverine habitat. These actions include ground disturbing activities, such as the proposed dispersed campground improvements (Fivemile, Yarnell). The campground improvements are outside of potential habitat, as previously defined, being in low elevation areas along Koocanusa Reservoir.

The Army COE is proposing to harvest and or slash/burn approximately 421 acres on COE lands included in the PSU boundary. The treatment areas avoid Dunn Creek which provides only potential scavenging habitat during the main part of winter as these lands are also along Koocanusa Reservoir. Therefore, the actions on COE lands would not impact this species.

Cumulative Effects

Summary of the Existing Condition

Given the general nature of wolverine habitat outside of denning, past forest management practices are thought to have contributed little to the cumulative impact on wolverine habitat with the exception of road construction in the PSU. Road development has improved human access, especially motorized, into most forest drainages which in turn tends to increase the risk of wolverine mortality via incidental trapping, vehicle collision or illegal harvesting. However, methods and tools used to manage for the threatened grizzly bear, since its listing in 1975, have had beneficial cumulative effects for wolverine by restricting motorized access to many high elevation forests and habitats within the PSU.

Effects of Current and Reasonably Foreseeable Actions

All activities identified to occur within the analysis area that have the potential to affect this species are discussed in the following paragraphs.

Vegetation Management and Fuels Reduction Activities

There are 25 acres planned for underburning within the East Reservoir analysis area which initiated under the treatment of FWF Unit 589. These 25 acres are within designated old growth and would alter the understory as described under direct effects for action alternatives. However, this is dry type ponderosa

pine old growth which has limited suitability as wolverine habitat.

Neighboring Fortine Ranger District, to the east of the analysis area, has six vegetation projects that may be active concurrently with treatments proposed under this project. These projects total 3360 acres and include: Davis Be Good (124 ac); Trego (673 ac); S. Meadow Fuels (280 ac); N. Meadow Fuels (2095 ac); Little Feet (178 ac) and Elk Twins (10 ac). Large roaming species like wolverine are more likely to be disturbed by these neighboring activities due to the typical sizes of their home ranges. Area wolverine may temporarily avoid (hours to days) these areas while activities are occurring. Because the most critical period for wolverine is the denning period (Dec. 1 – April 30), these activities are unlikely to add to the cumulative effect due to lack of temporal overlap with the denning period. Additionally, there are approximately 26,000 acres within the analysis area that are available for the species as secure habitat.

The action alternatives, in combination with other current and reasonably foreseeable actions including tree planting, precommercial thinning, Christmas tree cutting, boughs, pine cone collecting would have little impact on wolverine or its primary habitat due to human avoidance of high altitude alpine environments and talus slopes during these activities.

Livestock Grazing
Cattle grazing (Fivemile and Warland Allotments) would not result in a change of old growth habitat and riparian ecosystems, or down woody debris in the PSU that may facilitate wolverine use, as it does not involve the harvest of trees, dead or alive. Grazing cattle predominantly move along road systems and within past harvest units where an abundance of forage for livestock can be found. Primary wolverine habitat would not be impacted utilized by grazing cattle due to elevation and access.

Noxious Weed Treatment
Noxious weed management would result in no loss or change in wolverine habitat, as defined, because weed treatments primarily focus on the herbaceous layer along roads and in previously disturbed areas. Riparian ecosystems are considered to be more sensitive to herbicides and are largely avoided by noxious weed treatments. High-altitude alpine areas and talus slopes are largely inaccessible by weed treatment crews therefore there would be no disturbance to wolverines in primary habitat. Typically, approximately 200 acres are treated within the PSU on an annual basis.

Fire Suppression
In the event of a wildfire, construction of firelines, helispots and safety zones could potentially result in impacts to old growth habitats, including riparian environments which may be utilized by wolverines. Conversely, wildfire suppression also serves to preserve existing old growth and riparian areas serving as wolverine scavenging/foraging habitat. Suppression activities are typically subject to input from District Resource Advisors, and protection of special habitats, including old growth, is considered. However, if cumulative effects to old growth habitat result in the habitat no longer functioning as old growth, additional old growth habitat would be designated.

Road Management/Use Activities
Road management actions such as road maintenance and administrative use associated with permit administration, data collection and monitoring of NFS lands are not likely to affect old growth and other specialized habitats (e.g. riparian corridors, down woody debris, talus slopes) , that may be utilized by wolverine, because they generally do not result in vegetation removal. The down wood component would only be affected if considered a hazard to road users or impedes passage. These activities would not result in any change to primary high-altitude wolverine habitat by avoidance, thus no adverse cumulative effects would be expected. These activities include the Koocanusa Marina re-paving project (0.9 miles) to occur in the summer or fall of 2013. The standing tree and snag component would only be affected if considered a hazard to road users. These activities would not result in any change to the quantity or suitability of primary wolverine habitat by avoidance.

Recreation Maintenance

Routine maintenance of trails and developed and dispersed recreation sites would not contribute to the cumulative impact on wolverine habitat because maintenance of these facilities do not typically involve removal of habitat elements such as down wood, talus, snags unless deemed to be a safety hazard to forest users. In this situation, the removal of down wood is considered negligible. Maintenance of trails and dispersed sites in alpine areas may temporarily disturb resident wolverines and their prey (ex: marmots), but this impact would be short in duration and would not measurably impact habitat components such as talus.

Special Uses

There are areas previously impacted by special use permits such as mineral material sites (pits quarries, borrow, roadsides), water developments, utility corridors, private land access routes, and outfitter/guide trails/camps, COE monitoring stations, that would continue to be present and utilized. Ground disturbance on vegetation resources that may facilitate wolverine movement across the landscape, have been included under the existing condition and would have no additional impacts. Any expansion of existing gravel pits would be analyzed for potential impacts on wolverine and their habitat at that time.

The Koocanusa Marina plans to expand its camping site system and increase its septic capabilities beginning in 2012 through 2013. These expansions fall within the acreage for which it is already permitted and would not involve the removal or alteration of designated old growth stands or riparian areas serving as potential wolverine habitat. Additionally, this permitted area is on low elevation lands along Koocanusa Reservoir and outside of primary habitat for this species.

Public Use

Firewood gathering would continue to remove some down wood from riparian areas and old growth along open road corridors and these acres were previously accounted for as part of the existing condition. Other forest use activities such as mushroom and berry picking, camping, hunting, Christmas tree cutting, bough collection, etc. have little to no measurable impact on these specialized habitats because they are largely non-consumptive or rapidly re-established and would not contribute to the cumulative effect on this resource. With the exception of berry picking, camping and hunting, these activities would have little impact on wolverine or its primary habitat due to human avoidance of high altitude alpine environments and talus slopes during these activities.

Private Property

Private activities such as land clearing, home construction, livestock grazing, etc. are likely to continue on those private lands within the PSU. Therefore, there would likely be a decrease in dry-site old growth within the PSU, but outside of NFS lands and primary wolverine habitat.

Other Lands

The state of Montana is proposing to regenerate 198 acres and build approximately 0.84 miles of road in T31N, R29W, Section 12. However, these proposed actions are not adjacent to any mapped old growth type on NFS lands and therefore would have no edge effect on old growth stands. This area does contain one riparian zone which may facilitate movement. This riparian area would be subject to state stream management zones and would be protected in accordance with its status as a perennial or intermittent stream. Otherwise, this portion of state land is outside of primary, high-elevation wolverine habitat.

Summary of Cumulative Effects

As previously stated, fire suppression over the last century has altered stands historically maintained by fire disturbance. The affected stands have developed fuel loading and ladder fuels that are uncharacteristic for some sites. These conditions may contribute habitat for potential prey species of wolverines and facilitate movement in areas of frequent human use.

Potential natural disturbances (wildfire, insect or disease epidemics, wind) could reduce forested stands or completely void an area of cover under extreme conditions. Likewise, there is the potential for human caused fires initiating on private lands to move on to adjacent NFS lands and remove old growth and

possibly riparian habitats that have not been, at least partially, managed either by prescribed burning and/or removal of ladder fuels.

The most recent Forestwide old growth analysis concludes that at least 10% of the KNF below 5,500 feet elevation is designated for old growth management, much of which is in riparian areas and available to wolverines. The proposed activities would not affect the 10% standard for old growth at either the PSU or Forest scale. Likewise, the proposed activities would have no measurable impact on primary high-altitude habitat of the wolverine by avoidance. The prescribed burning on the upper elevations of the PSU would have beneficial impacts on the foraging component for marmots, the wolverine's primary prey.

REGULATORY CONSISTENCY

Kootenai National Forest Plan:

- All alternatives meet KNFP direction for sensitive species (FP Vol 1 II-1 #6) by maintaining appropriate amounts and quality of suitable habitat in order to maintain species viability.
- All alternatives are consistent with KNFP direction to maintain a minimum of 10% old growth below 5,500 feet in elevation in each third order drainage or compartment, or a combination of compartments (Kootenai Supplement No 85; supplement to FSM 2432.22).
- KNFP direction (Vol. I; II-1; Goal A. 7) is to "Maintain diverse age classes of vegetation for viable populations of all existing native, vertebrate, wildlife species,… in sufficient quality and quantity to maintain viable populations". This direction is met by developing a full range of alternatives which consider both habitat quantity and quality for resident species.
- All alternatives are consistent with KNFP riparian standards and guidelines (FP Vol 1 II-28 thru 33) as amended by INFS by creation of SMZs.

National Forest Management Act:

- The diversity requirement of NFMA is met by all alternatives as documented in the individual sensitive species and MIS analyses by maintaining a full range of associated habitats and supported by the statement of findings for each species.
- The project complies with the 2012 National Forest System Land and Resource Management Planning rule of March 27, 2013, by meeting KNF Land Management Plan direction for this habitat resource.

STATEMENT of FINDINGS

Implementation of Alternative 1 would have <u>no direct impac</u>t on the wolverine due to the lack of action within primary habitat. Indirectly, this alternative may impact prey species by the continued suppression of wildfires. Harvest activities on State lands may contribute cumulative effects on movement cover, however this area is outside of snow retention areas.

Alternatives 2 and 3 <u>may affect, but is not likely to adversely affect the wolverine</u>. This determination is based on: 1) the low probability for wolverine displacement by human activities during the breeding and rearing seasons in the PSU; 2) the wolverine is a habitat generalist and is unlikely to be adversely impacted by incremental and temporary habitat alteration when undisturbed areas are linked throughout the landscape; 3) the action alternatives would only have short-term impacts on a maximum of 612 acres of potential denning habitat; 4) prescribed burning with helicopter is likely to only temporarily displace any wolverines, if present, in the late summer, from approximately 5,362 acres and would have beneficial effects on foraging habitat for marmots, a primary prey species of wolverine; and 5) the additional miles of existing trails/roads proposed for access management changes under all action alternatives would have beneficial affects to wolverine habitat security.

MIGRATORY BIRDS

INTRODUCTION

Executive Order #13186 (January 10, 2001): "Responsibilities of Federal Agencies to Protect Migratory Birds" was issued by President Bill Clinton in furtherance of the purposes of the Migratory Bird Treaty

Act, the Bald and Golden Eagle Protection Acts, the Fish and Wildlife Coordination Act, the Endangered Species Act, and the National Environmental Policy Act (NEPA). This order requires including effects of federal actions on migratory birds as part of the environmental analysis process. On January 17, 2001, the USDA Forest Service and the USDI Fish and Wildlife Service signed a Memorandum of Understanding to complement the Executive Order (rev. 2008).

The National Forest Management Act (NFMA) (36 CFR 219.27) requires that Forest Plans and management prescriptions (where appropriate and to the extent practicable) shall “preserve and enhance the diversity of plant and animal communities, including endemic and desirable naturalized plant and animal species, so that it is at least as great as that which could be expected in a natural forest." Furthermore, implementation regulations for NFMA specify that, "Fish and wildlife habitat shall be managed to maintain viable populations of existing native and desired non-native vertebrate species in the planning area."

AFFECTED ENVIRONMENT

Neotropical migratory birds are those bird species that migrate to more northerly latitudes to breed on the KNF each summer. Come fall, these species migrate south to spend the winter months. Of the approximately 205 bird species known to occur on the KNF as breeders, migrants, winter visitors or transients, about 75 to 85 species could be classified as Neotropical migratory land birds (Al Bratkovich, Libby District Wildlife Biologist and Forest Land Bird Monitoring Program Coordinator, pers. comm. in November 2007).

Most of the habitats found on the Forest host one or more species of migratory birds. Generally speaking, the birds arrive in the spring to set up territories for breeding purposes. Young are raised and fledged by mid-summer. Most species leave the Forest by mid- to late summer.

A report issued by several organizations and Federal agencies summarized the general condition of birds across the US (NABCI 2009, 2011). It painted a picture of declines in multiple species across a variety of habitats. Climate change was one of the contributing factors to these declines, and is likely to continue impacting birds into the future. As the climate warms, breeding seasons and migrations are being altered. These activities may become out of sync with prey abundance, and climate change may also impact where and when those food items are available. This reinforces the need to have resilient habitat that is better able to handle climate change.

Table 3.106 displays the dominant vegetation types in the analysis area. There is some overlap in categories, and therefore some double-counting. For example, some acres counted as "riparian" would also be counted under the other forested types. Additionally, specific tree species may be found in more than one category, although for the purpose of display they were placed in only one category. Tree species may also be found in several other forest types. For example, aspen is displayed as a separate category, although aspen can be found in smaller quantities scattered throughout the other forested types.

Dominant vegetation type for the project area based on FIA subplots, VRU, vegetation mapping program (VMP) organized to approximate the Partners-in-Flight (PIF) priority habitats. Percentages and acreages do not tally to 100% due to rounding and overlap between some of the categories leading to double-counting.

Table 3.106 - Migratory Bird Table

DOMINANT VEGETATION TYPE	ESTIMATED % of ANALYSIS AREA	ESTIMATED ACRES of the ANALYSIS AREA
Dry forest (ponderosa pine/ Douglas-fir)	47.6%	44,090 ac
Lodgepole pine	17.0%	15,692 ac
Cedar / western hemlock	0.03%	28 ac

DOMINANT VEGETATION TYPE	ESTIMATED % of ANALYSIS AREA	ESTIMATED ACRES of the ANALYSIS AREA
Subalpine fir (spruce/fir)	3.8%	4146 ac
Moist grand fir	0.05%	46 ac
Aspen/birch/cottonwood	0.01%	13 ac
Misc. forest (alpine larch, mountain hemlock, western larch, white pine, intolerant mix)	30.2%	27,922 ac
Whitebark pine	0	0
Waterbodies (lakes, ponds, reservoirs, marsh, swamp, river)	0.08%	77 ac
Grassland	0	0
Shrubland	0	0
Burned forest*	0	0
Non-vegetated	0.6%	562 ac

* There are no areas of recently burned forest. Most recent burns date back to 1994. For species such as the black-backed woodpecker, recently burned (< 5 years old) forests are the most suitable habitat.

ENVIRONMENTAL CONSEQUENCES

Responses of migrant birds to timber harvest and burning (prescribed or wildfire) depends upon their individual habitat preferences and needs. Regeneration harvest removes forest cover used by some species (e.g. brown creeper, golden-crowned kinglet, hermit thrush) and at the same time creates grass, forbs and shrub habitat used by other bird species (e.g. American kestrel, calliope hummingbird, chipping sparrow). This activity also produces “edge” habitat that still other bird species use (e.g. dark-eyed junco, western tananger, Townsend’s warbler). Edge habitat is often similar to forest stands created with intermediate harvest (e.g. commercial thinning, shelterwood). Species using edge are often found in these stands, so this management practice may provide additional habitat for these species (Hutto and Young 1999).

Effects Common to All Alternatives

Management indicator species (MIS) have been designated for the KNF (See MIS Section; Old Growth Analysis; Pileated Woodpecker; forest cover discussion under the elk). These MIS species represent the habitat needs for migratory birds. Because habitat for MIS species is being maintained, it is assumed that sufficient habitat and populations of neo-tropical migratory land birds are also being maintained.

Effects related to the projects covered in this analysis include both direct and indirect. The direct affects are:

- Destruction of ground nests caused by ground disturbing activities, such as logging and prescribed fire.
- Displacement of individual birds from a specific location that is being used for reproduction or rearing of young due to disturbance from human use.
- Direct mortality of adult or juvenile birds.

The indirect effects include:

- Loss of vegetation supporting prey items.
- Reduction or alteration of vegetative cover, structure or composition used for nesting or foraging as a result of vegetation management and prescribed fire.

In the short-term, vegetation treatments would alter habitat for various species of neotropical migratory birds, changing stand structure and composition. Some species would benefit from this alteration while others would not. Some impacts may only be short-term. Overall, the long-term sustainability of the habitat would be increased as stand density and fuels concerns are addressed by this project and historic fire regimes are returned. Species such as white-headed woodpeckers, chipping sparrows, bluebirds and others would potentially benefit from fuels reduction in ponderosa pine, while other species that prefer denser stand conditions would lose habitat as a result of this project (Gaines et al. 2010, Gaines et al.

2007, George and Zack 2008, Hurteau et al. 2008, Saab et al. 2007) and could become more susceptible to predation or parasitism. Large trees would remain, smaller trees would be thinned, canopies would be opened, and therefore more sunlight would reach the forest floor within the treated dry forest stands. These factors would aid in maintaining or improving habitat for species adapted to these conditions (Lyons et al. 2008).

During the prescribed fires there may be additional negative impacts from smoke and disturbance, or even mortality to nestlings if nests are located on the ground or in small trees or shrubs. In the long-term, the herbaceous and shrub layer would return to pre-fire conditions or actually improve with more light available to the forest floor and return habitats to a state nearer what would have been present historically under natural disturbance regimes.

Cumulative Effects

Please refer to the discussions for various species or resources mentioned previously; specifically to the cumulative effects on old growth, snags and general forest cover where habitat elements required by neo-tropical and resident birds has been altered, resulting in both beneficial and harmful effects.

REGULATORY FRAMEWORK and CONSISTENCY

There are no specific goals or standards for migratory land birds in the KNFP. It does contain the goal to: "Maintain diverse age classes of vegetation for viable populations of all existing native, vertebrate, wildlife species," (FP Vol 1 II-1 Goal #7). All alternatives are consistent with the KNFP, as a wide range of successional habitats would be available (See Vegetation and MIS sections). The alternatives are in compliance with the Executive Order titled "Responsibilities of Federal Agencies to Protect Migratory Birds". In addition, as habitat for MIS species is being maintained in the Cripple PSU, and across the Kootenai National Forest, their habitat contributes to the maintenance of habitat and populations of neo-tropical migratory bird species.

NOXIOUS WEEDS INTRODUCTION

Noxious weeds are: "Those plant species designated as noxious weeds by the Secretary of Agriculture or by the responsible State official. Noxious weeds generally possess one or more of the following characteristics: aggressive and difficult to manage, poisonous, toxic, parasitic, a carrier or host of serious insects or disease and being native or new to or not common to the United States or parts thereof." (FSM 2080.5) Noxious weeds generally have the potential to adversely affect native flora and fauna and their habitats. The Lincoln County Weed Control Act (MCA 7-22-2101) defines a noxious weed as "any exotic plant species established or that may be introduced in the state which may render land unfit for agriculture, forestry, livestock, wildlife, or other beneficial uses or that may harm native plant communities and that is designated:

(i) as a statewide noxious weed by rule of the department; or
(ii) as a district noxious weed by a board, following public notice of intent and a public hearing."

REGULATORY FRAMEWORK

Federal

The objectives of National Forest Management Act (NFMA), 1976 include maintaining the diversity of plants and animals existing in forest ecosystems.

> (16 USC 1604(g)(3)(B). provide for diversity of plant and animal communities based on the suitability and capability of the specific land area in order to meet overall multiple-use objectives, and within the multiple-use objectives of a land management plan adopted pursuant to this section, provide, where appropriate, to the degree practicable, for steps to be taken to preserve the diversity of tree species similar to that existing in the region controlled by the plan.

Forest Service

Northern Region Overview, the Interior Columbia River Basin Ecosystem Management Project, and the 2004 USDA, National Strategy and Implementation Plan for Invasive Species Management all highlighted noxious weeds as a serious ecological, environmental and economic threat. Invasive species have been identified by the past Chief of USDA Forest Service (FS) as one of the four significant threats to our forest and rangeland ecosystems. The National Strategy and Implementation Plan for Invasive Species Management were developed to guide the FS in invasive species management. The national strategy encompasses four program elements including:

(1) Prevention;
(2) Early detection and rapid response;
(3) Control and management;
(4) Rehabilitation and restoration (USDA 2004).

State

The Montana County Noxious Weed Control Law (MCA 7-2101 through -2153) was established in 1948 to protect Montana from destructive noxious weeds. This act, amended in 1991, has established a set of criteria for the control and management of noxious weeds in Montana. The noxious weed control law establishes weed management districts throughout the state. These management districts have the responsibility to enforce the law and are defined by the boundaries of the county.

County

The Lincoln County Weed Control Act (MCA 7-22-2116) states that "it is unlawful for any person to permit any noxious weed to propagate or go to seed on his land, except that any person who adheres to the noxious weed management program of his district or who has entered into and is in compliance with a noxious weed management agreement is considered to be in compliance with this section." On July 26, 1991 the Kootenai National Forest (KNF) signed a memorandum of understanding with Lincoln County, Montana regarding noxious weed management standards. The KNF agreed to assist and cooperate with the Weed Board in fulfilling and enforcement of Montana State Weed Law (MCA 7-22).

Kootenai National Forest Plan (KNFP) Volume 1, page II-2, 23
Attempt to stop the spread and suppress the existing levels of noxious weeds through land management and weed suppression activities. An integrated pest management program including the use of herbicides will be used.

ANALYSIS AREA

Analysis bounds for most noxious weed occurrence and impacts will be the Fivemile, Warland, Cripple Horse, Canyon and Dunn Creek drainages and access routes within that drainage. For risk of new invaders, the analysis bounds will include the Kootenai National Forest (KNF).

The analysis area for weed effects includes the Fivemile, Warland, Cripple Horse, Canyon and Dunn Creek drainages which are located on the east side of the Koocanusa Reservoir. The analysis area 92,400 acres of which 78,546 are National Forest System (NFS) lands, 4,032 acres are Montana Department of Natural Resource and Conservation Lands (DNRC), 7, 672 acres are owned by Plum Creek Timber Company (PCTC), 802 acres of Corp of Engineer (COE) land and 1,355 are in other private ownership.

General historical or reference condition and the desired and existing condition information are described in the Vegetation Response Units (VRUs) and within the analysis area in the Vegetation Section of this document. The VRU groups will be used to describe some of the reference and desired conditions.

ANALYSIS METHODS

Information from field surveys conducted in the summer of 2002, herbicide treatment records in 2004, 2006, 2008 and 2009, and field reconnaissance conducted in 2009, are the basis for evaluation of current infestation levels, species presence and risk. The Libby Ranger District weed files contain the survey information for individual roads in the form of field forms. Weed density and infestation size were mapped using the *Montana Noxious Weed Survey and Mapping System*. Refer to the Project File for the Weed Surveys and the Herbicide Treatment Summary for weeds targeted.

AFFECTED ENVIRONMENT and INVASIVE SPECIES

Exotic Vegetation

Over the past 60-70 years, mixtures of non-native and native grasses and forbs have commonly been used to accomplish erosion control and revegetation of exposed areas. Non-native grass and forb species such as orchard grass (*Dactylis glomerata*), timothy (*Phleum pratense*), several bromes and various clovers (*Trifolium spp., Melilotus spp*.) have been used to revegetate log landings, road cuts and fills, stream crossings and heavily used recreation sites. Non-native seed used for revegetation is grown commercially for agricultural purposes and is generally available in large quantities and are inexpensive compared to native seed mixtures. Generally, the location and extent of non-native plants relates to human development and use. Within the developed areas of the NFS, non-native species are widespread. Due to the historic use of non-native seed to quickly stabilize disturbed sites, these areas often exhibit well established populations of non-native species.

Although non-native species are common on disturbed sites across the forest, displacement of native species is not known to be common. Many of the non-native plant species commonly used for revegetation are generally adapted to areas of disturbed soil and are not highly successful in competing with stable native plant communities. However, due to their aggressive competitiveness and adaptability, some non-native species have spread from disturbed areas into undisturbed areas. Non-native species such as Dutch white clover (*Trifolium repens*) and various varieties of blue grass are commonly found along stream channels, moist areas and often in grass/forb communities. The long-term effect of these non-native plants on native plant communities is not known.

Noxious Weeds

Noxious weeds are exotic vegetation that by definition are non-native, unwanted and detrimental to

desired conditions. Noxious weeds are a serious ecological and environmental threat to the natural resources. Noxious weeds can displace native plant communities (including endangered species), alter wildlife habitat, reduce forage for wildlife and livestock, and lower biodiversity. In some cases, noxious weeds increase soil surface runoff and sedimentation into streams.

Most noxious weeds and non-native plants arrive on site as stowaways. Seeds are inadvertently brought from one area to another on equipment, vehicles, off-highway vehicles (OHVs), and livestock or by well-intending people for gardens or to help control erosion. Some non-native plants minimally impact the local ecosystem or do not thrive at all, while others take hold, prosper and change the local ecosystem forever. Once established, weeds have a competitive edge over native plants because their natural enemies that co-existed with these plants in their homeland did not migrate with the weeds or are not adapted to the sites where the weeds established.

Weeds infest about 100 million acres in North America; they conquer more than 3 million acres each year, invading an estimated 6 square miles of FS and BLM lands every day. As of the late 1990s, spotted knapweed occupied five million acres in Montana (Stalling 1999). Previous road building, harvesting, mining, homesteading, construction of the Koocanusa Reservoir, recreation and rural development in the East Reservoir analysis area brought in weed seeds, which in some cases became established and flourished. Ongoing resource management activities such as timber harvest, forest fires, prescribed fires and recreational and administrative traffic have exacerbated the situation and weeds are established on most roads, in some harvest and/or burn units, and most home sites in the East Reservoir analysis area.

A number of noxious weed species have been introduced throughout the Libby Ranger District. The east side of the reservoir is accessed by several open roads and several recreation areas. Open road in the Fivemile Creek area include roads #48, #4893 and #6278; open roads in the Warland Creek area include #566, #566F and #4891; open roads in the Cripple Horse Creek area include #835, #4898, #4424, #6292, #4925, #4904, #4905; open roads in Canyon creek area include #4912, #334 and #4913 and open roads in the Dunn Creek area include #4911, #4916 and #525. Highway 37 cuts through the eastern edge of the entire analysis area. There are 123 miles of year-long open roads and 29 miles of seasonally open roads in the analysis area. These roads are used for numerous recreational activities. Areas along roads, campgrounds and trails are at risk for spreading existing populations of noxious weeds, as well as introduction of new species. The exact number of noxious weed species present in the analysis area is unknown. Weed surveys and ground reconnaissance conducted in the analysis area showed the following species to be present in the analysis area.

Spotted Knapweed (*Centaurea maculosa*)
Diffuse Knapweed (*Centaurea diffusa*)
Common St. John's-wort (*Hypericum perforatum*)
Orange Hawkweed (*Hieracium aurantiacum*)
Meadow Hawkweed (*Hieracium pratense)*
Sulfur Cinquefoil (*Potentilla recta*)
Rush Skeletonweed (*Chondrilla juncea*)
Cheatgrass (*Bromus tectorum*)
Oxeye Daisy (*Chrysanthemum leucanthemum*)
Dalmation Toadflax *(Linaria dalmatica)*
Canada Thistle (*Cirsium arvense*)
Yellow Hawkweed (*Hieracium caespitosum)*
Hound’s-tongue (*Cynoglossum officinale*)
Tansy Ragwort (*Senecio jacobaea*)
Common Tansy (*Tanacetum vulgare*)

Based on proximity to other populations yellow toadflax and leafy spurge are also on the watch list for this area.

Because of current establishment, spotted knapweed and cheatgrass are the most potentially threatening noxious weeds in the dryer VRUs 2 and 3, and the hawkweeds are potentially the most environmentally threatening noxious weeds in the analysis area in the moist VRUs 4, 7 and 9 (VRU Map in Map Section). Descriptions of the VRU groups can be found in the Vegetation Section of this document.

Cheatgrass is on the State list as a Priority3 - Regulated Plants. These regulated plants have the potential to have significant negative impacts. The plant may not be intentionally spread or sold other than as a contaminant in agricultural products. The state recommends research, education and prevention to minimize the spread of the regulated plant.

Because of this cheatgrass will be summarized within Category 1 – Established Weeds.

CATEGORY 1 – Established Weed Species

Spotted knapweed is a biennial or perennial forb that can produce up to 18,000 seeds per plant per year under favorable conditions (Lacy et al. 1995). Spotted knapweed ranks as the number one weed problem on rangeland in western Montana. It is adapted to a wide range of environmental conditions. Spotted knapweed is most aggressive in the forest-grassland interface on well-drained soils, and in drier sites (Sheley and Petroff 1999, pg. 350-351). Spotted knapweed plant density has been monitored over many sites in Montana following biological control agent releases. Two sites in western Montana where biological control agent, *Cyphocleonus achates* (insect that feed exclusively on host weed species), were released showed that spotted knapweed density declined significantly over time at both sites, and that *Cyphocleonus achates* numbers increased dramatically (Story 2006). Current distribution of spotted knapweed plants is primary along road sides in the East Reservoir drainages, with limited expansion into the dry forested environment. Recently, biological control agents, including *Cyphocleonus achates*, have been released on the KNF to control spotted knapweed and other species. The result of the releases are not yet conclusive on the KNF, but observations by weed managers suggests there is a declining density of spotted knapweed in many areas on the KNF and within Lincoln County.

Cheatgrass is a winter annual that reproduces by seeds. It is widely distributed and is common along roadsides within dry Douglas-fir habitats in VRUs 1 and 2S. It competes well with the native grasses because of late winter and early spring growth habit and its successful competition for early moisture. It also cures early, and after maturity, is highly flammable and can contribute to rapid fire spread. Currently cheatgrass is common on some open VRU1 and VRU2 sites within this analysis area.

Hawkweeds reproduce from seed and stolons, which are the same structures that strawberry plants use to spread. These extensive stolons allow hawkweeds to form a dense mat that crowds out all other vegetation. Areas of risk include tree plantations, general forest lands, pastures, meadows, wetlands, roadsides, and dispersed and developed recreation areas. These plants are successful on all but the driest sites (USDA 2000), but are most successful on disturbed sites within VRUs 4, 5, 6, 7 and 9.

Hawkweeds are currently the most rapidly expanding noxious weed in Montana (Littlefield 2007). Bio-control agents are being pursued, but as of this date there are no approved bio-control agents for hawkweeds in the United States. The current distribution and infestation levels of hawkweed plants range from light to moderate along road sides. Within the forested environment, there are generally light infestations in older harvest units, mining claims and recreation sites within the forested environment. Currently, the hawkweeds are considered to be the largest noxious weed threat to the ecological integrity of the East Reservoir watersheds. Because of the threat of these species, the Animal and Plant Health Inspection Service (APHIS) recently approved field release of the hawkweed gall wasp, *Aulacidea subterminalis* in 2010 for testing for the biological control of hawkweeds (*Hieracium pilosella, H. aurantiacum, H. floribundum* and *H flagellare*). Jeff Littlefield (MSU Department of Entomology) has released the gall wasp on several sites on Libby Ranger District. The parthenogentic gall wasp (*Aulacidea subterminalis*) ovipositions into the stolons of orange and mouse-ear hawkweeds in host range testing. The Hawkweed Biological Control Consortium is testing two additional insects; a hover fly (*Cheilosia urbana*) that impacts the roots, and a stem gall wasps (*Aulacidea pilosellae*) that reduces the number of flower heads and inhibit flowering of hawkweed plants. (www.cals.uidaho.edu/hawkweed/research)

Common St. John's-wort is a perennial forb that reproduces from seed, rhizomes and stolons. With this

comprehensive reproduction scheme, spread can be rapid and intensive. In areas of high density, common St. John's-wort can successfully out-compete native vegetation. Common St. John's-wort can be successful on most sites within the East Reservoir analysis area. The distribution of plants varies from very light to none within the forested environment to light along road sides and some winter range sites. Roadside herbicide treatments have targeted this species. In 2006, the Klamath beetle (*Coleoptera chrysomelidae*) was successfully feeding on this species, with almost complete defoliation of the plants. The Klamath beetle was released in California in 1946, causing the St. John's-wort population to be removed from the noxious weed list. The Klamath beetle tends to be cyclic in Montana but does appear to periodically reduce the infestation size of St. John's-wort during the periodic high cycles.

Oxeye Daisy is a perennial herb that spreads by rhizomes, and is one of our most common roadside weeds. It frequently invades fields and meadows where it competes aggressively, to form dense and expansive populations. It is widespread in the Northern Rockies and Pacific Northwest states and continues to expand its range (Taylor 1990). Establishment and expansion are limited by shading, and it is more common on basic or neutral soils and less common on acid soils (Sheley and Petroff 1999). So it typically does not spread under forested canopies but can invade meadows especially in moist areas. It commonly occurs along roadsides, and recently opened forest lands within East Reservoir and is frequently associated with the hawkweeds. Currently it is not considered a serious threat in this area because it is most common along roadsides which can be actively treated.

Canada Thistle is an aggressive perennial weed that spreads from deep rhizomes to form dense and persistent populations. It invades fields, pastures, waste areas and recently disturbed sites such as harvest units (Taylor 1990). It is commonly found in disturbed areas as part of the initial post-disturbance community (Duncan and Clarke 2005). It is best adapted to open sunny sites, and does not persist long in the forested environment. It is generally limited to the first 1-5 years following disturbance, but does persist along roadsides, disturbed riparian areas and private pasture lands. It is not considered a serious threat to this ecosystem.

Sulfur cinquefoil is a long-lived perennial that has become one of the most serious invaders of the Northern Rockies. The earliest records of sulfur cinquefoil in Montana were in 1947. By 1996, sulfur cinquefoil had spread to at least 30 counties in western Montana. This rapid spread over large geographic areas is similar to the exponential spread pattern of spotted knapweed. Cinquefoil has wide ecological amplitude, and is commonly associated with spotted knapweed. It is successful in invading low-disturbance sites, and is common in natural grasslands, shrub areas and open canopy forests (VRUs 1 and 2). Establishment and expansion are limited by shading from dense overstory tree canopies (Sheley and Petroff 1999, pg 282-285). Currently cinquefoil is not widespread within this analysis area.

Hound's-tongue is a biennial herb that is common along roadsides and in disturbed areas (Taylor 1990). Within the analysis area, it currently occurs along roads and private pasture lands, but is at risk for spread due to the burr-like seeds making long distance transport possible. It tolerates shade, but is more robust in full sun, and thrives in wetter grasslands. Hound's-tongue is a poor competitor with native plants, and requires disturbed or bare areas to establish (MSU 2003). Bio-control agents are not yet approved for use in the United States, but have been released in British Columbia and Alberta Canada in 1997 and 1998, and are expected to move across the borders into the United States. Hound's-tongue is not generally invasive in the forested landscape, and is not considered a serious threat to this ecosystem.

Common Tansy is a perennial herb that spreads from short rhizomes to form dense clumps. It is common along roadsides, pastures and riparian areas. It needs moist, disturbed soil for seedling establishment, and prefers open sites for at least part of the growing seasons (USDA NRCS 2008). It is very aggressive and persistent once established, particularly in riparian areas and along road ditches. The majority of the infestation is at the end of the #4912D road in Canyon Creek. The patch is located near the creek on an old landing that has been burned.

NEW INVADERS

Rush Skeletonweed has one known occurrence site within the analysis area, located in the Dunn Creek Campground on the Corp of Engineers lands. This site has been treated for several years and is rechecked several times each growing season.

Dalmation toadflax is also located in the analysis area along Highway 37. The FS, Lincoln County and the Corp of Engineers have been treating the infestation since the early 1990s. There is a recently identified population on Gopher Hill that was treated in 2012 and will be monitored.

Tansy Ragwort has one location in the Davis Mountain Area; three locations around the Weigel Mountain area to the east of the analysis area; and three locations in Canyon Creek inside the analysis area on the #4912U spur. These sites are monitored on an annual basis.

DESIRED CONDITIONS

Management Goals

The goal of noxious weed management on the KNF is to manage weeds in order to protect forests, rangelands, wildlands, adjacent farmlands, and to cooperate with private individuals and county and state agencies concerned with managing noxious weeds (USFS 1997).

The Purpose and Need identified in the KNF Invasive Plant Management FEIS (USDA FS 2007) is to:

- Prevent the introduction, establishment, and spread of new invader weed species;
- Prevent or limit the spread of established weeds;
- Restore native plant communities and improve forage on specific big game winter ranges;
- Treat weeds on NFS lands where adjacent to private landowners that are currently managing weeds;
- Limit the spread of weeds into and within the wilderness areas;
- Cooperate and educate the public regarding weed prevention, treatment, and control.

Preventing noxious weeds from invading new areas is the most economical and easiest way to control them (prevention). Spraying of herbicides is currently the most effective method of control for smaller populations once noxious weeds become established (early detection, rapid response, control, and management). Roads are a common vector for weed introduction, establishment and spread. Other ground disturbing activities such as timber harvest, mining and home sites are at risk for weed introduction and establishment. Spraying roadsides and right-of-ways, treating disturbed sites containment boundaries and satellite populations can be very effective in managing the spread of weeds.

Reducing the density and competition of noxious weeds before they have displaced the native vegetation is the most effective means to rehabilitation and restoration.

The desired conditions are to maintain the natural diversity of plants and animals within the forested ecosystem.

Management strategies should be applied to prevent introduction, establishment and spread of noxious weeds, in conjunction with restoration of native plant communities to restore vegetative health and increase ecological resilience and resistance to potential climate change.

Recent and Planned Weed Control Measures

Past weed control measures in the East Reservoir analysis area include herbicide treatment along road systems, campgrounds and gravel pits. Table 3.107 displays a summary of herbicide treatment for the past six years.

Table 3.107 - 2006-2011 Herbicide Treatment in East Reservoir Creek

DRAINAGE LOCATION	ACRES		DRAINAGE LOCATION	ACRES
2006			**2009**	
Fivemile Creek	2.4		Fivemile Creek	0
Warland Creek	0		Warland Creek	0
Cripple Horse Creek	21.0		Cripple Horse Creek	12.0
Canyon Creek	0		Canyon Creek	0
Dunn Creek	0		Dunn Creek	25.0
Koocanusa Face	26.7		Koocanusa Face	29.3
2007			**2010**	
Fivemile Creek	33.8		Fivemile Creek	63.5
Warland Creek	22.5		Warland Creek	14.1
Cripple Horse Creek	2		Cripple Horse Creek	69.7
Canyon Creek	15		Canyon Creek	28.6
Dunn Creek	56.8		Dunn Creek	2.5
Koocanusa Face	36.8		Koocanusa Face	26.3
2008			**2011**	
Fivemile Creek	0		Fivemile Creek	30.5
Warland Creek	0		Warland Creek	19.5
Cripple Horse Creek	11.3		Cripple Horse Creek	33.5
Canyon Creek	13.0		Canyon Creek	10.5
Dunn Creek	0		Dunn Creek	0
Koocanusa Face	20.9		Koocanusa Face	23.6

Future weed activities in the East Reservoir analysis area include the following:

- Continued treatment of the seasonally open road systems by the Forest Service;
- Continued treatement of new invader sites;
- Rocky Mountain Elk Foundation Grant for weed control pre and post prescribed wildlife enhancement burning. This is a multi-year grant that started Spring 2012.
- Requiring timber sale purchasers to spray up to 15' of the proposed haul routes prior to sale closure under timber sale clause R1-C(T) 6.27# - Noxious Weed Treatment, and to adhere to Weed Best Management Practices (BMPs); roads would be pretreated proir to sale offering.
- Monitoring of disturbed sites such as landings and major skid trail and treatment if necessary to control noxious weeds;
- Continue to release biocontrol agents as they become available to control noxious weeds;
- Apply weed management measures (Chapter 2) to all projects in the analysis area;
- Continue to survey and treat (if necessary) any new invader sites.

Since the late 1980s, biological control agents have been released on the KNF to control invasive plants. Several biological control agents have been released for spotted knapweed starting in 1987 and continuously since that time. The results on spotted knapweed are not scientifically conclusive on the KNF but observations by weed managers suggest there is a declining density of spotted knapweed in many areas on the KNF and within Lincoln County. Populations of spotted knapweed have crashed near Montana State University/Western Agricultural Research Center at Corvallis, Montana, where spotted knapweed biocontrol agents were released as early as 1974 (MSU News Service 2005; Story 2006).

Biological control agents were first released for tansy ragwort in 1999. The biological control agents on tansy ragwort have been monitored using scientific protocol and peer review and are effectively controlling the core population of this plant. Biological control agents were released for St John's-wort as early as 1996, Dalmatian toadflax in 1993, Canada thistle in 1998 and hawkweeds in 2011. While not scientifically conclusive, weed managers are seeing positive results for biological control releases on St. John's-wort, Dalmatian toadflax and Canada thistle. Literature and Kootenai National Forest Plan (KNFP) monitoring on the KNF has shown that biological control agents require a number of years to

increase their populations to a level that will noticeably impact their weed hosts, but are considered to be the best long-term solution to invasive plants that have high population density and have become well established across the landscape. In this analysis area, biological control is the best long-term solution for spotted knapweed and the hawkweeds.

Several release sites have been established for biological control agents within the East Reservoir analysis area. The areas include: *Cyphocleonus achates* was released at the Cripple Horse junction with road #835 and 4925 in 1996, and *Agapeta zoegana* in 1997, and *Cyphocleonus* was released in Canyon Creek in 1997. More recent releases occurred in the Fivemile Creek dispersed recreation site in 2010; Canyon Creek dispersed recreation site in 2010 and 2011; one reclaimed road in Warland Creek and one reclaimed road in Cripple Horse Creek. On these sites, *Cyphocleonus achates* has been released to target knapweed. Damage from this knapweed weevil has been observed on these sites.

Biocontrol is a viable strategy when conventional methods of weed control are not providing adequate solutions to the control of a specific noxious weed. Biological control agents generally impact their host weeds by reducing their vigor and/or seed production. Biological controls generally do not eliminate weeds, and they may not completely prevent their spread since some weed seeds are usually still produced. However, they can reduce the rate and extent of the spread of their particular host. Biological controls have the greatest impact on their weed hosts when several different agents are attacking the same plant host and are best used on weed species that are already well established in an area, that have sizable populations, and that have little or no possibility of being eradicated. Herbicide use or hand pulling are best used on new invaders that still may be eradicated and to treat spread vectors, high density sites, containment boundaries, or on small or satellite populations of other well established weeds.

Herbicide use along key spread vectors such as roads, recreation sites, trails, treatment of high density sites, containment boundaries and satellite populations are some of the most effective strategies to control the spread and establishment of existing populations of species such as spotted knapweed, hawkweeds, common St. John's-wort and oxeye daisy due to the widespread populations.

In order to identify appropriate levels of management toward the control of noxious weeds within Lincoln County, Montana, and the East Reservoir analysis area, noxious weed species have been grouped into categories. The categories are unique to Lincoln County, Montana and the KNF and are not intended to replace the State of Montana Noxious Weed list. Table 3.108 lists the weed classification and management strategy for known noxious weeds within the East Reservoir analysis area.

Table 3.108 - Weed Classification and Management Strategy

WEED CATEGORY	WEED SPECIES	MANAGEMENT STRATEGY
Category 3: Potential Invaders	No known populations (not currently known in Lincoln County)	Prevention; Eradication
Category 2: New Invaders	Rush skeletonweed Dalmatian toadflax Tansy Ragwort	Eradication; Contain main body; Eradication of populations outside main body.
Category 1: Established Infestations	spotted knapweed sulfur cinquefoil common St. John's-wort Canada thistle orange hawkweed oxeye daisy houndstongue common tansy meadow hawkweed complex	Prioritize areas to be treated; Reduce size of plant populations; Reduce rate of spread.
Species of Undetermined Status	No known populations in the analysis area	Monitor known populations for trends.

ENVIRONMENTAL CONSEQUENCES

The direct, indirect and cumulative effects of invasive plants are limited to the affected environment

consisting of East Reservoir analysis area and access routes. The potential effects that will be described represent the result of analysis, and professional judgment, and are based on research, experience and monitoring.

The direct and cumulative effects on noxious weed introduction and spread of past activities are primarily associated with disturbance from harvest, site preparation, permanent land clearing, road construction and maintenance, road storage and prescribed fire, and the concurrent opening of the canopy.

Foreseeable actions would include additional commercial harvest on state lands, road maintenance and storage, prescribed burning of fuels and wildlife units, precommercial thinning on NFS lands, mineral activities, grazing, recreation and weed management activities as described previously.

The direct and indirect effects of all action alternatives would result mainly from the vegetation management activities and associated site disturbance as described in the alternative descriptions for NFS lands harvest and fuel reduction activities, road maintenance, culvert replacement, temporary road access, road storage and road decommissioning, as described in Chapter 2 of this document.

The cumulative effects would result from the past activities, the proposed activities as described in Chapter 2, and the foreseeable actions described in Chapter 3 of this document.

Effects associated with actions on NFS lands will be disclosed in terms of:
- Potential changes to existing noxious weed infestations;
- Risk of expansion or introduction of new invasive species.

ALTERNATIVE 1 (No-Action)
Direct and Indirect Effects
With Alternative 1, there are no additional management actions proposed through this project on NFS lands. Road maintenance, recreational use and management activities on state and private lands would continue. Ongoing weed management activities as approved through the KNF Invasive Plant Management FEIS would continue as funding allows, and management activities on private lands would proceed. Natural disturbance process such as wildfire, insect, disease and big game use would also continue. Fires would be suppressed in accordance with KNFP direction.

The long-term health of these ecosystems is linked to our ability to manage or control noxious weeds. Ongoing weed control measures across the analysis area would continue, but without programmed activities, the focus of treatment would be limited to gravel pits, campgrounds, dispersed recreations sites, powerline access roads, and on main yearlong open roads into each main drainage. Even with treatment, the existing open roads may support low-level weed populations with some potential for seed spread by road maintenance equipment, as well as administrative and recreational traffic.

Yearlong restricted roads would be a low priority for treatment for all but the potential invaders and new invader species. Weed management activities associated with fuel treatment, timber removal, road improvements, road storage or fisheries improvement activities would not be implemented. Closed roads would continue to support weed populations because they would not be treated, and they could contribute to spread of weeds off the road prism and into the forest, particularly with the dry-land species such as knapweed and cheat grass, and the shade tolerant hawkweeds. The no-action alternative would not increase vehicle traffic into the analysis area. It would not increase site disturbances, such as temporary road construction, road storage, road decommissioning, recreation enhancement, timber harvest and fuel treatment; therefore weed spread would not be accelerated or slowed as a result of actions from this alternative.
Because current budgets only allow for treatment of the highest risk open roads and high use recreational sites, the no-action alternative is expected to allow existing weed populations outside these areas to cumulatively increase. If budgets do not allow for continued treatment, and present weed populations are

not managed, weed populations may continue to exceed KNFP standards (Table IV-1, pg. IV-10, KNFP 1987). With the current trend for appropriated budgets for noxious weed management, existing weeds are expected to continue moving off closed roadways into previously disturbed areas, onto undisturbed forested areas and into new or existing burned areas.

With current weed management emphasis of no increase in funding, and no project support for weed control, most established noxious weed species may continue to maintain presence and spread along closed and seasonal restricted road systems, 4-wheel trails, riparian areas and sites that are disturbed in the future. Emphasis on survey eradication of new invader species would continue.

Spotted knapweed, cheat grass and St. John's-wort, may expand off the closed road systems in the dry-land areas (VRU 2and 3). Orange hawkweed (*Hieracium aurantiacum*) and the meadow hawkweed complex (*Hieracium pratense, H. floribundum, H. piloselloides*) would continue to increase on all but the driest sites, and Canada thistle (*Cirsium arvense*) would continue to be a common component in disturbed areas. New invaders would have the potential to establish and spread along open roads, but current weed management activities should minimize this risk.

With the exception of the hawkweeds, weed species of concern are not persistent in forested vegetation communities that have moderate to high canopy closure. As stands close and succession continues, the spread of noxious weeds should slow. Without disturbance, many of the noxious weed species would not have a competitive advantage. However, the driest sites with light forest canopy would be at risk for spread of spotted knapweed, cheat grass and St. John's-wort, even without management activities on NFS lands.

The hawkweeds would continue to spread along closed roads and trails on all but the driest sites, and would move into areas with heavier canopies, and riparian areas, particularly if they have experienced any past duff reduction activities such as, mining, harvest or fire.

RESOURCE IMPACTS of NOXIOUS WEEDS

Impacts to Big Game Winter Range

Weeds impact native vegetation by competing for light, water and nutrients. Native vegetation provides forage, cover or nesting habitat for micro- and macro-fauna. In comparison, noxious weed species generally do not provide valuable forage or habitat for native animals (Trammell and Butler 1995). As weeds invade the dry sites, the carrying capacity of big game winter range within the East Reservoir analysis area may continue to be compromised. By altering the structure of plant communities, noxious weeds alter the structure of animal communities (Sheley and Petroff 1999). Warm and dry (mesic) forest types are most likely to be invaded by spotted knapweed, St John's-wort, Dalmatian toadflax, sulfur cinquefoil, rush skeletonweed and cheat grass. Of these species, spotted knapweed is the most prevalent, followed by St. Johns-wort, cheat grass, and sulfur cinquefoil. Dalmatian toadflax has locations along Highway 37 and has been treated since the early 1990s. These sites are closely monitored every year. Rush skeletonweed has only one location in the Dunn Creek campground on the Army Corp of Engineers lands. This site has had multiple treatments and is closely monitored every year. Tansy ragwort sites within Canyon Creek have been treated and are also closely monitored every year. There have been no new plants within these sites for several years.

Watson and Renney (1994) found that spotted knapweed infestations decreased bluebunch wheatgrass forage yield by 88% (Sheley and Petroff 1999). Associated elk use, was reduced by 98% on spotted knapweed-dominated range compared to bunchgrass-dominated sites (Sheley and Petroff 1999). Established bio-control agents including seed head flies *Urophoria spp*, and *Cyphocleonus achates* may help slow the spread of spotted knapweed on these important winter ranges.

St. John's-wort seedlings may require several years to reach reproductive maturity, and are not strong

competitors with other vegetation until they mature. Once the plant is mature, the large crowns can produce up to 30 stems and 15,000 to 33,000 seeds annually. Dense stands can displace native plants, and can greatly depreciate wildlife carrying capacities, and endanger the biological diversity of these lands (Sheley and Petroff 1999, pg. 374-376). The cyclic buildup of the Klamath beetle combined with ongoing emphasis to treat small infestations may help reduce the potential spread of this species.

Cheatgrass can out-compete native bunchgrasses due to its rapid growth in the late winter or early spring which occurs approximately six weeks earlier that native bunchgrasses such as bluebunch wheatgrass. Soil water depletion by cheatgrass is one of the principal mechanisms for competing with perennial grasses (Sheley and Petroff 1999, pg. 180). In southern Idaho, cheatgrass dominates many of the grass/shrub ecosystems. Increasing fire frequency in cheat grass systems have eliminated native, perennial species and encouraged invading annuals and the associated decline in species richness (Whisenant 1994). Cheatgrass has little value as winter forage, therefore increasing density of cheat grass results in a decrease in the carrying capacity of big game winter ranges.

Sulfur cinquefoil can establish and rapidly dominate range lands, dry land shrub communities and open canopy dry lands. Disturbance can accelerate this dominance, but it is also successful in invading native plant communities with little to no disturbance. It is commonly associated with spotted knapweed. It is avoided by most grazing animals therefore an increase in sulfur cinquefoil, results in a decrease in big game forage.

Impacts to Big Game Summer Range
Because of their competitive nature, and the ability to expand in forested conditions, the hawkweeds pose the greatest risk to big game summer range habitat. Hawkweeds can choke out most herbs, grasses and forbs with almost complete dominance of the understory vegetation.

Soil Effects of Noxious Weeds
Increases in noxious weeds have been shown to affect the structure of ecosystems by altering soil properties. Soil in areas dominated by noxious weeds may have lower amounts of organic matter and available nitrogen than areas supporting native grasslands. Noxious weeds may increase soil erosion, and chemical compounds may hinder soil macro-fauna and micro-fauna. Weeds may deplete soil nutrient reserves and alter soil temperatures (Sheley and Petroff 1999). As weed populations increase, the associated soil effects would increase.

Watershed Effects of Noxious Weeds
Noxious weed populations can increase surface runoff and sediment yield by reducing native plant community diversity and increasing exposed soil (Lacey et al. 1989). Where noxious weed canopies are light but native plants are in decline, vegetative cover of soil may be reduced, thus exposing increased soil surface and increasing evaporation thereby reducing soil moisture. Where canopies are dense, high transpiration rates by noxious weeds may deplete soil water content. The effects of uncontained noxious weed expansion in the analysis area would vary by site and species, but could change the watershed characteristics particularly associated with hydrology on the drier sites.

Impacts to Native Plant Communities
Noxious weeds have been shown to affect the structure of ecosystems by altering the composition of plant communities. In general, noxious weeds have invasive characteristics that allow them to be competitive and often out-compete and displace native plant species. This can affect the species diversity and species richness on a given site or area.

Impacts to Historic Fire Regimes
With ongoing expansion of invasive species such as spotted knapweed and St John’s-wort, in the dry land types (VRUs 2 and 3), the fire frequency may decrease due to the reduced density of fine fuels from native species. If cheatgrass were to increase, fire frequency may increase, resulting in accelerated decline in native shrubs and bunchgrasses.

With no hazard fuel reduction treatments, there is a potential for wildfires in timbered stands with heavy fuel loads to burn at higher intensities with a greater disturbance factor than they would with treatment. Fire disturbances, fire suppression activities and fireline construction could enhance the introduction and spread of noxious weeds.

Cumulative Effects

Past Harvest Activity

Harvest over the past 50 years has created variable levels of disturbance across NFS, state and private lands. The majority of the past harvest activities have been concentrated in the dry land VRUs (VRU 2 and 3). Spotted knapweed and cheat grass are the most common noxious weed species on the dry land VRUs, and have a presence on most of the road systems. The hawkweeds have infested most of the road corridors and major skid trails within the moist VRUs. Because these species are established within the East Reservoir analysis area, it is expected that hawkweeds would continue to increase without management until biological control agents are available and established, and spotted knapweed would retain presence but may decrease in density as currently established biological control agents expand. Other species present in the area, as a result of past harvest activity, may decrease or remain stable as the native vegetation recovers and shade out these invasive species.

Past Slashing and Underburning

Slashing and underburning have occurred throughout the analysis area. The effects of these habitat improvement and fuel reduction burns have generally decreased the understory component of conifers, and increased sunlight to the forest floor. The response of vegetation to fire is influenced by a variety of fire parameters including intensity, severity, soil heating and season of burn. These variations can and will cause differences in the response of individual species and the community as a whole, but generally spring burns would initially decrease the density of the native bunchgrasses, and shrubs, and give noxious weeds a temporary advantage. The shrubs respond very quickly to pre-burn density, but the bunchgrasses may take several years to reach pre-burn coverage. Fire studies and unpublished data from western Montana generally support the observation that where propagules are available, spotted knapweed is likely to establish, persist and/or spread following fire (www.fs.fed.us/database/feis/plants/forb/cenmac/). Cheat grass response to fire does vary by season of burn and burn intensity. The most common reports are that cheat grass densities decrease the first post-fire year and approximately equal pre-burn densities by 2nd and 3rd year post-fire. Cheat grass may also invade recently burned sites where it does not usually dominate or did not previously occur. (www.fs.fed.us/database/feis/plants/graminoid/brotec).

Past Road Construction and Access

Past road construction has served as the primary vector for introduction and spread of noxious weeds in the East Reservoir analysis area. Severe site disturbances associated with construction, and the potential for seed movement on equipment has been instrumental in establishing noxious weeds within this area. Noxious weed management such as weed best management practices (BMPs) and pre-treatment with herbicide were not incorporated into most of these past activities. Noxious weeds are concentrated along these linear road features.

Past Road Storage and Decommissioning

Past road storage and decommissioning in the East Reservoir analysis area have decreased access for noxious weed management, increased disturbance on the site and generally increased density of noxious weeds following the disturbance. The areas where past road storage and decommissioning activities took place were not treated with herbicide prior to the ground disturbance; however they were seeded with a roadside seed mix to quickly establish a vegetation cover to compete with noxious weeds.

Past Road Closures

Road closures have reduced noxious weed introduction and spread by eliminating vehicle traffic; however they have also reduced accessibility for noxious weed management. Closures have generally reduced the spread rate of invasive plants, and as the road systems re-vegetate with native species (particularly

shrubs), generally the density of all species except the hawkweeds have declined.

Past Weed Management

Past weed control has consisted of herbicide treatment, education and prevention in this analysis area. Weed educational posters have been posted at campgrounds, and weed-free seed certified hay is required for all stock use on NFS lands. Herbicide treatment has been ongoing since the mid-1990s and has been effective in containing and controlling noxious weeds on the main seasonally open roads and at the campgrounds. Areas that have been treated repeatedly over the past decade have low composition of noxious weeds. Weed density on closed road systems varies from low to moderate depending on the time since treatment and the recovery stage of the native vegetation. Refer to the project file for herbicide treatment since 2004.

Herbicide treatment generally has about a three year effect in reducing the density of noxious weeds, and can slow spread for many years if vegetation recovery occurs during this time. Herbicides used in this area have been Aminopyralid, Picloram, Clopyralid, Triclopyr and 2,4-D.

Clopyralid, Picloram, Triclopyr and 2,4-D, are synthetic plant growth hormones and have some structural similarities to naturally occurring hormones called auxins. They disrupt plant growth by binding to molecules that are normally used as receptors for the natural growth hormones. The binding causes abnormal growth leading to plant death in a few days or weeks, depending on the species and the herbicide. The Environmental Protection Agency (EPA) has approved these herbicides for controlling noxious weeds, and requires that any use restrictions be included in the product label. All of the herbicides, except 2,4-D, are rated by the EPA as slightly toxic to humans; 2,4-D is the most commonly used herbicide in the United States and is rated as moderately toxic. It degrades quickly with a half-life of roughly one week. Clopyralid is a selective herbicide that affects members of only three families, making it useful for killing knapweeds while protecting native plant species. It has a soil half-life of 20 days. Picloram is a rate selective herbicide that has an average soil half-life of 90 days and Triclopyr has a half-life in the soil of 30 days (USDA FS 2007).

Reasonably Foreseeable Actions

Planned Harvest Activity on DNRC Lands

Approximately 198 acres of harvest activity and 0.84 miles of new road construction are proposed on DNRC lands between 2013 and 2023. These activities would create additional disturbance and a receptive seed bed for noxious weeds. The majority of the planned harvest activities are within the dryland VRUs (VRU 2 and 3). Because spotted knapweed and common St. John's-wort are generally established on the road systems, it is likely the populations would expand within the harvested dryland types. The DNRC does have an aggressive weed management program and do require many of the same weed BMPs that the federal agencies require. These activities would substantially reduce the risk of new introductions, but expansion of on-site noxious weed species is a risk that is associated with these activities.

Precommercial Thinning on FS Lands

Approximately 760 acres of precommercial thinning has been approved and let out on contracts in the Cripple Horse and Canyon Creek drainages. This thinning would be on-going over the next five years. Because this is not a ground disturbing activity, there should be no effects to the noxious weeds through this activity.

Road Maintenance

Routine road maintenance is likely to occur on roads that are currently open to the public. These are on a periodic herbicide treatment schedule, so while the increased disturbance would provide a receptive seed bed for noxious weeds, the herbicide treatment should serve to maintain a low density of noxious weeds.

Fuels and Wildlife Units Projects

Planned spring underburning may increase the competitive advantage of some noxious weeds. Cheat grass is an example, as it is a cool season grass and is often past its major growth cycle by the time the

burns are implemented. Generally the native bunchgrasses are actively growing and the prescribed fire in the spring would set these species back and it may take several years for them to recover their pre-burn density. Most studies show that fire initially reduces frequency and basal area of Idaho fescue, bluebunch wheatgrass and rough fescue (www.fs.fed.us/database/feis/plants/graminoid/). Current management measures for these projects include a pre-treatment survey for noxious weeds. If infestations are located off the roads within the forested environment, they would either be treated before or following the burn to eliminate seed and reduce the potential for spread. These projects may also provide funding for biological control release if the infestations are large enough.

If funding remains consistent with the past few years or greater, current monitoring and treatment completed as authorized under the Kootenai National Forest Invasive Plant Management FEIS, combined with bio-control agents, should prevent significant spread of these invasive species on big game winter range sites within NFS lands in the analysis area.

Planned Weed Control

Future weed control would consist of herbicide treatment, education and prevention in this analysis area. Weed educational posters would continue to be posted at campgrounds. Acres treated with herbicide would vary depending on funding and the ability to acquire grants. Acres treated over the past six years vary from 50 acres in 2005 to a high of 207 acres in 2010 in preparation for a potential project in this area. The overall average is roughly 110 acres per year. If those funds are not available, it is estimated that we would only treated an average of about 50 acres per year with herbicide. Refer to the project file for herbicide treatment since 2005. Approximately 183 acres was sprayed in the Cripple Planning Unit (Weeds Project File) in 2010.

As long as the KNF can continue treating the main spread vectors, the treatment should be effective at containing and controlling noxious weeds on the seasonally open roads, campgrounds and at trailheads. Weed density on closed roads would decline for species that are not tolerant of shade, but would continue to increase for species that are tolerant of shade such as the hawkweeds. Survey and eradication of new invader species would continue.

The effects of herbicides on humans and the environment are displayed in the USDA Forest Service KNF Invasive Plant Management FEIS (2007).

Off-Road-Vehicles

Off-road-vehicles (OHV) would continue to use existing trails in the analysis area. Unless funding is provided to treat these trails, weed seeds are expected to keep moving into un-infested areas as OHV use continues.

Cattle Grazing

Cattle occasionally graze on weed species and pass seeds on as they graze across forest lands. All animals are seed vectors for some species of weeds, cattle being no different. Seed beds may also be created in areas where cattle congregate, although these areas appear to be limited within the analysis area. Effects from grazing are difficult to quantify, they are dispersed, and generally recognized as occurring, but are not a major concern at this time. Fivemile is the only drainage where current grazing is occurring and would continue in the future. There is a chance that grazing may occur in the future in the Warland drainage.

Potential Climate Change

Predictions for potential climate change within northwest Montana vary from warmer and drier to warmer and moister, and most predict a longer growing season and less available moisture for plants during the active growing season. Global warming and other climate changes would affect the growth, phenology and geographical distribution of weeds. Weed species currently restricted to the southern United States may expand northward (Patterson 1995). Fire risk is strongly associated with increased spring and summer temperatures and an earlier spring snowmelt (Westerling et al. 2006). A synthesis of literature

results indicates that noxious weeds on the whole have a larger than expected growth increase to both recent and projected increases in atmospheric C~ relative to other plant species. There is also evidence that rising carbon dioxide (CO_2) may preferentially select for invasive, noxious species within plant communities (Ziska 2004).

Most of the dry-land noxious weeds on the KNF appear to respond favorably to drought, so potential climate change to a warmer environment with a longer growing season, the associated soil moisture depletion and increased CO_2 could cumulatively favor these species and could result in decreased plant diversity and decreased big game forage. In the case of the cool season cheat-grass, earlier soil moisture depletion, would strongly favor the cheat-grass over native bunchgrass, which could start a cycle similar to the south and intermountain west where the fire frequency has been increased with the cured cheat-grass biomass, giving cheat-grass an additional competitive edge.

Resources managers will be challenged to integrate adaptation strategies in a time of potential climate change. Adaptive strategies would include resistance options (forestall impacts and protect highly valued resources), resilience options (improve the capacity of ecosystems to return to desired conditions after disturbance) and response options (facilitate transition of ecosystems from current to new conditions) (Millar 2007). Successful management of invasive weeds would require active inventory and management to prevent new introductions and persistent efforts to reduce existing infestations. While the no-action alternative allows for current weed management programs, it does not promote an increase in integrated weed management strategy.

ALTERNATIVES 2 and 3

Direct and Indirect Effects

The potential to spread noxious weeds is strongly correlated with site disturbance and seed introduction. The planned activities are listed are listed from highest to lowest potential:

- Road construction;
- Road storage;
- Road maintenance and BMP work;
- Harvest utilizing ground based equipment;
- Road decommissioning;
- Motorized trail use
- Site preparation on regeneration harvest units through spot grapple scarification;
- Fuel reduction through spot grapple piling or spot mastication;
- Site preparation on regeneration harvest units through prescribed fire;
- Underburning for hazard reduction in intermediate harvests treatments;
- Harvest utilizing a skyline system;
- Winter harvest utilizing ground based equipment;
- Underburning for natural fuels reduction, and/or forage enhancement;
- Non-motorized trail construction
- Tree planting;
- Precommercial thinning

Existing Roads and Associated Effects

With the exception of the main access roads up the drainages and the tie through roads, the majority of the access routes to NFS lands in East Reservoir analysis area are currently closed yearlong, so there is limited additional opportunity to close roads to reduce weed spread. Options to reduce the current rate of spread include herbicide treatments, bio-control and road storage.

ACTIVITIES with HIGHEST RISK of SPREADING or INTRODUCING NOXIOUS WEEDS

Permanent Road Construction

Road construction has a high potential to spread noxious weeds through severe disturbance that creates a receptive seedbed and allows noxious weeds to establish and flourish. This site disturbance can last

several years on dry land sites. Once established, travel along the new road can continue to spread weeds. Alternative 2 include 9.25 miles of new permanent road construction and Alternatives 3 includes 8.06 miles of new permanent road construction.

Temporary Road Construction

Temporary road construction has a high potential to spread noxious weeds through severe disturbance that creates a receptive seedbed and allows noxious weeds to establish and flourish. This site disturbance can last several years on dry-land sites. Once established, travel along the new road can continue to spread weeds. Temporary road construction is generally not proposed where a major amount of earthwork would be required so this work may include minor earthwork, temporary culvert installations, installing surface water drainage structures, removing all drainage structures and restoring the slope template following use. If the temporary road would be utilized over more than one season, seeding and fertilization would be required the first growing season following construction. If the temporary road would be utilized for only one season, seeding and fertilizing would be required following restoration activity.

Alternative 2 includes 4.26 miles of temporary road construction and Alternative 3 has 4.05 miles of temporary road construction. Of the miles of temporary road construction proposed, three different levels of disturbances would occur. The temporary road construction is in all VRUs.

Because the proposed temporary road construction on NFS lands would be restored following harvest activities, seeding would be required on the road immediately following construction if the road is going to stay in place for more than a season, and also immediately following restoration.

Management measures include equipment washing, use of weed-free certified seed and straw, seeding and fertilizing restored road template, use of materials from approved weed-free sources, monitoring and future herbicide treatments. There is a small risk of introducing weed seeds on equipment associated with the road construction and restoration, even with the required equipment washing. The greatest risk is posed when equipment from outside the area is utilized for these activities, since they may bring new invaders onto these sites.

Road Storage and Decommissioning

In the short-term, road storage/decommissioning may increase spread of on-site weed seed, and transport off-site seed into the area on equipment. Disturbance associated with these activities can create a seedbed that allows noxious weeds to re-establish and flourish. Management measures include equipment washing, herbicide treatments prior to storage/decommissioning activities, use of weed-free certified seed and straw, seeding and fertilizing on disturbed areas, post-treatment monitoring and herbicide treatment. Monitoring has shown that herbicide treatments prior to storage/decommissioning work helps reduce weed densities and population size, and that the long-term benefits of road storage/decommissioning are a reduced rate of noxious weed spread, particularly for new invaders. There is a small risk of introducing weed seeds on equipment associated with the storage/decommissioning even with the required equipment washing. The greatest risk is posed when equipment from outside the area is utilized for these activities, since they may bring new invaders onto these sites. The long-term effects of road decommissioning/ storage are a reduced rate of weed spread due to these areas not being accessible to vehicle use. Once re-vegetated, roads that are stored/decommissioned would be fairly resistant to spread of all but the species that continue to flourish under a shaded environment, such as hawkweeds. The spread of hawkweeds may be higher through storage than the yearlong closures due to the difficulty in treating these roads once storage activities have occurred.

Alternative 2 proposes 16 miles and Alternatives 3 propose 17.62 miles of road storage. Alternative 2 and 3 both propose 5.93 miles of road decommissioning. Because the majority of these roads have current infestations of hawkweeds, knapweed, common St. John’s-wort, daisy and Canada thistle, management measures would require herbicide treatment prior to the storage/decommissioning activities. Once stored/decommissioned, they would reduce the risk of spreading other existing weed species and introducing new invaders due to the storage/decommission. Alternative 2 has the lowest risk of

contributing to long-term spread of weeds due to the lower disturbance and less future access reduction to treat the template. For other species, the risk is the similar to all alternatives as these road segments are not accessible for vehicle traffic now.

Table 3.109 shows road related impacts for all alternatives including the "no-action". In general, the higher the miles of restricted road access, and in the long-term, the higher the miles in decommission/ storage, the lower the rate of noxious weed spread. The exception to this rule is the hawkweed that would continue to spread on stored/decommissioned roads due to the difficulty in treating these vectors once the storage/decommission activities have taken place.

Road Reconstruction, Reconditioning and BMP Work
Road reconstruction can spread noxious weeds through disturbance that creates a receptive seedbed and allows noxious weeds to re-establish and flourish. Once established, administrative and recreational travel along the new road can spread weeds. Reconstruction work may include minor earthwork, motor grading, seeding, brushing, ditch cleaning, ditch construction, ditch relief drainage, installing surface water drainage structures, culvert replacement and new culvert installations, surface rock replacement, dust abatement and sub-grade reinforcement.

All of the action alternatives would haul volume on roads in the East Reservoir analysis area. The project proposes approximately 176.4 miles of reconditioning, reconstruction, BMP work and/or blading and shaping for Alternative 2 and 167.8 miles for Alternative 3.

Management measures include equipment washing, use of weed-free certified seed and straw, seeding and fertilizing areas with disturbance beyond blading and shaping the road template, use of materials from approved weed-free sources, monitoring and future herbicide treatments. There is a small risk of introducing weed seeds on equipment associated with the reconstruction maintenance work even with the required equipment washing. The greatest risk is posed when equipment from outside the area is utilized for these activities, since they may bring new invaders onto these sites. Table 3.109 displays the activities with heavy disturbance and high risk of noxious weed invasion and spread by alternative.

Table 3.109 – Activities with Heavy Disturbance and High Risk of Noxious Weed Invasion and Spread (miles)

ACTIVITY	ALT 1	ALT 2	ALT 3
New Road Construction	0	9.25	8.06
Temporary Road Construction & Restoration	0	4.26	4.05
Road Reconditioning, Reconstruction and BMP Work	0	176.4	167.8
Road Storage	0	16	17.62
Road Decommission	0	5.93	5.93
Total Miles	**0**	**211.84**	**203.46**

ACTIVITIES with MODERATE RISK of SPREADING or INTRODUCING NOXIOUS WEEDS
- Harvest utilizing ground based equipment;
- Site preparation on regeneration harvest units through grapple piling and scarification.

Timber Harvest Utilizing Ground Based Yarding
Timber harvest activities can spread noxious weeds by transporting seeds on personal vehicles and harvest equipment. Ground disturbance associated with timber harvest creates a receptive seedbed on landings and skid trails. Harvest activities can spread noxious weed seeds by transporting seeds from the decking, landing and servicing areas to un-infested sites in harvest units on skidders, tractors or other mechanized logging equipment. Management measures include equipment washing, seeding and fertilizing landings and major skid trails, use of certified weed-free seed, limiting soil disturbance during harvest activities, and post-harvest monitoring and treatment for any new invaders. The risk of noxious weed spread is related to the amount of disturbance. Tables 3.110 and Table 3.111 display the amount of

acres harvested by system on NFS.

Winter logging reduces the chance of spreading existing weeds by generally reducing soil disturbance. Specific units lower in the drainages have required winter logging to reduce impacts to soils, cultural resource sites and also to reduce weed spread. The specific units are listed in Tables 2.0 and 2.15 in Chapter 2 of this document.

Site Preparation and Fuel Reduction through Grapple Piling and Scarification
In the regeneration units that have grapple scarification planned, up to 25% of the unit may have the majority of the duff removed, and up to 50% of the unit may be disturbed through the grapple scarification activity. In units with grapple piling for fuel reduction, scarification is not an objective, but up to 25% of the unit may have duff removal and up to 50% of the ground could be disturbed through this activity. The impacts would be lower if the piling or mastication were accomplished over frozen ground conditions. This ground disturbance creates a receptive seedbed for noxious weeds within the harvest unit. In addition, equipment may transport some noxious weed seed into the unit even with the required equipment washing. Management measures include equipment washing, limiting soil disturbance to the minimum required for reforestation, minimizing the area treated and disturbance in the fuel reduction units, and post-harvest monitoring and treatment of any new invaders. Treatments such as commercial thinning and sanitation salvage would not require grapple piling and maximum disturbance would likely be 25% of the ground. Table 3.110 displays the activities with moderate disturbance and moderate risk of noxious weed invasion and spread by alternative. Display acres are total acres of the treatment units although only a certain percentage of the acres would be disturbed as described previously.

Table 3.110 - Activities with Moderate Disturbance and Moderate Risk of Noxious Weed Invasion and Spread (acres)

ACTIVITY	ALT 1	ALT 2	ALT 3
Non-Winter Ground Based (Tractor) Logging with Grapple Piling	0	1,463	1,625
Skyline Yarding with Grapple Piling	0	204	0

ACTIVITIES with LOW to Moderate RISK of Noxious Weed Invasion and Spread
- Site preparation on regeneration harvest units through prescribed fire;
- Underburning for hazard reduction in intermediate harvests treatments;
- Harvest utilizing a skyline system;
- Winter harvest utilizing ground based equipment;
- Underburning for natural fuels reduction and/or forage enhancement;
- Allowing motorized use on a trail that is currently impassable.

Site Preparation on Regeneration Harvest Units through Prescribed Fire or Underburning in Intermediate Harvests Treatments
Site preparation through prescribed fire and underburning in intermediate harvest treatments would have a moderate to low potential to spread noxious weeds depending on the severity of the burn, and the amount of duff reduction. Treatments involving harvest and burning were found to have more noxious weeds post-treatment than less intense single-disturbance treatments (burn-only or harvest-only) (Dodson and Fiedler 2006). Prescribed fire can increase the rate of spread of noxious weeds by creating a receptive seedbed that allows noxious weeds to establish and flourish. The dry land areas would have spring burns and the moist areas would generally have fall burns. While the severity and amount of disturbance may be higher from fall burning, the dry land burns may be more susceptible to noxious weed increase due to the more open conditions and lower existing duff levels. Burns that have adjacent road access would be pre-treated a minimum of one year prior to burning.

Harvest Utilizing a Skyline System or Winter Ground Based Harvest
Timber harvest activities can spread noxious weeds by transporting seeds on personal vehicles and

harvest equipment. Ground disturbance associated with timber harvest creates a receptive seedbed on landings and skid trails. Cable logging systems similarly reduce soil disturbance and potential weed spread as compared to tractor logging. Winter logging has a lower disturbance level, and therefore reduces the chance of spreading weeds. All systems can spread noxious weed seeds by transporting seeds from the decking, landing and servicing areas to un-infested sites in harvest units. Management measures include equipment washing, seeding and fertilizing landings and major skid trails, use of certified weed-free seed, limiting soil disturbance during harvest activities, and post-harvest monitoring and treatment for any new invaders. The risk of noxious weed spread is related to the amount of disturbance. Table 3.111 displays activities with moderate to low disturbance and moderate to low risk of noxious weed invasion and spread by alternative.

Motorize Trail Use
Alternative 2 would make trail access changes to 36.56 miles of trails that are currently open to motorized use. These trails would be closed to motorized use if Alternative 2 is chosen. This closure would reduce the potential of weed spread by motorized recreational vehicles. Alternative 3 would allow 9.67 miles of trail to continue to be accessed by motorized recreational vehicles. This would increase the chances of weed spread on these trails. Currently, there is little motorized use on the 36.56 miles of motorized trails.

Prescribed Fire for Natural Fuels Reduction and/or Forage Enhancement
Prescribed fire can increase the rate of spread of noxious weeds by creating a receptive seedbed that allows noxious weeds to establish and flourish. The potential is dependent on the severity of the burn and the current level of weed infestation on site. The dry land areas would have spring burns and the moist areas would generally have fall burns. While the severity and amount of disturbance may be higher from fall burning, the dry land burns may be more susceptible to noxious weed increase due to the more open conditions and lower existing duff levels. Burns that have adjacent road access would be pre-treated a minimum of one year prior to burning.

There are over 11,000 acres of underburning for natural fuels reduction and/or forage enhancement included in the action alternatives for this project. A decision matrix would be developed to address weed concerns and to prioritize the units for burning based on desired objectives of the burning and whether weeds were currently on site. This decision matrix would identify potential weed concerns and identify target habitat enhancement or fuel reduction objectives. This way weed control efforts can focus on particular species prior and post-burning.

Table 3.111 - Activities with Low to Moderate Disturbance and Risk of Noxious Weed Invasion and Spread (acres)

ACTIVITY	ALT 1	ALT 2	ALT 3
Non-Winter Ground Based (Tractor) Logging with Site Prep and Fuels Reduction Using Prescribed Fire	0	1,341	1,912
Skyline Yarding with Underburning	0	810	664
Winter Ground Based (tractor) Yarding (includes Winter GP and UB)	0	1,610	1,611
Underburning for Natural Fuels Reduction/Forage Enhancement	0	11,427	11,358
Winter Ground Based (Tractor) Whole Tree Yarding (CTs)	0	1,668	1,489
Non-Winter Ground Based (Tractor) Whole Tree Yarding (CTs)	0	588	476
Total Acres	**0**	**17,444**	**17,510**

ACTIVITIES with VERY LOW RISK of NOXIOUS WEED INTRODUCTION and SPREAD
Because risk is generally associated with disturbance and equipment, the following activities have a very low risk. The affected acreage will not be summarized because of this lower risk. Having these activities occurring may increase the probability of locating and mapping noxious weed infestation by having personnel on the ground. Management measures include monitoring and treatment of any new invaders.

- Tree planting;

- Precommercial thinning;
- Adding undetermined roads to the NF system roads.

ACTIVITIES with a POSITIVE IMPACT to WEED INTRODUCTION and SPREAD

Weed Treatment along Haul Routes

Alternative 2 would treat 176.4 miles of haul route and Alternative 3 would treat 167.8 mile of haul route. The no-action alternative (1) would continue to treat some miles but not the full haul routes.

Weed Treatment Activities

- Continued treatment of the seasonally open road systems by the FS (acres and miles treated would be similar to those displayed in Table 3.107 that displays average acres treated from 2006-2011);
- Continued treatement of new invader sites;
- Rocky Mountain Elk Foundation Grant for weed control pre and post prescribed wildlife enhancement burning. This is a multi-year grant that started Spring 2012;
- Continue to release biocontrol agents as they become available to control noxious weeds.

Table 3.112 - Comparison of Disturbance Levels and Risk by Alternative

ACTIVITY	DISTURBANCE and RISK	ALT 1	ALT 2	ALT 3
New Road Construction (miles)	High	0	9.25	8.06
Temporary Road Construction/Restoration (miles)	High	0	4.26	4.05
Road Storage (miles)	High	0	16.00	17.62
Road Decommissioning (miles)	High	0	5.93	5.93
Road Reconstruction & BMP Work (miles)	High	0	176.4	167.8
Non-Winter Ground Based Logging With Grapple Piling (acres)	Moderate	0	1,463	1,625
Skyline Yarding With Grapple Piling (acres)	Moderate	0	204	0
Skyline Yarding With Underburn (acres)	Low to Mod	0	810	664
Non-Winter Ground Based Logging with Site Prep and Fuels Reduction Using Prescribed Fire	Low to Mod	0	1,341	1,912
Winter Ground Based Yarding (includes winter GP and UB)	Low to Mod	0	1,610	1,611
Non-Winter Ground Based (Tractor) with WTY (PCT)	Low to Mod	0	588	476
Winter Ground Based (Tractor) Whole Tree Yarding (CT)	Low	0	1,668	1,489
Underburning for Natural Fuels Reduction/Forage Enhancement	Low	0	11,427	11,358
Total Miles - High Risk	High	0	211.84	203.46
Total Acres - Moderate Risk	Moderate	0	1,667	1,625
Total Acres - Low to Moderate Risk	Low to Mod	0	3,539	4,187
Total Acres - Low Risk	Low	0	13,095	12,847

Ground-based Logging = Tractor PCT = Precommercial Thin CT = Commercial thin

The total number of acres treated does not indicate that all of these acres would be infested with noxious weeds if the treatment were implemented; however, disturbance translates to higher risk of increased noxious weed infestation.

The amount of acres with moderate and high levels of disturbance and the associated moderate and high risk of having a receptive seedbed for noxious weeds can be used to compare the alternatives and the relative risk for noxious weed introduction and spread.

Referring to Table 3.112, Alternative 2 has 8 more miles of road work than Alternative 3. Since road activities have the highest risk for infestation, Alternative 2 would have a slightly higher risk than Alternative 3. Alternative 3 also has fewer acres of low and moderate risk treatments but a slightly higher low to moderate treatments. The difference between the alternatives is similar enough that the risk would essentially be the same for types of treatments.

The no-action alternative also has a probability of noxious weed spread along travel routes such as roads

and trails. Even without management related disturbance, species that are tolerant of shade such as the hawkweeds can continue to spread in the moister VRUs. Species such as spotted knapweed, common St. John's-wort, cheatgrass and sulfur cinquefoil can spread in the open VRU 2 and 3, especially along roads.

NOXIOUS WEEDS DESIGN CRITERIA (MANAGEMENT MEASURES)

The management measures identified in this document and incorporated in Chapter 2 of this document (Table 2.34), and the specific weed control measures to be implemented in accordance with the 2007 KNF Invasive Plant Management EIS, were designed to help reduce the spread of weeds in the East Reservoir analysis area and minimize the chance of introducing new species. Herbicide treatment of roads in the analysis area would be completed in accordance with the KNF 2007 Invasive Plant Management FEIS and ROD. Refer to the 2007 KNF Invasive Plant Management for further information.

The recommended management measures are focused on prevention as the most effective and least expensive weed management strategy, and early detection and eradication as the best alternative once a new species has been introduced. For established invaders, treating spread vectors and keeping these species out of new locations is the main objective. It is well documented that roads are often the first place to have weed infestations due to the efficiency of vehicles in seed transport and the receptive seed bed available for seed germination and establishment. It is also well documented that roads serve as sources for weed seed to be transported to other locations. Once the roadsides are colonized, the invasive species move into adjacent vulnerable habitat. Because roads serve as a primary spread vector, much of the recommended mitigation is road related. Specific project management measures would include all weed BMPs identified in R-1 FSM 2080 Noxious Weed Management Handbook. The following design criteria are intended to reduce spread of weeds:

- **Winter Tractor Units to Avoid Noxious Weed Spread:** Winter tractor operations for Units 2B, 2C, 2D, 3A, 9, 10, 11, 17, 28, 157, 158, 158A, 190, 194T, 196, 305, 306, 307, COE1 and COE3.
- Certified weed-free forage is required for use on all national forest lands in Montana (36 CFR 261.50)
- Treat existing noxious weeds on roads to be reconstructed or stored prior to that activity, (if possible schedule spraying two or more seasons before activities are expected to occur to reduce the amount of viable weed seed stored in the soil).
- Treat existing noxious weeds in gravel/rock pits, inspect these sources for weeds and treat before material is transported.
- Survey and pre-treat existing noxious weeds on proposed trailhead construction site, and access sites for in-stream work.
- Require weed free certified straw for all construction, reconstruction, and restoration activities.
- Seed and fertilize stored roads with certified weed free seed immediately following restoration activities.
- Limit scarification objectives to the minimal required to meet reforestation objectives.
- Pressure-wash logging equipment, road maintenance and restoration equipment before entering the analysis area.
- Require timber sale purchaser to treat existing noxious weeds along haul routes the first operational season for weed spraying (spring or early summer)
- Seed newly constructed roads, trailheads, landings and major skid trails with certified weed-free seed.
- Prevent road maintenance machinery from blading or brushing through known populations of new invaders. In areas where weeds are established, (and activities are opening and blading restricted or closed roads with significantly lesser infestations); brush and blade road systems from un-infested segments of road systems to infested areas. Limit brushing and mowing to the minimum distance and height necessary to meet safety objectives in areas of heavy weed infestations
- Minimize soil disturbance and mineral soil exposure during activities. Soil disturbance should be no more than needed to meet project objectives. This includes not exceeding recommended mineral soil exposure for site preparation in regeneration harvest units; and utilizing timing and designated skid

trails to minimize mineral soil exposure in harvest units.

- Survey proposed burn units for noxious weeds. Determine the risk of weed spread with prescribed fire. If there is a risk of spread beyond the road corridor, defer burning until the weeds can be treated or ensure post treatment funding for weed control.
- Survey proposed access for mechanized in stream for noxious weeds. Determine the risk of spread with the associated activity. If there is risk of spread, pre-treat the area before activity.
- Continue to monitor/survey the analysis area for new invader weed species. Monitor weed population levels in treated areas, with particular emphasis on haul routes, stored and decommissioned roads, and landings. Retreat as funding allows.
- Treat and sign sites if new invaders are located and defer ground disturbing activities within those sites until the weed specialist determines the site is no longer a threat, and approves those activities.
- Site-specific guidelines will be followed for weed treatments within or adjacent to known sensitive plant populations. All future treatment sites would be evaluated for sensitive plan habitat suitability; suitable habitats would be surveyed as necessary prior to treatment.
- All noxious weed control activities would comply with state and local laws and agency guidelines.
- As per the 2007 KNF Invasive Plant Management EIS and ROD, all herbicides used in the analysis area would be applied according to the labeled rates and recommendations to ensure the protection of surface water, ecological integrity and public health and safety. Herbicide selection will be based on target species on the site, site factors (such as soil types, distance to water, etc), and with the objective to minimize impacts to non-target species.
- Design road storage to allow passage of a 4-wheeler to continue treatment of hawkweeds and common tansy in the future. Hawkweed and common tansy populations will continue to expand even after the template has re-vegetated.
- Keep administrative traffic on closed roads to a minimum. Whenever possible, time activities prior to seed set of the primary weed species or emphasis weeds on a given road.
- Release bio-control agents on applicable sites, as they become available, and funding allows.
- Plan follow up noxious weed treatment the spring or early summer, following final purchaser blading of all haul roads if funds allow (this would be funded with appropriated or KV dollars).
- **Burning and Noxious Weed Spread:** A decision matrix will be developed to address weed concerns and to prioritize the units for burning based on desired objectives of the burning. This decision matrix will identify potential weed concerns and identify target habitat enhancement or fuel reduction objectives. This way weed control efforts can focus on particular species prior and post-burning.

Cumulative Effects

Past soil-disturbing activity such as road construction, harvest, mining and vehicle traffic have helped introduce and spread noxious weeds into the analysis area. Much of this past activity did not have concurrent weed treatment and management measures.

Because roads are a primary spread vector, spraying of yearlong open roads in the analysis area is expected to continue to be a priority for the district and the county due the amount of recreation use in the area. Herbicide treatment is also required for all activities that have been recently approved through other analysis processes, such as the State timber and fuels projects that would use cost-share roads. Approximately 167-176 miles of road treatment (BMPs) is proposed within the range of alternatives. Because roads are such a key introduction and spread vector, this amount of treatment would be highly effective in reducing noxious weed introduction and spread.

Roads would be treated primarily with Milestone (active ingredient is aminopyralid) where appropriate, under label restrictions, at a rate of 7 oz. per acre. This treatment should have a three to four year effect in reducing the density of noxious weeds, primarily spotted knapweed, St. John's-wort, sulfur cinquefoil and hawkweeds. This treatment in conjunction with other establishment of native species (such as seeding after disturbance) could have a much longer affect.

In addition to the road associated activities, other management actions proposed in this project in conjunction with past and reasonably foreseeable actions have the potential to increase noxious weed infestation in the analysis area due to the additional disturbance. This disturbance would be mitigated through herbicide treatments along the haul routes associated with harvest activities, along roads to be stored, on harvest landings, on access routes for other activities such as mining, power lines, on access to and within recreational sites, and along trails. In addition, spot treatments for isolated populations of noxious weeds that are located through monitoring may be treated. Follow up monitoring surveys and treatment are proposed for all activities as described in this report, disturbance level and risk by management activity, in the design criteria and management measures in Chapter 2. It should be noted that the existing infestation of noxious weeds in the analysis area is strongly correlated with past management actions such as roads, mining and harvest activities, that until recently, did not have weed management measures associated with them. The District has noted a reduction in noxious weed introduction and spread during such activities as a result of the current weed management programs and weed best management practices.

In the case of species that do well in shaded and forested environments, such as the hawkweeds, periodic herbicide treatment that is funded through project activities is critical to management of this species and keeping it out of special areas. Because dry land species such as knapweed, cheatgrass and common St. John's-wort are already established, monitoring and treatment through proposed activities such as harvest and burns may be critical to helping curb the spread of these species in high value big game ranges. Past prescribed fire and the associated weed survey and treatments that were funded through the Rocky Mountain Elk Foundation and Forestwide Fuels projects have been instrumental to the location and treatment of small isolated knapweed and common St. John's-wort populations. While the Klamath Beetle has not been released in this area, the Klamath Beetle was noted on the isolated common St. John's-wort populations in the analysis area. Monitoring on *Cyphocleonus* root weevil has indicated establishment and damage to roots in knapweed. The seed head flies have been shown to be well established throughout the area and *Cyphocleonus* combined with the seed head flies appear to be reducing density and plant vigor in spotted knapweed in other areas on the KNF. Management activities may help fund additional release of these bio-control agents in analysis area.

Resources managers will be challenged to integrate adaptation strategies in a time of potential climate change. Successful management of invasive weeds would require active inventory and management to prevent new introductions, and persistent efforts to reduce existing infestations. While the action alternatives contribute to site disturbance and provide a favorable seed bed for noxious weeds, they also promote an active management strategy associated with proposed activities.

While the no-action alternative allows for current weed management programs, it does not promote an integrated active weed management strategy. The no-action alternative has the potential to contribute to an overall increase in noxious weed infested area some unknown time in the future, because only open roads that are currently on a treatment schedule and roads associated with power lines would be treated. It is unlikely that roads that are not open to the public would be treated with current budgets and programs.

CONSISTENCY with the FOREST PLAN and OTHER MANAGEMENT DIRECTION

Forest Service Manual (FSM) 2901.03 Executive Order 13122 directs Federal agencies to: (1) identify actions that may affect status of invasive species; (2)(a) prevent introduction of such species; (b) detect and control such species; (c) monitor population of such species; (d) provide for restoration of native species; (e) conduct research on invasive species and develop technologies to prevent introduction of such species: (f) promote public education of such species; and (3) not authorize, fund or carry out actions likely to cause the introduction or spread of invasive species in the United States or elsewhere unless the benefits of the action clearly outweigh the harm and the agencies take steps to minimize the harm.

NOXIOUS WEEDS

The Lincoln County Weed Control Act (MCA 7-22-2116) indicates that "it is unlawful for any person to permit any noxious weed to propagate or go to seed on his land, except that any person who adheres to the noxious weed management program of his district or who has entered into and is in compliance with a noxious weed management agreement is considered to be in compliance with this section."

The KNF has entered into a weed Memorandum of Understanding (MOU) with Lincoln County, which is a management agreement under this law. Because the management measures identified and described in Chapter 2 (Table 2.34) would be followed, this project is in compliance with the MOU and the Federal Noxious Weed Act.

These actions would also help to meet the goal for noxious weed management as stated in the KNFP and with the identified noxious weed management measures, all alternatives are consistent with FSM direction, Lincoln County Weed Control act and the KNFP direction.

It is recommended that post-harvest weed management treatments be a high priority for any available KV funding.

AIR QUALITY INTRODUCTION

This analysis discloses the potential effects to air quality from implementing the "action" alternatives and the potential effects of the "no action" alternative to provide the decision maker with a means of comparing these alternatives. The analysis of the "action" alternatives and "no-action" alternative include the effects of prescribed fire smoke, fugitive dust and some discussion on smoke from wildfires.

Wildland fires are a natural combustion process that consumes both living and dead vegetative material and produces smoke that can have adverse impacts on air quality. The occurrence, intensity and size of wildland fires depends directly on variables such as meteorological conditions, the type of vegetation present, the moisture content of both live and dead fuel, topography and the total weight of consumable material available. Small fuel, such as dead grass and conifer needles, supports fire spread. Larger dead fuel consumption varies depending on its moisture content. Environmental conditions that reduce the moisture content of live fuels, such as drought and extreme heat, allow these live fuels to become available to burn. Slope effects fire in much the same way wind does; the steeper the slope the greater the effect. The aspect of a slope influences the moisture content of fuels with north aspects generally being more moist than south aspects. Under the extreme condition of heavy fuel, drought, and hot, dry weather nearly all forest fuels are available for consumption. The impacts to air quality are relative to the amount of smoke produced, which varies with burning conditions and duration. Large amounts of smoke are produced under extreme burning conditions and for extended periods with little or no control by fire managers under a large wildfire scenario.

Smoke produced from the prescribed burning of timber harvest residue and natural fuels can have an adverse effect on air quality. The amount of smoke produced is influenced by the same factors that influence the amount of smoke produced by wildfires. Increasing the utilization of sub-merchantable material can reduce the amount of fuel remaining after timber harvest which reduces the amount of smoke produced. The type and timing of burning, as well as weather conditions, also influences the amount of smoke produced. Unlike a wildfire, fire managers have more control over how much and when smoke is produced with prescribed burning.

Air quality is also affected by fugitive dust produced by vehicular traffic, especially on native surface roads. The silt content of the road surface layer, the distance traveled, the weight and speed of the vehicle as well as weather conditions, influence the amount of dust produced. Paved roads produce significantly less dust than do native surface roads, especially during dry weather. Management measures, that reduce the availability of fine silt particles, such as watering or dust suppressants, are effective. Reducing the speed of vehicles can reduce localized impacts.

REGULATORY FRAMEWORK

Federal Clean Air Act

The framework for controlling air pollutants in the United States is mandated by the 1970 Clean Air Act (CAA), which was amended in 1977 and again in 1990. The CAA was designed to "protect and enhance" air quality. Section 160 of the CAA requires measures "to preserve, protect, and enhance the air quality in national parks, national wilderness areas, national monuments, national seashores, and other areas of special national or regional natural, recreation, scenic, or historic value." Stringent requirements are therefore established for areas designated as "Class I" areas. Class I areas include Forest Service (FS) and Fish and Wildlife Service (FWS) wilderness areas over 5,000 acres that were in existence before August 1977 and National Parks in excess of 6,000 acres as of August 1977. Designation as a Class I area allows only very small increments of new pollution above already existing air pollution levels. Examples of Class I areas include the Cabinet Mountains Wilderness, Glacier National Park and Bob Marshall Wilderness. Class II areas are currently all other areas of the country that are not Class I.

National and State Ambient Air Quality Standards

The Environmental Protection Agency (EPA) has established National Ambient Air Quality Standards

(NAAQS) for specific pollutants emitted in significant quantities that may be a danger to public health and welfare. These pollutants are called criteria pollutants. The criteria pollutants and the National and State standards are included in the Table 3.113. The NAAQS are designed to protect human health and the public welfare.

Table 3.113 - National and State Ambient Air Quality Standards

POLLUTANT	TIME PERIOD AVERAGE	FEDERAL	MONTANA
Carbon Monoxide (CO)	One hour 8-hour	35 ppm 9 ppm	23 ppm 9 ppm
Lead (Pb)	Quarterly Rolling 3-Month	1.5 $\mu g/m^3$ .15 $\mu g/m^3$	1.5 $\mu g/m^3$ ----------
Nitrogen Dioxide (NO_2)	Annual Average Hourly Average	0.053 ppm ----------	0.30 ppm 0.05 ppm
Sulfur Dioxide (SO_2)	Annual Average 24-hour 3-hour Hourly Average	0.03 ppm 0.14 ppm 0.50 ppm ----------	0.02 ppm 0.10 ppm ---------- 0.50 ppm
Ozone	8-hour Hourly Average	0.075 ppm 0.12 ppm	---------- 0.10 ppm
PM_{10}	Annual Average 24-hour	---------- 150 $\mu g/m^3$	50 $\mu g/m^3$ 150 $\mu g/m^3$
$PM_{2.5}$	Annual Average 24-hour	12 $\mu g/m^3$ 35 $\mu g/m^3$	------- -------

PM - Particulate Matter ppm = parts per million $\mu g/m^3$ = micrograms per cubic meter
Standards and violation rules can be found at http://www.deq.state.mt.us/AirMonitoring

If a community or area regularly exceeds the standards, it becomes a non-attainment area and must demonstrate to the public and EPA how it will meet standards in the future. This demonstration is done through the State Implementation Plan (SIP).

Wildfire and natural resource management activities such as timber harvest, road construction, site preparation, mining and fire-use can generate ozone, carbon monoxide and particulate matter. While ozone is a byproduct of fire, potential ozone exposures are infrequent (Sandberg and Dost 1990). Carbon monoxide is rapidly diluted at short distances from a burning area; therefore, it poses little or no risk to public health (Sandberg and Dost 1990). Particulate matter (PM) is the pollutant of most concern from smoke. It is a concern to public health and visibility within the immediate area and downwind. Because of its smaller size, $PM_{2.5}$ poses greater health risks than PM_{10}. Large volumes of particulate matter can be produced from fire and, depending on meteorological conditions, may affect large areas for extended periods of time.

Airshed Monitoring

The majority of the legal entities in Montana and Idaho (including the FS) which create particulates as a result of their burning activities have formed the Montana/Idaho Airshed Group. This group has established a smoke monitoring system that provides air quality predictions and restrictions to its members. In Montana, the Department of Environmental Quality (DEQ) issues an annual burn permit to the FS. Issuance of this permit is based on participation and compliance with burning restrictions set by the Montana/Idaho Airshed Group.

All prescribed burning implemented within the analysis area would comply with the State requirements of the SIP and the Smoke Management Plan. Prescribed burning is reported to the Airshed Coordinator on a daily basis. If ventilation problems are forecasted by the monitoring unit, prescribed burning is either restricted by elevation or postponed until good ventilation exists.

Regional Haze Rule (1990 Clean Air Act Amendments), 40 CFR Part 51
In 1999, EPA announced the Regional Haze Rule (40 CFR 51.308-309), which calls for states to establish goals for improving visibility in mandatory Class I areas and to develop long-term strategies for reducing the emissions of air pollutants that cause visibility impairment. The Regional Haze Rule requires states to demonstrate "reasonable progress" toward improving visibility in each Class I area over a 60-year period (to 2064), during which visibility should be returned to natural conditions.

The Regional Haze Rule also requires states to address visibility impairment in mandatory Class I areas due to emissions from fire activities. The preamble to the rule emphasizes the "implementation of smoke management programs to minimize effects of all fire activities on visibility." The Rule requires states to address visibility effects from all fire sources contributing to visibility impairment in mandatory Class I areas (Dzomba 2005).

Interim Air Quality Policy on Wildland and Prescribed Fire
On May 15, 1998, the EPA issued this policy to address impacts to public health and welfare. This policy was prepared in response to anticipated increases in fire use that were expected to occur as a result of implementing the 1995 Fire Management and Policy Review, which outlined a need to restore fire as an ecosystem process. The Interim Policy reconciles the competing needs to use fire while still considering the protection of public health.

Forest Plan Direction
Kootenai National Forest Plan (KNFP) (Volume 1, Chapter 2, p.26) directs activities on the Forest to meet State Air Quality Standards. The Forest cooperates and complies with the State in meeting the requirements of the SIP and the Smoke Management Plan. The KNFP also directs managers to prevent long-term deterioration of air quality for the Cabinet Mountains Wilderness a Class I airshed.

All Management Areas (MAs) would comply with the State Smoke Management Plan and SIP.

ANALYSIS AREA
The analysis area for air quality includes Montana Airshed 1, which includes all of Lincoln County (a map of the Montana Airsheds is included in the project file). Various forms of prescribed burning are proposed in all action alternatives to meet the purpose and need of reducing hazardous fuels adjacent to private property and across the landscape while re-introducing fire to the ecosystem.

ANALYSIS METHODS
First Order Fire Effects Model (FOFEM) version 5.9 was used to calculate emissions from prescribed burning as proposed in the action alternatives and to derive the total fuels (litter, wood, duff, herbaceous, crown) available for combustion during prescribed burning. FOFEM is a computer program used in predicting and planning for fire effects. Currently, FOFEM provides quantitative fire effects information for tree mortality, fuel consumption, mineral soil exposure, smoke production and soil heating. FOFEM models smoke production, not visibility or dispersion. More information on FOFEM and its assumptions can be found at http://www.fire.org.

Windrose data was derived from FireFamily Plus version 4.0. Windrose for the months of March-November (typical months for prescribed burning) were utilized from the Libby Remote Automated Weather Station (RAWS) for the period 1992-2011 to assess the percent of the time a wind will blow from a certain direction. This provides a reasonable estimate of the direction the smoke from prescribed burning or a wildfire will travel.

AFFECTED ENVIRONMENT
Airshed Characteristics and Existing Condition
Montana is divided into ten airsheds by the Montana DEQ. The East Reservoir analysis area lies entirely

within Airshed 1. Smoke produced at any location within the analysis area would most likely be carried in an easterly direction by the predominantly westerly windflow pattern that influences western Montana.

Smoke dispersal is usually best during the spring and early summer because daytime heating and general wind flows help smoke rise above ridge tops and into the free air winds where it is diluted and dispersed. Stable high-pressure systems that often occur during late summer and fall hamper the vertical motion of air and reduce the smoke dispersion potential. Infrequent, low-pressure systems also move through the area during this period and improve smoke dispersal until high pressure re-establishes. As the heat of summer passes and nighttime temperatures begin to drop, air quality begins to deteriorate as nighttime inversions become more prevalent. Weather patterns begin to change during the fall months with periodic cold front passages being interspersed with periods of stable high pressure. These cold fronts are often dry but can bring substantial moisture. Wind associated with these cold fronts provide good ventilation but also increase the risk that a prescribed burn may escape control. The late fall often marks the return of wet, foggy and cloudy weather to the analysis area. During this time, periods of good ventilation occur during fontal passages but valley inversions often hamper the dispersion of smoke. Winter weather is very similar, with smoke dispersion being poor.

The mountainous topography of the analysis area also influences the dispersion of smoke. Smoke produced at higher elevations is closer to the free-air winds that occur at and above ridge tops, so dispersion is usually better than at lower elevation. Conversely, smoke produced at lower elevations is more likely to be effected by valley inversions and must rise farther to enter the free air wind. Burns on south exposures are more likely to be affected by local thermal winds than those on north slopes. Burns on slopes exposed to the prevailing wind would have better smoke dispersion than those located on the lee slope.

Smoke dispersal is best when the daytime heating is greatest. This usually coincides with the period of greatest atmospheric instability for the day. Free air winds penetrate into lower elevation at this time resulting in good vertical motion and smoke dilution. Smoke dispersal is usually poor for night-time burning due to the increase in atmospheric stability as cool air pools in valleys. This process also results in the development of valley inversions.

Quantitative air quality data is not available for the period prior to settlement of the analysis area late in the 19th century. However, it is known that fire played a major role in the development of vegetative patterns throughout western Montana. Journals from early day explorers and newspaper articles from the late 1800s often mention the smoky conditions from summer fires burning in western Montana and northern Idaho. Leenhouts (1998) compared historical data to modern records and concluded that ten times more acres burned annually in the United States 200-400 years ago than we see in modern times.

The annual amount of smoke generated from forest fires has generally decreased since the early 1900s, even with today's use of prescribed fire. Prior to the advent of effective fire suppression, variously reported as the 1930s or 1940s, fires that started in the area now known as the Libby Ranger District, generally burned unchecked from the time of ignition until weather changes stopped their spread. Smoke production varied as environmental factors changed. Smoke could have been produced for just a few hours or for as long as several months. During severe fire seasons, especially when stagnant high-pressure systems persisted, regional air quality was likely poor. The number of acres burned by wildland fires decreased as effective fire suppression became common and as a result, air quality improved. During the last two decades, natural fuels resulting from decades of fire suppression and changing climatic conditions have reached a level where larger, more intense fires are becoming common. Degradation of air quality can be a direct result of these wildfires.

Airshed 1 air quality is influenced predominantly by smoke and dust originating from areas located to the west. This includes grass burning on the Rathdrum and Palouse Prairies, located between Sandpoint and

Lewiston, Idaho, as well as other agricultural areas in Washington and northern Oregon. Industrial emissions as well as those from internal combustion engines add to the level of regional haze and air pollution load. Prescribed burning of logging residue by private and other government entities adds wood smoke to the air mass. The use of woodstoves for home heating is likely the most significant contributor to poor air quality during the winter months. Wildfires burning in other states can also contribute to air quality degradation. Dust, originating from tilled farmland, during dry windy weather, can add to local haze and reduce air quality.

The Need for Prescribed Burning

In order to meet the purpose and need of the project, the selection of a fuel management technique depends on several factors including silvicultural system, timber harvest method, timber harvest type, treatment economics, wildlife habitat, soil, water, cultural resource protection and air quality. The Interdisciplinary Team (IDT) selected fuel treatment options that best balance resource objectives and economic concerns. The options chosen include the following types of prescribed burning and fuel reduction methods:

Underburning: Underburning is utilized when there is an objective to retain a live, overstory tree component. This type of burning would be utilized in the East Reservoir Project for fuel treatments in the intermediate harvest units and the proposed fuels treatment units. It would also be utilized to reduce fuels and improve wildlife habitat and browse in the Fuels and Wildlife units. These burns would be accomplished prior to the growing season in the spring, or in the fall after the growing season. Generally, south aspects are burned in the spring and north aspects are burned in the fall due to fuel moistures or access issues.

Broadcast Burning: Broadcast burning is usually associated with regeneration harvest. Generally, the objective is to reduce activity fuels and prepare the area for site preparation for tree planting. In order to accomplish the resource objectives, broadcast burning is usually a hotter burn with more complete consumption of the surface fuels than an underburn. Because there are less live overstory trees to be concerned about, this type of burn can be done to generate enough heat causing a smoke column to rise higher into the transport winds and allow for more dispersion of smoke over greater distances than an underburn.

Excavator Piling followed by Pile Burning: This treatment method is used to accomplish a range of resource objectives in treatment areas where the resulting stand density is low, slopes are generally 35% or less and site preparation objectives can be met. Piled slash would generally be burned in late fall after receiving adequate moisture to reduce the threat of the fire spreading and escaping. Pile burning in the spring is usually too risky due to the potential for piles to come back to life when fuels dry out. Since pile burning occurs late in the fall season when smoke dispersion is often poor, it is possible that piles burned on a good ventilation day would smolder long enough to cause some impacts on air quality during poor ventilation days. Well compacted, dirt free piles can reduce the smoldering time. Smoke is more diffuse and does not rise into the upper transport winds. By burning during conditions that do not allow for the fire to spread, it is possible to halt the ignition at any point to limit smoke impacts.

Handpiling followed by Handpile Burning: This treatment is usually used in small areas, on steep slopes, in sensitive areas or landtypes, and/or areas without good access. Handpiling is kept to a minimum due to the high cost associated with this treatment. The handpiles are usually smaller and less compact than excavator piling so they do not burn as easily. Handpile burning would occur in the spring or fall. Because of their small size they are less likely to pose a risk of escape after a drying trend so spring burning is an option. Smoke is more diffuse and does not rise into the upper transport winds. Handpiling is common next to private property where aesthetics can be a significant concern.

Yard Tops to Landing: This treatment method would be required in all proposed harvest units. It requires the logging contractor to process the tree at the landing. Under this method, some of the activity fuels are brought in to and concentrated at the landing. Yarding tops would be the only fuels treatment proposed for the commercial thin units identified in all the action alternatives. In some of the units with the highest fuel load, the contractor may be required to yard unmerchantable material (YUM) to reduce natural fuel loads.

Natural Abatement: Natural abatement uses the process of decomposition and compaction (e.g. the weight of snow and gravity over time causes fuels to compact down) to lower the fuel bed depth and slowly reduce fuel loads. The smaller the fuel the quicker it compacts and decomposes. For example, needles and small branch material will breakdown in about 2-5 years; whereas, fire-killed trees take years to fall to the ground and then decades to decompose. This treatment would be applied when it is determined that the cost of fuel treatment would be excessive when considered in the context of the risk of loss to a wildfire or when prescribed burning would cause unacceptable levels of tree mortality. Specific instances where this treatment would be used includes: precommercial thinning where the cost of fuel treatment would equal or exceed the cost of the thinning and the risk of loss to wildfire is low; commercially thinned units where most unwanted fuel would be removed by whole tree yarding; and in areas isolated by surrounding fuel reduction treatments that would limit the spread of fire outside the untreated area.

Because of the need to reintroduce fire back into the ecosystem and to reduce natural and activity fuels, prescribed fire would be used the greatest extent possible under the East Reservoir Project.

Timing

The proposed burning associated with each action alternative would occur throughout the analysis area. For each of the action alternatives in this analysis, areas identified for burning would receive only one burn treatment under this document.

After a timber sale is sold, it may be harvested over the course of several years. The sale may qualify for a contract extension that could extend sale completion well past the end of the original contract period. Due to the uncertainty about when harvest would occur, it is not possible to accurately predict the exact timing of burning, but generally one to five years after harvest.

Burning associated with this project would occur annually, during the spring or fall burning periods, until all burning is completed. The spring burning period usually runs from late March through June. The fall burning period usually occurs in September through the end of November. Pile burning would occur during the late fall burn period which would generally start in October and end before December. Montana DEQ restricts open burning in western Montana during December, January and February.

The criteria used to select timing of burn projects would include fuel moistures, risk of escape, general weather patterns, smoke dispersion, live fuel moistures, resource objectives and air quality approval.

Fugitive Dust from Vehicle Traffic on Unpaved Roads

Fugitive road dust is a result of motorized vehicle use when road surfaces are dry. When a motorized vehicle travels on an unpaved road, the force of the wheels moving across the road surface causes pulverization of surface material. Dust is lofted by the rolling wheels as well as by the turbulence caused by the vehicle itself. This air turbulence can persist for a period of time after the vehicle passes.

The quantity of dust emissions from a given segment of unpaved road varies linearly with the volume of traffic. Variables that influence the amount of dust produced include the average vehicle speed, the average vehicle weight, the average number of wheels per vehicle, the road surface texture, the fraction of road surface material which is classified as silt (particles less than 75 microns in diameter) and the

moisture content of the road surface.

The moisture content of the road surface has the greatest influence on the amount of fugitive dust produced. Within the analysis area, unpaved roads are generally impassable or closed during the winter months from snow or for wildlife habitat security. July, August and September are generally dry so most dust production would occur during this period. Precipitation during these months is usually limited, so it would only reduce dust production for short periods.

Management measures that may be used to reduce fugitive road dust emissions within the analysis area include: the application of chemicals that increase the moisture retention of road surfaces, specifically magnesium chloride, watering during high use periods or during road maintenance operations, and speed restrictions in sensitive areas. While some or all of these measures would likely be used, it is not possible, at this time, to specify the actual management measures that would be needed.

Potential Management Measures Taken to Reduce Pile Burning Emissions
The amount of smoke emissions, resulting from prescribed burning of natural and activity fuels would be managed by these general methods: fuel loading reduction, reduction in the amount of fuel consumed, flaming combustion optimization, and impact avoidance. Refer to Table 2.34 for the design features and management measures that would be applied to this project to protect resources in all action alternatives**.**

Trained and Qualified Prescribed Fire Practitioners
Individual burn bosses are trained in smoke management techniques prior to being qualified as burn bosses. Part of a burn boss' responsibility is to evaluate smoke dispersion and halt burning operations in the event the actual smoke dispersion is not as forecasted and would cause significant impacts. Prescribed fire burn plans require analysis of smoke concerns and mitigations measures if needed. Burn Bosses are required to follow the burn plan, which requires tracking and monitoring of weather conditions and documenting smoke dispersal during the burn.

Public Notification
At the beginning of each burn season the Libby Ranger District places an advertisement in the local newspaper alerting the public to prescribed burning that may affect local air quality. On days when burning is expected to occur, residents near the burn may be contacted to make them aware of potential air quality impacts.

Monitoring
The FS is a member of the Montana/Idaho Airshed Group, which monitors air quality on a daily basis during burning season. The Monitoring Unit is activated when prescribed fire activity begins in the spring and continues until the end of November when the open burn season closes. The amount of burning allowed for any given day is based on this monitoring as well as forecast weather conditions. Air quality monitoring is performed daily at several locations within the area covered by this group. The amount of burning allowed within each airshed is tied directly to the daily monitoring of ambient air quality. The process of monitoring and forecasting has been effective at achieving the Airshed Group's objectives, which are listed in the Montana/Idaho Smoke Management Agreement.

One objective is to minimize or prevent accumulation of smoke during the fall prescribed burning season when burning is necessary for conducting accepted forest management practices such as hazard fuel reduction, site preparation and wildlife habitat improvement. This is done by prohibiting or restricting burning at times and places where stagnant weather conditions result in poor smoke dispersion, and by conducting prescribed burns when ventilation and air quality conditions are good.

A second objective is to develop a smoke management plan for reporting and coordinating burning operations on all forest and rangelands within Montana and Idaho. Guidelines in the plan would be based

upon technical information currently available on smoke dispersion and on State and Federal air quality regulations.

The third objective is to improve the smoke management program through regular review and evaluation. One or two general meetings of members are held annually to exchange ideas, review operations and offer suggestions for improving the program.

In addition, each burn plan (required for every FS burn) includes the provision for a test fire. The purpose of this test fire is to allow the burn boss to determine if burn objectives would be met as well as determining if smoke dispersal would be adequate.

ENVIRONMENTAL CONSEQUENCES

ALTERNATIVE 1 (No Action)

Direct and Indirect Effects

There would be no direct effects from Alternative 1 (no-action) since there would be no additional planned understory burns, ecosystem burning, pile burning or logging traffic to increase fugitive dust.

An indirect effect is that the potential for a high-severity wildfire to occur in the analysis area is greatest with the no-action alternative (Alternative 1). This would likely have greater impacts on air quality than any proposed action. Smoke from wildfires is unmanageable and would likely produce greater quantities of particulates, last longer in duration, and likely impact a larger area (e.g. Class 1 Airsheds and other communities downwind) than planned ignitions from prescribed fire. This was evident in the Northern Rockies in 1988, 1994, 2000, 2001 and 2003. Air quality impacts from a wildfire would normally occur during the summer months when visitor and outdoor use is highest.

Table 3.114 is used to compare prescribed fire pile burning and broadcast burning to reasonably expected emissions from a wildfire. As is evident in the table, a wildfire could produce 1.5 to three times the particulates per ton of fuels consumed as compared to pile burning or broadcast burning. A large wildfire would also consume significantly more tons of fuel than prescribed burning due to the size of the fire and amount of consumption. Within the analysis area, the north aspects and sites with a high component of grand fir or lodgepole pine generally have coarse woody fuel loadings of 20-60 tons/acre. By utilizing typical loading from FOFEM v5.9, a grand fir forest type would have an additional 15-30 tons/acre of forest litter and duff available to burn during a wildfire. The drier sites in the analysis area, which tend to occur on the south aspects or at lower elevations, are dominated by Douglas-fir and ponderosa pine. These sites have much lighter woody fuel loadings of 5-30 tons to the acre and 8-12 tons/acre of forest litter and duff.

Table 3.114 - Comparison of Smoke Emissions*

FUEL CONFIGURATION	COMBUSTION PHASE	PM_{10}**	$PM_{2.5}$**
Pile and Burn Slash:	Flaming	7.4	6.6
Mixed conifer	Smoldering	15.9	14.0
	Average	12.4	10.8
Broadcast Burning Slash:	Flaming	11.7	9.6
Mixed conifer	Smoldering	25.3	23.6
	Average	20.5	18.8
Wildfire (Forests)	Fire Average	30.0	27.0

*From 2001 Smoke Management Guide for Prescribed Fire
** Pounds of emissions per ton of fuel consumed

Cumulative Effects

Air resources are somewhat unique in that the past impacts to air quality are not usually evident or cumulative because they tend to be episodic in nature. Since no new management activities would occur in the analysis area with Alternative 1, there would not be any cumulative effects unless a wildfire were to

occur. As the analysis area begins to experience even more tree mortality from insects, disease, wind throw and snow breakage, fuel loading would increase as would the fire hazard. Eventually, a large wildfire, such as the 1988 Dry Fork Fire, would occur in the analysis area, and when this does happen there would likely be significant impacts to areas downwind of the fire event combined with cumulative impacts from other fires occurring in the Northern Rockies and/or the Pacific Northwest.

ALTERNATIVE 2 and 3

The direct, indirect and cumulative effects for all action alternatives will be compared together since the only difference between them, when it comes to effects on air quality, is the number of acres under each type of prescribed burning that would occur. This would directly affect the amount of PM_{10} and $PM_{2.5}$ produced by prescribed burning.

Particulate matter (PM) air pollution refers to microscopic airborne particles made up of dust, dirt, soot, smoke, sulfates, nitrates and liquid droplets. PM can vary in size, but according to the EPA, particles less than 2.5 micrometers in diameter ($PM_{2.5}$) are believed to pose the greatest risks to human health. Due to the small size of $PM_{2.5}$, it can travel longer distances and has a longer life than coarse particulate matter. To a lesser extent, PM_{10} can also be a health concern. Both reduced visibility and add to regional haze.

Smoke particles from the combustion of woody biomass are small, with about 80-90% of smoke particulates being less than 2.5 microns. Health problems can be caused by $PM_{2.5}$ especially for people suffering from cardiopulmonary illnesses. Federal Ambient Air Quality Standards are set at conservative levels intended to protect public health for even the most sensitive groups.

Direct and Indirect Effects

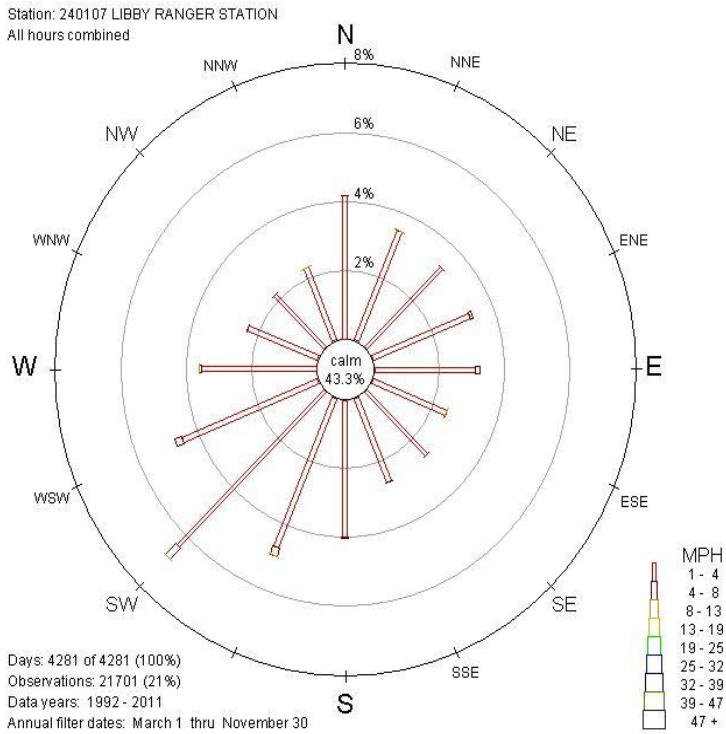
Table 3.115 shows the PM_{10} and $PM_{2.5}$ produced by the different types of prescribed burning by alternative. The variation in quantities produced is due to the following factors: fuel loading, fuel moistures and season of burn. The fuel loading and the amount consumed in all the units include forest litter, woody material, duff, herbaceous material, shrubs, crown foliage and crown branch-wood. Fuel moistures vary by season of burn and the environmental prescription parameters needed to meet burn objectives. The season of burn is generally in the spring or fall. Fall burns usually exhibit higher fuel consumption rates due to lower fuel moistures. The Fuels and Wildlife burns assume that some slashing of ladder fuels has occurred prior to burning. The Corps of Engineers land is also included in the total acres by alternative.

Table 3.115 - Particulate Emissions by Burn Type and Alternative

ALTERNATIVE	UNDERBURN TIMBER HARVEST UNITS PM_{10}=1052-2774 LBS/AC $PM_{2.5}$=892-2351 LBS/AC	UNDERBURN FUELS & WILDLIFE UNITS PM_{10}=617-833 LBS/AC $PM_{2.5}$=523-706 LBS/AC	HAND and GRAPPLE PILE BURN PM_{10}=846-1611 LBS/AC $PM_{2.5}$=717-1366 LBS/AC
1	0	765	0
2	3,005 acres	11,064 acres	4,361 acres
3	3,651 acres	11,120 acres	2,820 acres

Fuel treatment by prescribed fire and the associated smoke emissions in the East Reservoir analysis area would occur over a period of time. PM_{10} and $PM_{2.5}$ produced from each unit varies by the burn unit size and environmental conditions at the time of implementation. For example, a 40 acre underburn in a dry site, light fuel load timber harvest unit would produce about 42,080-46,920 pounds of PM_{10} and 35,680-39,760 pounds of $PM_{2.5}$ emissions, primarily during the day of ignition, and be significantly less each day until the burn goes out. Coordination with the Montana/Idaho Airshed Group is vital to successful smoke dispersion and reduced smoke impacts. The District expects to implement from 300-2,000 acres of prescribed burning per year under the action alternatives of this project.
As is evident in the windrose graph below, the majority of the wind in the analysis area comes from the

west, southwest and south (41% of the time when the wind is actually blowing) from March-November when prescribed burning or wildfires would occur. The windrose graph was derived from the Libby RAWS. The Fisher River RAWS is actually closer to the analysis area but due to its location at the junction of two major river drainages (Kootenai and Fisher), the wind directions were not representative of the general wind pattern for the analysis area.



The windrose previously described, were used to show the percent probability of a wind blowing towards an area of concern during the months of March-November. As is evident in Table 3.116, the likelihood of a wind blowing towards areas of concern is low. This is further reduced by the distance to the locations of concern which would allow for greater mixing and dilution of particulates. None of the burning in the action alternatives is expected to produce any pollutants of concern that would exceed the National Ambient Air Quality Standards for the areas of concern. However, there are scattered homes in the analysis area and recreational visitors that would likely be temporarily impacted by prescribed burning smoke. They would likely experience higher concentrations of particulate matter during the course of the prescribed burning operation. Impacts generally last from one day to one week depending on the number of acres burned with the day of ignition generating the most smoke.

Table 3.116 - Wind Direction and Areas of Concern

AREAS of CONCERN	WIND DIRECTION from PROJECT to AREA of CONCERN	DISTANCE from PROJECT to AREA of CONCERN	% PROBABILITY of WIND DIRECTION OCCURRENCE
Libby, MT; non-attainment PM 10, 2.5	NE	15 Miles	3%
Whitefish, MT; non-attainment PM10	W	42 Miles	4%
Columbia Falls, MT; non-attainment PM10	W	47 Miles	4%
Kalispell, MT; non-attainment PM10	NW	57 Miles	2%
Thompson Falls, MT; non-attainment PM10	N	60 Miles	4%
Cabinet Mt. Wilderness Class I Airshed	NE	20 Miles	3%

AREAS of CONCERN	WIND DIRECTION from PROJECT to AREA of CONCERN	DISTANCE from PROJECT to AREA of CONCERN	% PROBABILITY of WIND DIRECTION OCCURRENCE
Glacier National Park Class I Airshed	W	57 Miles	4%
Bob Marshall Wilderness Class I Airshed	NW	70 miles	2%

Cumulative Effects

Cumulative effects on air quality from prescribed burning under the action alternatives would result in an incremental decrease in air quality as PM_{10} and $PM_{2.5}$ particles from this project combined with other particles produced by other local and regional sources located upwind. Prescribed burning of logging slash, on other federal, state or private lands, would also contribute particulates, as would agricultural burning and fugitive dust from tilled ground. Particulates from industrial and automotive sources also contribute to regional particulate loading. It is not possible to predict the amount of particulates contributed by these other sources due to the tremendous variation at any given time.

There may be days when regional air quality does not meet the established standards. Because of the Montana/ Idaho Airshed Group's effectiveness at limiting the amount of burning in any given day, it is unlikely that any source associated with this project or any other present or reasonably foreseeable future burning project, would be a significant contributor. This would not be the case in a large wildfire situation.

The production of air pollutants associated with the implementation of this project would vary over time and would not be continuous. Impacts would be episodic in nature and the potential for occurrence would end when the implementation of this project is completed.

CONSISTENCY with REGULATORY FRAMEWORK

All alternatives would be consistent with State and Federal regulations and KNFP standards. The KNFP objectives for air quality are to "Maintain the excellent air quality on the Forest," "Protect local and regional air quality by cooperating with the Air Resources Management Bureau in the Prevention of Significant Deterioration (PSD) program and State Implementation Plan (SIP)," and "Prevent long-term deterioration of the air quality, classified as Class I for the Cabinet Mountains Wilderness, and Class II for the rest of the Forest" (USDA Forest Service 1987a II-6).

RANGE RESOURCE INTRODUCTION

The East Reservoir Planning Area contains four range allotments, the Fivemile, Warland, Cripple Horse and Canyon Creek. The latter two allotments (Cripple Horse and Canyon Creek) have been closed through the administrative closure process due to declining transitory range, lack of demand and riparian area concerns. Cripple Horse and Canyon Creek have been vacant for over ten years. All four allotments were included in the Reservoir Range Environmental Analysis completed in 1997/1998. The Reservoir Range EA permitted grazing on all four allotments from 1998-2008. Fivemile is the only active allotment. The Fivemile Permit was renewed for another ten year period beginning in 2008. The Warland Creek Allotment has been vacant for six years; the permit was waived back to the Forest Service (FS) in 2010. It will be maintained as a vacant allotment with potential for grazing in the foreseeable future.

The Fivemile Allotment supports 17 cow/calf pair with a grazing season of June 1 - October 15. Much of the grazing is on private land owned by the permit holder along Fivemile Creek and upland areas adjacent to Blue Sky Road #6271 and in the Upper Fivemile drainage along Road #4893. A Designated Monitoring Area (DMA) was established during the 2010 grazing season on Fivemile Creek immediately below the permit holder's private land boundary. Monitoring of the DMA and accompanying fish habitat monitoring will establish trend information for the riparian and stream channel conditions on the Fivemile Allotment.

The analysis area for effects to the range resource will be the Fivemile Allotment. A map of the allotment in relation to the East Reservoir Planning Area is located in the Project File.

The Fivemile Allotment has been active since the 1950s or before. This 8,400-acre allotment straddles the mainstem of Fivemile Creek. The topography consists of steep hillsides surrounding a narrow riparian stream bottom. Elevations range from 2,700 to 4,800 feet.

Historically, cattle forage mainly consisted of grasses along roadsides, in a few scattered, harvest-created openings with gentler slopes, and in the private land in the stream bottom.

EXISTING CONDITIONS and TRENDS

Most of the allotment is covered by mixed conifer forests in various successional stages. Suitable range occurs on roadsides, open coniferous stands and early successional stands up to 30 years old generally on slopes less than 30%. Acres of suitable range were figured using data calculated in the Pinkham Ridge Range Allotment (USDA 1997) and the South End Allotments (USDA 1995). Calculations are based on the premise that each different range type produces different amounts of forage. In cutting units 0-15 years old it is estimated 6.25 acres are needed to support one cow/calf pair for one month. In cutting units 16-30 years old, it is estimated 12.5 acres are needed. These types of units are called primary transitory range. In secondary transitory range, which includes cutting units older than 30 years or units with slopes greater than 30%, it is estimated 33 acres are needed to support a cow/calf pair for one month. Available roadside acres are figured by multiplying all road miles in the allotment by the average roadside use widths (12 feet) and the conversion factor of 0.95 acres (amount needed for a cow/calf pair for one month).

Currently, on the Fivemile Allotment, seven acres of forage are in the 0-15 year age class with less than 30% slope which provides 1 AUM (an Animal Unit Month provides one month’s forage for one cow/calf pair); 125 acres of forage are in the 16-30 year age class with less than 30% slope which provides 10 AUMs; and 1,285 acres of forage openings are over 30 years in age or on slopes greater than 30% providing 39 AUMs; and 30 miles of roadsides provide approximately 87 acres of forage and 83 AUMs. The currently available forage equates to 133 AUMs. A downward trend in forage availability over the past decade has resulted from forest growth in previously harvested units equating to about 40 AUMs. Grazing utilization on the Fivemile Allotment is low along roadsides and moderate along the riparian

bottom. Much of the National Forest portion of the riparian bottom is not attractive to grazing because of a dense forest overstory with very little grass understory. Overall condition of the range remains good. Monitoring of the riparian bottom will continue.

ENVIRONMENTAL CONSEQUENCES

ALTERNATIVE 1 (No-Action)

Direct and Indirect Effects

Alternative 1 would not propose any management activity at this time. On the Fivemile Allotment, roadside forage would continue to be available to cattle on about 87 acres. Over time, the younger more open harvest units would decrease in forage production as trees shade out the grasses. The estimated seven acres that are currently 0-15 years old would decrease slightly in forage production; the 125 acres that are currently 16-30 years old would have a moderate to high decrease in forage production over the next 10 years. Without "replacement" forage created by management activities, forage availability would trend downwards on approximately 130 acres of forage openings equating to an estimated 6 AUM decrease over the next 10 years. The current available forage is likely to support the permitted number of cattle over the next 10-year period. However, eventually, the loss of a regular influx of newly created openings that provide forage would result in long-term decreased carrying capacity and subsequent reduction of permitted cattle or a reduced grazing season.

EFFECTS COMMON to ALTERNATIVES 2 and 3

Vegetation management activities proposed in the action alternatives would create new forage opportunities at varying levels. Regeneration-type treatments such as seedtree and shelterwood methods would open up stands the most and provide the highest increase in forage production (about 6.25 acres would provide 1 AUM). Intermediate harvest treatments such as understory thinning, prescribed burning, and improvement harvests would provide moderate to high increases in forage production (ranging from 6.25 to 12.5 acres providing 1 AUM).

Even though forage may increase after harvest and burning activities, the ability of cattle to utilize new forage would be tempered by other site-specific factors such as slope, access and proximity to water. The majority of treatments proposed in the Fivemile Allotment are on slopes greater than 30% which greatly limits the access for livestock grazing. The prescribed burns being proposed under Alternatives 2 and 3 are also mainly on the steeper south-facing slopes of the allotment.

Road management changes proposed within the Fivemile Allotment under Alternatives 2 and 3 would not affect management activities within the allotment. No new road construction or temporary construction is proposed within the allotment.

No recreation developments are proposed within the Fivemile Allotment.

ALTERNATIVE 2

Direct and Indirect Effects

Based on access, treatment type and slope, Alternative 2 is expected to improve forage on about 649 acres over the next 10 years; only 110 acres of the proposed treatment are on slopes less than 30%. This includes about 274 acres (41 acres on slopes <30%) of commercial thinning and fuels treatment which would create a moderate to high forage increase, and about 375 acres (31 acres on slopes <30%) of seedtree harvest which would create a high increase in forage (refer to the Project File for specific unit information). The same decreases in 130 acres of existing forage described under Alternative 1 (no-action) would still occur as stands matured, however, unlike the no-action alternative, Alternative 2 would "replace" that decline with new forage equating to approximately 28 AUMs. Range resources would benefit most under this action alternative.

ALTERNATIVE 3

Direct and Indirect Effects

Alternative 3 is expected to improve forage on about 410 acres over the next 10 years; only 55 acres of the proposed treatment are on slopes less than 30%. This includes about 206 acres (27 acres on slopes <30%) of understory fuels treatment creating a moderate to high forage increase and about 205 acres (28 acres on slopes <30%) of regeneration harvest creating a high increase in forage (refer to the Project File for specific unit information). The same decreases in 130 acres of existing forage described under Alternative 1 (no-action) would still occur as stands matured. Alternative 3 is similar to Alternative 2 in effects to forage availability, but to a lesser degree. Forage production increases would provide 17 additional AUMs over the next 10 years.

Cumulative Effects

The list of past, current and reasonably foreseeable actions identified in Chapter 3 (pg. 3-1 to 3-7) of this DEIS were considered for cumulative effects. Past and current vegetation and fuel management actions such as timber sales that opened forests or created new openings were used to determine the existing condition of forage availability for range resources, including the age of forage openings and when the declining forage would be expected. No adverse cumulative effects of vegetation management, fuels reduction or prescribed fires with this project were identified for the range resource.

Noxious weed treatments generally occur along roads and in some management units. Removal of noxious weeds would allow suppressed native and introduced forage grasses to grow more vigorously, thereby improving roadside forage availability. This would result in cumulatively beneficial effects to range resources.

Road maintenance activities such as blading or road reconditioning can temporarily reduce forage availability. There can be a direct but short-term reduction of forage due to maintenance, but cumulatively with this project there would be no adverse effects to range resources because of the low level of maintenance activities that would occur and the short-term effects these activities would have. The road systems and forage areas provide more than adequate forage to offset a short-term reduction.

Activities unrelated to vegetation changes such as recreational use, site improvements, administrative use, special uses, public use, etc., generally do not have adverse effects to cattle use of the allotment. There is a potential for human disturbance such as harassment or even mortality, however, this is a result of the presence of humans unrelated to the cumulative effects surrounding this project.

No other cumulative effects to range resources with this project were identified.

CONSISTENCY with REGULATORY FRAMEWORK

The Kootenai National Forest Plan has a goal to “provide forage to meet all anticipated demand for domestic livestock grazing (USDA Forest Service 1987, II-2). Over time, the no-action - Alternative 1 - would not be consistent with this goal. Alternatives 2 and 3 would all contribute to this goal by providing a continued influx of forage-producing treatments to meet grazing needs through time.

There are no other laws or regulations applicable to range resources.

SCENIC RESOURCE INTRODUCTION

In 1998, Chief of the Forest Service Michael Dombeck re-affirmed the Agency's commitment to scenic resource management. At that time he displayed a "natural resource agenda" to chart future resource management (FS-630, A Nation's Natural Resource Legacy). Of the four resource areas emphasized in this publication, recreation had as its highest priority, "Improving the settings for outdoor recreation and enhancing visitor experiences".

Effects analysis for scenic resources is performed using the Forest Service Scenery Management System (USDA Forest Service 1995). This system compares the visual appearance of a proposed action to the landscape character and existing condition of the surrounding area. As part of this analysis, Scenic Integrity Levels (SILs) are inventoried and mapped for the activity areas. The SIL defines the acceptable level of alteration of the landscape character. The degree of alteration is measured in terms of the noticeability of scenic contrast with the surrounding natural landscape.

This system of analysis is used to estimate the effects of human caused changes to the scenic resource; it is not used to estimate the effects of natural change (disease, fire, insects, wind, etc.). Natural change is considered an integral part of the natural landscape character of an area - neither good or bad, nor pretty or ugly.

Scenic Integrity Objectives (SIOs) are developed in an interdisciplinary setting by a team during project planning. The SIOs for an area does not change even though human-caused changes may alter the scenic integrity levels.

The Kootenai National Forest Plan (KNFP) prescribes Visual Quality Objectives (VQOs) for each Management Area (MA). These VQOs may be more or less restrictive than what would be inventoried based on the Scenery Management System (SMS). This analysis describes what the effects to the scenic resource are and whether or not the alternatives meet KNFP VQO standards and Scenic Integrity Levels.

MODERATE (Mod) Scenic Integrity equates to a **PARTIAL RETENTION (PR)** Visual Quality Objective. Moderate scenic integrity refers to landscapes where the valued landscape character "appears slightly altered". Noticeable deviations must remain visually subordinate to the landscape character being viewed.

LOW (L) Scenic Integrity equates to a **MODIFICATION (Mod)** Visual Quality Objective. Low scenic integrity refers to landscapes where the natural-appearing landscape character "appears moderately altered". Deviations from the natural-appearing character begin to dominate the viewing area, and they may incorporate valued landscape character attributes from outside the viewing area such as size, shape, edge effect, and pattern of natural openings, or vegetative type changes. However, these deviations must also be compatible or complimentary to the natural landscape character within the viewing area.

VERY LOW (VL) Scenic Integrity equates to a **MAXIMUM MODIFICATION (MM)** Visual Quality Objective. Very low scenic integrity refers to landscapes where the natural-appearing landscape character "appears heavily altered". Deviations from the natural-appearing character may strongly dominate the viewing area, and they may not incorporate valued landscape character attributes such as size, shape, edge effect, and pattern of natural openings, or vegetative type changes from within or outside the viewing area. However, these deviations must be shaped and blended with the natural terrain (landforms) so that elements such as unnatural edges, roads, landings, and structures do not dominate the composition.

UNACCEPTABLY LOW (UL) scenic integrity refers to landscapes where the natural-appearing landscape character appears extremely altered. Deviations are extremely dominant and incorporate little if any form, line, color, texture or scale from the natural-appearing landscape character of the viewing area. Landscapes at this level of integrity need rehabilitation. This level should only be used

to inventory existing integrity. It must not be used as a management objective.

NATURAL LANDSCAPE CHARACTER

The East Reservoir analysis area consists of the following drainages: Fivemile Creek, Warland Creek, Cripple Horse Creek, Canyon Creek and Dunn Creek. These drainages flow from east to west. Scenic analysis is focused on activity areas for this project, so the headwaters of drainages in the area will not be discussed. These drainages are deeply incised by their streams and the ridgelines have fairly gentle slopes. Side slopes between these two features are generally steep. Prominent features are Stenerson Mountain (5,828 feet), Mineral Mountain (5,588 feet), Sheep Mountain (5,761 feet), Davis Mountain (6,051 feet), Warland Peak (5,950 feet), Boundary Mountain (5,955 feet), Cripple Horse Mountain (5,422 feet), Richards Mountain (6,005 feet), Dunn Peak (5,762 feet) and Hornet Ridge. Numerous spur ridges come off the main ridges and trend north and south to lower elevations. The south and west aspects of the analysis area have numerous small natural openings in a ponderosa pine and Douglas-fir canopy. The north and east aspects have a nearly continuous canopy of Douglas-fir, larch and lodgepole pine. This tree canopy is broken sharply by drainages. Montana State Highway (MSH) 37 is a favored drive by recreationists at all seasons, and is designated as a National and State Scenic Byway. Seasonal color variation is most pronounced in late September when cottonwoods in the creek bottoms turn a brilliant yellow and mid-October when western larch on northerly aspects turn a brilliant gold. The Cripple Horse - Canyon Loop drive on Forest Roads #835/4912 is favored by the public for its fall color displays due to the high percentage of western larch in the forest canopy. There are several major rock forms visible in this analysis area, especially along Lake Koocanusa, from on the ground views.

EXISTING SCENIC CONDITION

The sensitivity of the East Reservoir area viewshed is determined by the high percentage/acres of Forest Service (FS) ownership and seen area as viewed from Sensitivity Level (SL) 1 or 2 travel routes. SL1 travel routes are primary travel routes, use areas, or water bodies where at least ¼ of users have major concern for scenic qualities. SL2 travel routes are primary travel routes, use areas, or water bodies where less than ¼ of users have major concern for scenic qualities. SL3 are secondary travel routes, use areas and water bodies where less than ¼ of users have major concerns for scenic qualities. Land management activities (road construction, tree harvest) through time have incorporated scenery mitigation techniques. Large geometric shaped tree harvest units (seed tree, clearcut) are found predominantly in the headwaters of the drainages on north/east aspects and are viewed mostly from local roads. These have uncharacteristic form/line and do not mimic the natural openings present. The SIL for this area is moderate to low. A small percentage of the analysis area is viewed from Montana Highway 37 (National Scenic Byway) and Koocanusa Reservoir (SL1). There are no SL2 travel routes inventoried for this analysis area. A high percentage of the area is viewed from SL3 travel routes at a middle ground distance. Middle-ground views are significant to the public because these are the most noticeable in their travels to/through the Kootenai National Forest (KNF).

DESIRED FUTURE LANDSCAPE CHARACTER

Vegetative diversity is especially desirable to introduce on the north and east aspects of the watersheds where homogenous canopies currently dominate. Vegetation manipulations must avoid large geometric shapes that result in uncharacteristic form or harsh lines. Western larch should be a key species to retain or perpetuate for its fall color displays. On south and west aspects, vegetative manipulation should mimic the numerous small openings present. Mature Ponderosa pine is the key species to retain, especially along roads and trails. No road cut/fill slopes should be visible from any SL1 travel route (MSH 37 Scenic Byway) or use area (Lake Koocanusa).

VIEWING AREAS

Montana State Highway (MSH) 37 and Lake Koocanusa are the major north-south travel route and use area near the west side of the analysis area. They are inventoried as SL1 (high sensitivity) travel route due to its yearlong access link between Libby and Eureka, and the recreation access and use

afforded the public. That portion of MSH 37 through the analysis area is part of a designated Scenic Byway. Along MSH 37 there are scenic turnouts with signs and parking areas. These are located at milepost 18.7, 21.2, 26.1, 28.1 and 30.1. Views from these turnouts focus' on Lake Koocanusa and NFS lands on the west side of the eservoir. All views of the analysis area in the vicinity of proposed actions from this travel route and use area are at foreground (0-1/2 mile) and middle-ground (1/2-4 miles) distances. Visibility of the analysis area is determined by landform without vegetation considered. MSH 37 and Lake Koocanusa is positioned near the toe of the slope, thereby providing inferior viewer positions of the analysis area. Views of management activities during the snow cover months (November-April) are most sensitive as form (size/shape) and line are well defined. Views of significant portions of the analysis area are screened from the MSH 37 corridor by topography. VQOs for areas seen from this road range from partial retention to modification. The SMS SIO for areas viewed from this roads range from moderate to low scenic integrity.

Fivemile Creek, Warland Creek, Cripple Horse Creek, Canyon Creek, and Dunn Creek Roads - These west-east access roads are open to public motorized use yearlong through the drainages. These roads link MSH 37and residential areas with trailheads located near the headwaters, and are classified as a SL3 (low sensitivity) travel route. Views of proposed actions are at foreground, and middle-ground distances from these roads. KNFP VQOs for areas seen from these roads range from modification to maximum modification. Scenic integrity levels (SILs) for areas seen from this road ranges from low to very low scenic integrity.

The remaining parts of the analysis area are difficult to view from these travel routes due to topographic screening. However, they may be viewed from FS and Plum Creek Timber Company "local" roads at foreground and middle-ground distances. Such areas have a KNFP VQO of maximum modification. SILs for areas seen from local roads range have a very low scenic integrity.

Richards Mountain 97, Warland Ridge 279, Warland Peak LO 280, Cripple Horse 281, Canyon Divide 420, Hornet Ridge 500 – These trails traverse the main ridges through the analysis area. Views from these trails are generally screened by trees, except where the trails cross open grassy parks near prominent mountain summits. In this area, proposed treatment areas are viewed from a superior view angle. Other hiking trails in the analysis area are positioned near the valley floor or within incised drainages where views of the analysis area are limited.

ENVIRONMENTAL CONSEQUENCES

ALTERNATIVE 1 (No-Action)

Direct and Indirect Effects

No-action would leave the area in the same condition in the short-term. The middle-ground views from MSH 37 and Lake Koocanusa would change over time with the growth of trees in previously harvested areas. The views of management activities seen from these routes/use areas would be obscured as tree growth approached 15 feet high. This is estimated to take 15-20 years or more.

Cumulative Effects

Alternative 1 is not envisioned to cumulatively affect the scenic resources of the analysis area.

CONSISTENCY with the FOREST PLAN

This alternative is consistent with the Kootenai National Forest Plan.

ALTERNATIVE 2 – Proposed Action

The proposed action consists of 312 tree harvest areas for 6,589 acres (Tables 2.0, 2.2, 2.3), 27 commercial thinning areas for 2,256 acres, 18 fuel treatment areas for 1,378 acres (Table 2.4), 238 precommercial thinning areas for 5,563 acres (Table 2.1) and 33 Fuel and Wildlife treatment areas for 10,049 acres (Table 2.5). The purpose of these treatments is to regenerate decadent stands, improve forest health by reducing tree density, and reduce fuel loadings to more natural historic levels. To facilitate

access to treatment areas, 21 segments of new road totaling 9.25 miles (Table 2.6) would be constructed, and 15 segments of temporary road totaling 4.26 miles (Table 2.7) would be constructed. Following treatment, all temporary roads would be recontoured to slope and revegetated.

Direct and Indirect Effects

Table 3.117 displays, by unit, the scenic resource effects of Alternative 2.

Table 3.117 – Scenic Resource Effects and Rationale for Alternative 2

UNIT #	ACRES	MA	VQO/SI.	Rx	VQO ACHIEVED	RATIONALE
1A	11	16	PR/Mod	SW	PR	Proposed shelterwood treatment is located north of Fivemile Creek and west of MSH 37. It is positioned near the toe of the slope on gentle terrain with a southwest aspect. Such treatments regenerate a stand by removing 85% of the canopy and leave 15-20 of the largest, best quality trees/acre for restocking. Treatment would be viewed from MSH 37 at a foreground distance. Due to leave trees and gentle terrain, this treatment would not attract viewer attention. **Marking guides would focus on irregular spacing/clumping of leave trees and the proposed treatment would achieve an enhancement objective.**
2	14	16	PR/Mod	ST	PR	Proposed seedtree treatment is located north of Fivemile Creek near MSH 37. It is positioned near the toe of the slope on gentle terrain on a south aspect with screening to MSH 37. Such treatments regenerate a stand by removing 95% of the canopy and leave 5-10 of the largest, best quality trees/acre for reseeding. Treatment would be viewed from MSH 37 at a foreground distance by south bound traffic. Due to gentle terrain and screening to MSH 37, the proposed treatment would not attract viewer attention.
3	27	16	PR/Mod	ST	Mod	Proposed seedtree treatment is located north of Fivemile Creek adjacent to MSH 37. It is positioned near the toe of the slope on gentle terrain with a west aspect. Such treatments regenerate a stand by removing 95% of the canopy and leave 5-10 of the largest, best quality trees/acre for reseeding. Treatment would be viewed from MSH 37 at a foreground distance. **A minimum of 15 trees/acre in clumps and leave islands of smaller trees for vertical structure would be left to meet VQOs.** Due to leave trees and gentle terrain, this proposed treatment would not attract viewer attention.
3c	13	11	Mod/Low	ST	Mod	Proposed seedtree treatment is located north of Fivemile Creek near private land. It is positioned near the toe of the slope on gentle terrain with a south aspect. Such treatments regenerate a stand by removing 95% of the canopy and leave 5-10 of the largest, best quality trees/acre for reseeding. Treatment would be viewed from Fivemile Creek Road 48 at a foreground distance. Due to gentle terrain and viewing distance from a SL3 road, the proposed treatment would not attract attention.
6	11	17	PR/Mod	ST	Mod	Proposed seedtree treatment is located south of Fivemile Creek adjacent to MSH 37. It is positioned near the toe of the slope on gentle terrain on a north aspect. Such treatments regenerate a stand by removing 95% of the canopy and leave 5-10 of the largest, best quality trees/acre for reseeding. Treatment would be viewed from MSH 37 at a foreground distance. **A minimum of 15 trees/acre in clumps and leave islands of smaller trees for vertical structure would be left to meet VQOs.** Due to leave trees and gentle terrain, this proposed treatment would not attract viewer attention.
7	19	17	PR/Mod	ST	Mod	Proposed seedtree treatment is located south of Fivemile Creek near MSH 37. It is positioned near the toe of the slope on gentle terrain on a north aspect. Such treatments regenerate a stand by removing 95% of the canopy and leave 5-10 of the largest, best quality trees/acre for reseeding. Treatment would be viewed from MSH 37 at a foreground distance. **A minimum of 15 trees/acre in clumps would be left to meet VQOs.** Due to leave trees and gentle terrain, this proposed treatment would not attract viewer attention.

UNIT #	ACRES	MA	VQO/SI.	Rx	VQO ACHIEVED	RATIONALE
8	13	16	PR/Mod	ST	Mod	Proposed seedtree treatment is located south of Fivemile Creek near MSH 37. It is positioned on the lower 1/3 of the slope with face terrain on a north aspect. Such treatments regenerate a stand by removing 95% of the canopy and leave 5-10 of the largest, best quality trees/acre for reseeding. Treatment would be viewed from MSH 37 at a foreground distance by south bound traffic. **A minimum of 15 trees/acre in clumps would be left to meet VQOs.** Due to leave trees, low slope position and gentle terrain, this proposed treatment would not attract viewer attention.
13	22	15	MM/VL	ST	Mod	Proposed seedtree treatment is located south of Warland Creek near private property. It is positioned low on the slope with face terrain on a north aspect. Such treatments regenerate a stand by removing 95% of the canopy and leave 5-10 of the largest, best quality trees/acre for reseeding. Treatment would be viewed from Warland Creek Road 566 at a foreground distance. Due to leave trees, low slope position and view from a SL3 road, this proposed treatment would not attract viewer attention.
14	40	15	MM/VL	ST	MM	Proposed seedtree treatment is located south of Warland Creek near private property. It is positioned low on the slope with face terrain on a north aspect. Such treatments regenerate a stand by removing 95% of the canopy and leave 5-10 of the largest, best quality trees/acre for reseeding. Treatment would be viewed from Warland Creek Road 566 at a foreground distance. Due to leave trees, low slope position and view from a SL3 road, this proposed treatment would not attract viewer attention.
14A	26	15	MM/VL	SW	Mod	Proposed shelterwood treatment is located south of Warland Creek and adjacent to private land. It is positioned low on the slope on face terrain with a north aspect. Such treatments regenerate a stand by removing 85% of the canopy and leave 15-20 of the largest, best quality trees/acre for restocking. Treatment would be viewed from Warland Creek Road 566 at a foreground distance. Due to leave trees and low slope position, this treatment would not attract viewer attention. **Marking guides would focus on irregular spacing/ clumping of leave trees and the proposed treatment would achieve a partial retention objective.**
16	29	17	PR/Mod	SW	PR	Proposed shelterwood treatment is located south of Warland Creek and adjacent to MSH 37. It is positioned low on the slope on gentle terrain with a northwest aspect. Such treatments regenerate a stand by removing 85% of the canopy and leave 15-20 of the largest, best quality trees/acre for restocking. Treatment would be viewed from MSH 37 at a foreground distance. Due to leave trees and gentle terrain, this treatment would not attract viewer attention. **Marking guides would focus on irregular spacing/clumping of leave trees and the proposed treatment would achieve an enhancement objective.**
18	40	17	PR/Mod	SW	PR	Proposed shelterwood treatment is located north of Cripple Horse Creek and adjacent to MSH 37. It is positioned near the toe of the slope on gentle terrain with a southwest aspect. Such treatments regenerate a stand by removing 85% of the canopy and leave 15-20 of the largest, best quality trees/acre for restocking. Treatment would be viewed from MSH 37 at a foreground distance. Due to leave trees and gentle terrain, this treatment would not attract viewer attention. **Marking guides would focus on irregular spacing/clumping of leave trees and the proposed treatment would achieve an enhancement objective.**
36	41	15	MM/VL	ST	MM	Proposed seedtree treatment is located south of Cripple Horse Creek and two miles east of MSH 37. It is positioned near the toe of the slope on gentle terrain on a northwest aspect. Such treatments regenerate a stand by removing 95% of the canopy and leave 5-10 of the largest, best quality trees/acre for reseeding. Treatment would be

UNIT #	ACRES	MA	VQO/SI.	Rx	VQO ACHIEVED	RATIONALE
						viewed from Cripple Horse Creek Road 835 at a foreground distance. Due to leave trees, low slope position and view from a SL3 road, this proposed treatment would not attract viewer attention.
39	40	15	MM/VL	ST	MM	Proposed seedtree treatment is located south of Canyon Creek and high on Hornet Ridge. It is positioned at mid-slope on face terrain on a north aspect. Such treatments regenerate a stand by removing 95% of the canopy and leave 5-10 of the largest, best quality trees/acre for reseeding. Treatment would be viewed from the Canyon-Dunn road 4913 at a foreground distance. Due to leave trees, irregular unit boundaries, and view from a SL3 road, this proposed treatment would not attract viewer attention.
40	156	15	MM/VL	ST	UM	Proposed seedtree treatment is located south of Canyon Creek and high on Hornet Ridge. It is positioned at mid-slope on face terrain on a north aspect. Such treatments regenerate a stand by removing 95% of the canopy and leave 5-10 of the largest, best quality trees/acre for reseeding. Treatment would be viewed from the Canyon-Dunn Road 4913 at a foreground distance. **Due to large unit size, face terrain, leave trees, and view from a SL3 road, this proposed treatment would NOT meet KNFP standards for scenic resources.**
41	40	15	MM/VL	CC	MM	Proposed clearcut treatment is located south of Canyon Creek on Hornet Ridge. It is positioned near mid-slope on gentle terrain on a north aspect. Such treatments regenerate a stand by removing 98% of the canopy and leave 2-3 trees/acre for wildlife habitat. Treatment would be viewed from the Canyon-Dunn Road 4913 at a foreground distance. Due to gentle terrain, irregular unit boundaries, and view from a SL3 road, this proposed treatment would not attract viewer attention.
44	28	11	Mod/Low	SW	PR	Proposed shelterwood treatment is located north of Dunn Creek and adjacent to Dunn Creek Road 525. It is positioned low on the slope on gentle terrain with a west aspect. Such treatments regenerate a stand by removing 85% of the canopy and leave 15-20 of the largest, best quality trees/acre for restocking. Treatment would be viewed from the Dunn Creek Road 525 at a foreground distance. Due to leave trees and gentle terrain, this treatment would not attract viewer attention. **Marking guides would focus on irregular spacing/clumping of leave trees and the proposed treatment would achieve an enhancement objective.**
45B	39	12	MM/VL	ST	MM	Proposed seedtree treatment is located north of Dunn Creek and south of the BPA power line. It is positioned near the top of the slope on steep terrain on a west aspect. Such treatments regenerate a stand by removing 95% of the canopy and leave 5-10 of the largest, best quality trees/acre for reseeding. Treatment would be viewed from the Canyon-Dunn Road 4913 at a middle-ground distance. Due to leave trees, and view from a SL3 road, this proposed treatment would not attract viewer attention.
46	37	12	MM/VL	ST	MM	Proposed seedtree treatment is located north of Dunn Creek and south of the BPA power line. It is positioned near the top of the slope on gentle terrain on a west aspect. Such treatments regenerate a stand by removing 95% of the canopy and leave 5-10 of the largest, best quality trees/acre for reseeding. Treatment would be viewed from the Canyon-Dunn Road 4913 at a foreground distance. Due to leave trees, gentle terrain, and view from a SL3 road, this proposed treatment would not attract viewer attention.
47	40	12	MM/VL	ST	MM	Proposed seedtree treatment is located north of Dunn Creek and south/adjacent to the BPA power line. It is positioned near the top of the slope on gentle terrain on a southwest aspect. Such treatments regenerate a stand by removing 95% of the canopy and leave 5-10 of the largest, best quality trees/acre for reseeding. Treatment would be viewed from the BPA Powerline Road at a foreground distance. Due to leave trees, gentle terrain, and view from a SL3 road, this proposed

UNIT #	ACRES	MA	VQO/SI.	Rx	VQO ACHIEVED	RATIONALE
						treatment would not attract viewer attention.
51	7	12	MM/VL	ST	Mod	Proposed seedtree treatment is located south of Warland Creek near its headwaters. It is positioned low on the slope on gentle terrain on a north aspect. Such treatments regenerate a stand by removing 95% of the canopy and leave 5-10 of the largest, best quality trees/acre for reseeding. Treatment would be viewed from Warland Creek Road 566 at a foreground distance. Due to leave trees, low slope position, unit size and view from a SL3 road, this proposed treatment would not attract viewer attention
52A	24	12	MM/VL	ST	MM	Proposed seedtree treatment is located south of Warland Creek near its headwaters. It is positioned low on the slope on gentle terrain on a north aspect. Such treatments regenerate a stand by removing 95% of the canopy and leave 5-10 of the largest, best quality trees/acre for reseeding. Treatment would be viewed from the Warland Creek Road 4891 at a foreground distance. Due to leave trees, low slope position, gentle terrain, and view from a SL3 road, this proposed treatment would not attract viewer attention.
53	40	12	MM/VL	ST	MM	Proposed seedtree treatment is located south of Warland Creek near its headwaters. It is positioned near the toe of the slope on gentle terrain on a north aspect. Such treatments regenerate a stand by removing 95% of the canopy and leave 5-10 of the largest, best quality trees/acre for reseeding. Treatment would be viewed from the Warland Creek Road 4891 at a foreground distance. Due to leave trees, gentle terrain, and view from a SL3 road, this proposed treatment would not attract viewer attention.
54	9	15	MM/VL	ST	Mod	Proposed seedtree treatment is located south of Warland Creek near the ridge line. It is positioned high on the slope on gentle terrain on a north aspect. Such treatments regenerate a stand by removing 95% of the canopy and leave 5-10 of the largest, best quality trees/acre for reseeding. Treatment would be viewed from Warland Creek Road 4891 at a foreground distance. Due to leave trees, small unit size and view from a SL3 road, this proposed treatment would not attract viewer attention.
59	39	15	MM/VL	ST	MM	Proposed seedtree treatment is located northwest of Davis Mountain and east of the Lake Creek Road 4424. It is positioned at mid-slope on gentle terrain with a southwest aspect. Such treatments regenerate a stand by removing 95% of the canopy and leave 5-10 of the largest, best quality trees/acre for reseeding. Treatment would be viewed from the Lake Creek road at a foreground distance. Due to leave trees, gentle terrain and view from a SL3 road, this proposed treatment would not attract viewer attention.
61	19	15	MM/VL	CC	MM	Proposed clearcut treatment is located north of Davis Mountain and east of the Lake Creek Road 4424. It is positioned at the top of the slope on gentle terrain with a west aspect. Such treatments regenerate a stand by removing 98% of the canopy and leave 2-3 trees/acre for wildlife habitat. Treatment would be viewed from the Lake Creek Road at a middle ground distance. Due to irregular unit shape, gentle terrain and viewing from a SL3 road, this treatment would not attract viewer attention.
62	77	15	MM/VL	ST	MM	Proposed seedtree treatment is located northwest of Davis Mountain and east of the Lake Creek Road 4424. It is positioned at mid-slope on gentle terrain with a west aspect. Such treatments regenerate a stand by removing 95% of the canopy and leave 5-10 of the largest, best quality trees/acre for reseeding. Treatment would be viewed from the Lake Creek Road at a middle ground distance. Due to leave trees, irregular unit boundaries, and view from a SL3 road, this proposed treatment would not attract viewer attention.
64	8	15	MM/VL	ST	Mod	Proposed seedtree treatment is located near the headwaters of Fivemile Creek and west of the Lake Creek Road 4424. It is positioned at the toe of the slope on steep terrain with a west aspect.

UNIT #	ACRES	MA	VQO/SI.	Rx	VQO ACHIEVED	RATIONALE
						Such treatments regenerate a stand by removing 95% of the canopy and leave 5-10 of the largest, best quality trees/acre for reseeding. Treatment would be viewed from the Lake Creek Road at a foreground distance. Due to leave trees, small unit size and viewing from a SL3 road, this treatment would not attract viewer attention
64A	28	15	MM/VL	ST	MM	Proposed seedtree treatment is located near the headwaters of Fivemile Creek and east of the Lake Creek Road 4424. It is positioned near the toe of the slope on gentle terrain with a northwest aspect. Such treatments regenerate a stand by removing 95% of the canopy and leave 5-10 of the largest, best quality trees/acre for reseeding. Treatment would be viewed from the Lake Creek Road at a foreground distance. Due to leave trees, gentle terrain and viewing from a SL3 road, this treatment would not attract viewer attention.
64B	10	15	MM/VL	ST	Mod	Proposed seedtree treatment is located near the headwaters of Fivemile Creek and east of the Lake Creek Road 4424. It is positioned at the toe of the slope on gentle terrain with a west aspect. Such treatments regenerate a stand by removing 95% of the canopy and leave 5-10 of the largest, best quality trees/acre for reseeding. Treatment would be viewed from the Lake Creek Road at a foreground distance. Due to leave trees, small unit size and viewing from a SL3 road, this treatment would not attract viewer attention.
68	25	16	MM/VL	CC	MM	Proposed clearcut treatment is located south of the Fivemile Creek and adjacent to private land. It is positioned near the toe of the slope on gentle terrain with a north aspect. Such treatments regenerate a stand by removing 98% of the canopy and leave 2-3 trees/acre for wildlife habitat. Treatment would be viewed from the Fivemile Creek Road 48 at a foreground distance. Due to gentle terrain and viewing from a SL3 road, this treatment would not attract viewer attention.
69	16	16	Mod/L	ST	Mod	Proposed seedtree treatment is located south of Fivemile Creek and 1.5 miles east of MSH 37. It is positioned low on the slope on steep terrain on a north aspect. Such treatments regenerate a stand by removing 95% of the canopy and leave 5-10 of the largest, best quality trees/acre for reseeding. Treatment would be viewed from Fivemile Creek Road 48 at a foreground distance. Due to leave trees, small unit size and view from a SL3 road, this proposed treatment would not attract viewer attention.
70	14	16	Mod/L	ST	Mod	Proposed seedtree treatment is located south of Fivemile Creek and 1.25 miles east of MSH 37. It is positioned low on the slope on steep terrain on a north aspect. Such treatments regenerate a stand by removing 95% of the canopy and leave 5-10 of the largest, best quality trees/acre for reseeding. Treatment would be viewed from Fivemile Creek Road 48 at a foreground distance. Due to leave trees, small unit size and view from a SL3 road, this proposed treatment would not attract viewer attention.
70T	9	16	Mod/Low	ST	Mod	Proposed seedtree treatment is located south of Fivemile Creek and adjacent to private land. It is positioned low on the slope on gentle terrain on a north aspect. Such treatments regenerate a stand by removing 95% of the canopy and leave 5-10 of the largest, best quality trees/acre for reseeding. Treatment would be viewed from Fivemile Creek Road 48 at a foreground distance. Due to leave trees, small unit size and view from a SL3 road, this proposed treatment would not attract viewer attention.
71	18	16	Mod/L	ST	Mod	Proposed seedtree treatment is located south of Fivemile Creek and one mile east of MSH 37. It is positioned low on the slope on gentle terrain on a north aspect. Such treatments regenerate a stand by removing 95% of the canopy and leave 5-10 of the largest, best quality trees/acre for reseeding. Treatment would be viewed from Fivemile Creek Road 48 at a foreground distance. Due to leave trees and view from a SL3 road, this proposed treatment would not attract viewer attention.

UNIT #	ACRES	MA	VQO/SI.	Rx	VQO ACHIEVED	RATIONALE
72	12	16	Mod/L	ST	Mod	Proposed seedtree treatment is located south of Fivemile Creek and one mile east of MSH 37. It is positioned low on the slope on gentle terrain on a north aspect. Such treatments regenerate a stand by removing 95% of the canopy and leave 5-10 of the largest, best quality trees/acre for reseeding. Treatment would be viewed from MSH 37 at a middle-ground distance. Due to leave trees, small unit size and oblique view angle from MSH 37, this proposed treatment would not attract viewer attention.
73T	31	16	Mod/L	ST	Mod	Proposed seedtree treatment is located south of the South Fork of Cripple Horse Creek. It is positioned at mid-slope on gentle terrain on a north aspect. Such treatments regenerate a stand by removing 95% of the canopy and leave 5-10 of the largest, best quality trees/acre for reseeding. Treatment would be viewed from Boundary Mountain Road 4904 at a foreground distance. Due to leave trees and view from a SL3 road, this proposed treatment would not attract viewer attention.
75	36	15	MM/VL	SW	PR	Proposed shelterwood treatment is located south of the South Fork of Cripple Horse Creek. It is positioned near the toe of the slope on steep terrain with a northeast aspect. Such treatments regenerate a stand by removing 85% of the canopy and leave 15-20 of the largest, best quality trees/acre for restocking. Treatment would be viewed from Boundary Mountain Road 4904 at a foreground distance. Due to leave trees and viewing from a SL3 road, this treatment would not attract viewer attention. **Marking guides would focus on irregular spacing/clumping of leave trees and the proposed treatment would achieve an enhancement objective.**
80	110	16	Mod/L	ST	MM	Proposed seedtree treatment is located south of Cripple Horse Creek above the confluence with the South Fork. It is positioned at mid-slope on face terrain on a north aspect. Such treatments regenerate a stand by removing 95% of the canopy and leave 5-10 of the largest, best quality trees/acre for reseeding. Treatment would be viewed from the MSH 37 south bound traffic at a middle ground distance. **A minimum of 10-15 trees/acre in clumps and leave islands of smaller trees for vertical diversity would be left to meet VQOs. Additionally, the straight line west unit boundary would be made to be irregular with grapple piling proposed.** Due to leave trees/islands and gentle terrain, this proposed treatment would not attract viewer attention.
81	36	16	Mod/L	ST	MM	Proposed seedtree treatment is located south of Cripple Horse Creek adjacent to the Cripple Horse Trail #281. It is positioned at mid-slope on face terrain on a west aspect. Such treatments regenerate a stand by removing 95% of the canopy and leave 5-10 of the largest, best quality trees/acre for reseeding. Treatment would be viewed from the MSH 37 at a middle ground distance. **A minimum of 10-15 trees/acre in clumps would be left to meet VQOs. The Cripple Horse trail #281 goes through this unit and it would be protected during all phases of activity.** Due to leave trees and gentle terrain, this proposed treatment would not attract viewer attention.
82	25	16	Mod/L	ST	MM	Proposed seedtree treatment is located south of Cripple Horse Creek. It is positioned at mid-slope on face terrain on a north aspect. Such treatments regenerate a stand by removing 95% of the canopy and leave 5-10 of the largest, best quality trees/acre for reseeding. Treatment would be viewed from the MSH 37 at a middle ground distance. **A minimum of 15 trees/acre in clumps would be left to meet VQOs.** Due to leave trees and gentle terrain, this proposed treatment would not attract viewer attention.
141	24	16	Mod/Low	SW	PR	Proposed shelterwood treatment is located south of Fivemile Creek within two miles of MSH 37. It is positioned at mid-slope on face terrain on a north aspect. Such treatments regenerate a stand by removing 85% of the canopy and leave 15-20 of the largest, best quality trees/acre for restocking. Treatment would be viewed from the

UNIT #	ACRES	MA	VQO/SI.	Rx	VQO ACHIEVED	RATIONALE
						MSH 37 at a middle ground distance. Due to leave trees and oblique view angle from MSH 37, this proposed treatment would not attract viewer attention.
142	9	16	Mod/Low	ST	Mod	Proposed seedtree treatment is located south of Fivemile Creek within two miles of MSH 37. It is positioned at mid-slope on face terrain on a north aspect. Such treatments regenerate a stand by removing 95% of the canopy and leave 5-10 of the largest, best quality trees/acre for reseeding. Treatment would be viewed from the MSH 37 at a middle ground distance. Due small unit size, oblique view angle and leave trees, this proposed treatment would not attract viewer attention.
143A	18	16	Mod/Low	SW	PR	Proposed shelterwood treatment is located south of Fivemile Creek within two miles of MSH 37. It is positioned at mid-slope on face terrain on a north aspect. Such treatments regenerate a stand by removing 85% of the canopy and leave 15-20 of the largest, best quality trees/acre for restocking. Treatment would be viewed from the MSH 37 at a middle ground distance. Due to leave trees and oblique view angle from MSH37, this proposed treatment would not attract viewer attention.
144S	22	16	Mod/Low	ST	Mod	Proposed seedtree treatment is located south of Fivemile Creek within two miles of MSH 37. It is positioned at mid-slope on face terrain on a north aspect. Such treatments regenerate a stand by removing 95% of the canopy and leave 5-10 of the largest, best quality trees/acre for reseeding. Treatment would be viewed from the Fivemile Road 48 at a foreground distance. Due to leave trees and view from a SL3 road, this proposed treatment would not attract viewer attention.
144T	18	16	Mod/Low	ST	Mod	Proposed seedtree treatment is located south of Fivemile Creek within two miles of MSH 37. It is positioned at mid-slope on face terrain on a north aspect. Such treatments regenerate a stand by removing 95% of the canopy and leave 5-10 of the largest, best quality trees/acre for reseeding. Treatment would be viewed from the Fivemile Road 48 at a foreground distance. Due to leave trees and view from a SL3 road, this proposed treatment would not attract viewer attention.
147	93	15	MM/VL	ST	UM	Proposed seedtree treatment is located south of Fivemile Creek, one mile above private property. It is positioned at mid slope on face terrain on a northwest aspect. Such treatments regenerate a stand by removing 95% of the canopy and leave 5-10 of the largest, best quality trees/acre for reseeding. Treatment would be viewed from the Fivemile Road 4893 at a foreground distance. **Due to large unit size, geometric shape, face terrain, leave trees, and view from a SL3 road, this proposed treatment would NOT meet KNFP standards for scenic resources.**
148	77	15	MM/VL	ST	UM	Proposed seedtree treatment is located south of Fivemile Creek, 1.5 miles above private property. It is positioned near the toe of the slope on face terrain on a northwest aspect. Such treatments regenerate a stand by removing 95% of the canopy and leave 5-10 of the largest, best quality trees/acre for reseeding. Treatment would be viewed from the Fivemile Road 4893 at a foreground distance. **Due to large unit size, geometric shape, face terrain, straight unit boundaries, leave trees, and view from a SL3 road, this proposed treatment would NOT meet KNFP standards for scenic resources**.
149	65	15	MM/VL	ST	UM	Proposed seedtree treatment is located south of Fivemile Creek, two miles above private property. It is positioned near the toe of the slope on face terrain on a northwest aspect. Such treatments regenerate a stand by removing 95% of the canopy and leave 5-10 of the largest, best quality trees/acre for reseeding. Treatment would be viewed from the Fivemile Road 4893 at a foreground distance. **Due to large unit size, geometric shape, face terrain, straight unit boundaries, leave trees, and view from a SL3 road, this proposed treatment would NOT meet KNFP standards for scenic resources.**
150	103	15	MM/VL	ST	UM	Proposed seedtree treatment is located south of Fivemile Creek, two

UNIT #	ACRES	MA	VQO/SI.	Rx	VQO ACHIEVED	RATIONALE
						miles above private property. It is positioned near mid slope on face terrain on a northwest aspect. Such treatments regenerate a stand by removing 95% of the canopy and leave 5-10 of the largest, best quality trees/acre for reseeding. Treatment would be viewed from the Fivemile Road 4893 at a foreground distance. **Due to large unit size, geometric shape, face terrain, straight unit boundaries, leave trees, and view from a SL3 road, this proposed treatment would NOT meet KNFP standards for scenic resources.**
151	40	15	MM/VL	ST	MM	Proposed seedtree treatment is located east of the forks of Fivemile Creek and northwest of the Lake Creek Road 4424. It is positioned near the toe of the slope on gentle terrain with a northwest aspect. Such treatments regenerate a stand by removing 95% of the canopy and leave 5-10 of the largest, best quality trees/acre for reseeding. Treatment would be viewed from the Lake Creek Road 4424 at a foreground distance. Due to Leave trees, gentle terrain and viewing from a SL3 road, this treatment would not attract viewer attention. **The upper level (10-12** trees/acre**) of leave trees would be left in this proposed unit. Effort should be made to modify the geometric (square) shape of this proposed unit.**
159A	18	15	MM/VL	ST	MM	Proposed seedtree treatment is located south of Warland Creek and private property. It is positioned at mid-slope on face terrain on a north aspect. Such treatments regenerate a stand by removing 95% of the canopy and leave 5-10 of the largest, best quality trees/acre for reseeding. Treatment would be viewed from MSH 37 at a middle ground distance. Due to leave trees, and oblique view from MSH 37, this proposed treatment would not attract viewer attention.
170	97	15	MM/VL	SW	MM	Proposed shelterwood treatment is located south of Warland Creek, one mile above private property. It is positioned at mid-slope to the ridgeline on steep face terrain on a north aspect. Such treatments regenerate a stand by removing 85% of the canopy and leave 15-20 of the largest, best quality trees/acre for restocking. Treatment would be viewed from the Fivemile Road 4893 at a middle ground distance**.** Due to leave trees and view from a SL3 road, this proposed treatment would not attract viewer attention.
185	27	15	MM/VL	ST	MM	Proposed seedtree treatment is located south of Cripple Horse Creek and Montana State Section 12. It is positioned at mid slope on gentle terrain on a north aspect. Such treatments regenerate a stand by removing 95% of the canopy and leave 5-10 of the largest, best quality trees/acre for reseeding. Treatment would be viewed from MSH 37 at a middle ground distance. Due to leave trees, irregular unit boundaries and gentle terrain, this proposed treatment would not attract viewer attention.
185N	22	15	MM/VL	ST	MM	Proposed seedtree treatment is located south of Cripple Horse Creek and adjacent to Montana State section 12. It is positioned at mid slope on gentle terrain on a northwest aspect. Such treatments regenerate a stand by removing 95% of the canopy and leave 5-10 of the largest, best quality trees/acre for reseeding. Treatment would be viewed from MSH 37 at a middle ground distance. Due to leave trees, irregular unit boundaries and gentle terrain, this proposed treatment would not attract viewer attention.
187	5	15	MM/VL	ST	MM	Proposed seedtree treatment is located south of Cripple Horse Creek at the South Fork confluence. It is positioned at the toe of the slope on gentle terrain on a northeast aspect. Such treatments regenerate a stand by removing 95% of the canopy and leave 5-10 of the largest, best quality trees/acre for reseeding. Treatment would be viewed from Cripple Horse Creek Road 835 at a middle ground distance. Due to leave trees, low slope position and gentle terrain, this proposed treatment would not attract viewer attention.
188	40	16	MM/VL	ST	MM	Proposed seedtree treatment is located south of Cripple Horse Creek at the South Fork confluence. It is positioned at the toe of the slope on

UNIT #	ACRES	MA	VQO/SI.	Rx	VQO ACHIEVED	RATIONALE
						steep terrain on a north aspect. Such treatments regenerate a stand by removing 95% of the canopy and leave 5-10 of the largest, best quality trees/acre for reseeding. Treatment would be viewed from Cripple Horse Creek Road 835 at a middle ground distance. Due to leave trees and low slope position, this proposed treatment would not attract viewer attention Concern should arise when this proposed treatment is viewed in the context of another adjoining large seedtree proposal (Unit 73T).
193	17	11	Mod/Low	SW	PR	Proposed shelterwood treatment is located along the southeast boundary of Montana State Section 14 between Canyon Creek and Cripple Horse Creek. It is positioned near the toe of the slope on gentle terrain with a southwest aspect. Such treatments regenerate a stand by removing 85% of the canopy and leave 15-20 of the largest, best quality trees/acre for restocking. Treatment would be viewed from Canyon-Cripple Horse Road 4925 at a foreground distance. Due to leave trees, gentle terrain and viewing from SL3 road, this treatment would not attract viewer attention. **Marking guides would focus on irregular spacing/clumping of leave trees and the proposed treatment would achieve an enhancement objective.**
207	40	15	MM/VL	SW	Mod	Proposed shelterwood treatment is located south of Canyon Creek and 1.25 miles from MSH 37. It is positioned near the toe of the slope on gentle terrain with a northeast aspect. Such treatments regenerate a stand by removing 85% of the canopy and leave 15-20 of the largest, best quality trees/acre for restocking. Treatment would be viewed from Canyon Creek Road 4912 at a foreground distance. Due to leave trees, gentle terrain and viewing from SL3 road, this treatment would not attract viewer attention. **Marking guides would focus on irregular spacing/clumping of leave trees and the proposed treatment would achieve a partial retention objective.**
208	40	15	MM/VL	ST	MM	Proposed seedtree treatment is located south of Canyon Creek 1.5 miles from MSH. It is positioned at the toe of the slope on gentle terrain on a north aspect. Such treatments regenerate a stand by removing 95% of the canopy and leave 5-10 of the largest, best quality trees/acre for reseeding. Treatment would be viewed from Canyon Creek Road 4912 at a foreground distance. Due to leave trees, gentle terrain and viewing from a SL3 road, this proposed treatment would not attract viewer attention.
214	6	12	MM/VL	ST	Mod	Proposed seedtree treatment is located along the north side of the BPA powerline on Hornet Ridge. It is positioned at mid-slope on Hornet Ridge on a southwest aspect. Such treatments regenerate a stand by removing 95% of the canopy and leave 5-10 of the largest, best quality trees/acre for reseeding. Treatment would be difficult to view from any public travel route due to location. Due to difficulty in viewing, leave trees and unit size, this proposed treatment would not attract viewer attention.
219	38	12	MM/VL	ST	MM	Proposed seedtree treatment is located north of Dunn Creek and northwest of Wyoma Creek. It is positioned at mid-slope in a deeply incised tributary to Dunn Creek on a west aspect. Such treatments regenerate a stand by removing 95% of the canopy and leave 5-10 of the largest, best quality trees/acre for reseeding. Treatment would be difficult to view from any public travel route due to location. Due to difficulty in viewing and leave trees, this proposed treatment would not attract viewer attention.
362	192	12	MM/VL	CC	UM	Proposed clearcut treatment is located in the headwaters of Wyoma Creek near the BPA powerline. It is positioned near the top of Hornet Ridge on gentle terrain with a southwest aspect. Such treatments regenerate a stand by removing 98% of the canopy and leave 2-3 trees/acre for wildlife habitat. Treatment would be viewed from the closed Hornet Ridge Powerline Road #2364 at a foreground distance. **Due to lack of leave trees, large geometric shape and straight unit**

UNIT #	ACRES	MA	VQO/SI.	Rx	VQO ACHIEVED	RATIONALE
						boundaries, this proposed treatment would NOT meet KNFP standards for scenic resources.
363	40	12	MM/VL	CC	MM	Proposed clearcut treatment is located in the headwaters of Snag Gulch near the BPA powerline. It is positioned near the top of Hornet Ridge on gentle terrain with a southwest aspect. Such treatments regenerate a stand by removing 98% of the canopy and leave 2-3 trees/acre for wildlife habitat. Treatment would be viewed from the closed Hornet Ridge Powerline Road #2364 at a foreground distance. Due to remote location and gentle terrain this treatment would not attract viewer attention.
364	33	12	MM/VL	CC	MM	Proposed clearcut treatment is located in the headwaters of Snag Gulch near the BPA powerline. It is positioned near Hornet Ridge on gentle terrain with a southwest aspect. Such treatments regenerate a stand by removing 98% of the canopy and leave 2-3 trees/acre for wildlife habitat. Treatment would be viewed from the closed Hornet Ridge Powerline Road #2364 at a foreground distance. Due to remote location, irregular unit shape and gentle terrain this treatment would not attract viewer attention.
365	25	12	MM/VL	CC	MM	Proposed clearcut treatment is located in the headwaters of Snag Gulch. It is positioned at mid-slope on gentle terrain with a southwest aspect. Such treatments regenerate a stand by removing 98% of the canopy and leave 2-3 trees/acre for wildlife habitat. Treatment would be viewed from the closed Snag Gulch Road #4922 at a foreground distance. Due to remote location, irregular unit shape and gentle terrain this treatment would not attract viewer attention.
366	6	12	MM/VL	CC	Mod	Proposed clearcut treatment is located in the headwaters of Snag Gulch. It is positioned at mid-slope on gentle terrain with a south aspect. Such treatments regenerate a stand by removing 98% of the canopy and leave 2-3 trees/acre for wildlife habitat. Treatment would be viewed from the closed Snag Gulch Road #4922 at a foreground distance. Due to remote location, small unit size, and gentle terrain this treatment would not attract viewer attention.
367	38	12	MM/VL	CC	MM	Proposed clearcut treatment is located north of Dunn Creek. It is positioned at mid-slope on gentle terrain with a southwest aspect. Such treatments regenerate a stand by removing 98% of the canopy and leave 2-3 trees/acre for wildlife habitat. Treatment would be viewed from the closed Snag Gulch Road #4922 at a foreground distance. Due to remote location, and gentle terrain this treatment would not attract viewer attention. **Effort should be made to modify the straight line east boundary.**
367A	40	12	MM/VL	CC	MM	Proposed clearcut treatment is located north of Dunn Creek. It is positioned at mid-slope on gentle terrain with a south aspect. Such treatments regenerate a stand by removing 98% of the canopy and leave 2-3 trees/acre for wildlife habitat. Treatment would be viewed from the closed Snag Gulch Road #4922 at a foreground distance. Due to remote location, and gentle terrain this treatment would not attract viewer attention. **Effort should be made to modify the straight line west boundary.**
368A	11	12	MM/VL	CC	MM	Proposed clearcut treatment is located north of Dunn Creek marsh. It is positioned at mid-slope on gentle terrain with a south aspect. Such treatments regenerate a stand by removing 98% of the canopy and leave 2-3 trees/acre for wildlife habitat. Treatment would be viewed from the closed Snag Gulch Road #4922 at a foreground distance. Due to remote location , irregular shape, and gentle terrain this treatment would not attract viewer attention.
368B	6	12	MM/VL	CC	Mod	Proposed clearcut treatment is located north of Dunn Creek marsh. It is positioned at mid-slope on gentle terrain with a southwest aspect. Such treatments regenerate a stand by removing 98% of the canopy and leave 2-3 trees/acre for wildlife habitat. Treatment would be viewed from the closed Snag Gulch Road #4922 at a foreground

UNIT #	ACRES	MA	VQO/SI.	Rx	VQO ACHIEVED	RATIONALE
						distance. Due to remote location, small unit size, irregular shape, and gentle terrain this treatment would not attract viewer attention.
368C	7	12	MM/VL	CC	Mod	Proposed clearcut treatment is located north of Dunn Creek marsh. It is positioned at mid-slope on gentle terrain with a southwest aspect. Such treatments regenerate a stand by removing 98% of the canopy and leave 2-3 trees/acre for wildlife habitat. Treatment would be viewed from the closed Snag Gulch Road #4922 at a foreground distance. Due to remote location, small unit size, irregular shape, and gentle terrain this treatment would not attract viewer attention.
369	40	12	MM/VL	CC	MM	Proposed clearcut treatment is located near the west end of Hornet Ridge adjacent to the BPA powerline. It is positioned high on the slope on gentle terrain with a southwest aspect. Such treatments regenerate a stand by removing 98% of the canopy and leave 2-3 trees/acre for wildlife habitat. Treatment would be viewed from the closed Hornet Ridge Powerline Road #2364 at a foreground distance. Due to remote location and gentle terrain, this treatment would not attract viewer attention. **Effort should be made to modify the straight line west boundary**

Alternative 2 proposes 72 regeneration harvest treatments (shelterwood, seedtree, clearcut). Sixteen (16) of these treatments are forecasted to positively exceed the KNFP VQO (i.e. a VQO of partial retention is achieved where a VQO of modification is prescribed). Fifty proposed treatments are forecasted to meet the prescribed KNFP VQO. Six (6) proposed treatments are forecasted to not meet the KNFP VQO.

Intermediate Stand Treatments are being proposed to modify existing forest conditions in order to enhance growth, quality, vigor and composition. Such treatments occur prior to stand maturity and are not intended to promote regeneration. The following descriptions are examples of intermediate treatments proposed with this project:

Improvement Harvest is being proposed to improve forest resiliency, composition and quality by reducing tree density. This treatment would retain 50-70% of the existing forest canopy and promote a more open stand structure. The largest, healthiest and best quality trees of desired species are retained. The proposed action proposes 53 improvement harvest treatments totaling 3,565 acres. All of these proposed treatments are forecasted to meet or positively exceed KNFP VQOs due to leave tree quality and density.

Sanitation-Salvage is being proposed to remove diseased trees prior to re-infection and to capture mortality prior to loss of product marketability. Dead and down merchantable trees are harvested. Western larch with high levels of dwarf mistletoe infection are removed. This proposed treatment often mimics the group selection discussed previously. The proposed action proposes six sanitation-salvage treatments totaling 332 acres. All of these proposed treatments are forecasted to meet or positively exceed KNFP VQOs due to leave tree density and small opening size.

Commercial Thinning is being proposed to improve tree growth and enhance forest health by reducing stand density. Thinning normally removes suppressed trees from below the dominant tree canopy. The largest, best quality trees are retained in a fully stocked stand following treatment. The proposed action proposes 27 commercial thinning treatments totaling 2,256 acres (Table 2.2). All of these proposed treatments are forecasted to meet or positively exceed KNFP VQOs due leave tree quality and density.

Precommercial Thinning is being proposed to reduce tree density and improve growing conditions of the retained trees by reducing the competition for light and nutrients. The largest, best quality trees of the desired species are retained in a fully stocked stand following treatment. The proposed action proposes 5,775 acres of precommercial thinning in overstocked, sapling sized trees that were established 15-25 years prior. All of these proposed treatments are forecasted to meet or positively exceed KNFP VQOs due to leave tree quality and density.

Fuel Treatment is being proposed to reduce hazardous fuels by utilizing a combination of prescribed fire and/or mechanical treatments. These treatments are located adjacent to private property and are intended to reduce hazardous fuels in the wild land–urban interface. Such treatments would promote a more open stand structure resistant to crown fire. Small diameter forest products may be removed to enhance burning conditions. The proposed action proposes 18 fuel treatments totaling 1,378 acres (Table 2.4). All of these proposed treatments are forecasted to meet or positively exceed the KNFP VQOs due to leave tree density and slash disposal.

Fuel and Wildlife Treatment is being proposed to reduce hazardous fuels and enhance wildlife habitat by utilizing prescribed fire and mechanical slashing. Some of the proposed treatments may have small diameter forest product removal from gentle slopes. The proposed action proposes 33 fuel treatments on wildlife ranges totaling 10,049 acres (Table 2.5). All of these proposed treatments are forecasted to meet or positively exceed the KNFP VQOs due leave trees, slash disposal and irregular treatment patterns.

New Road Construction is being proposed to access nine proposed harvest units, one fuels unit and to allow Montana Department of State Lands to access their lands. This proposed construction would result in 9.25 miles (Table 2.6) of new permanent roads in the analysis area. Road constructions in this area typically results in the exposure of light colored sub soils on cut and fill slopes. Such construction can be visually obtrusive unless cut and fill slopes are successfully revegetated. Revegetation would be required of any permanent road construction. However, post-treatment monitoring is the only way to assess revegetation success.

Temporary Road Construction is being proposed to access treatment proposals. This proposed construction would result in 15 segments totaling approximately4.26 miles (Table 2.7) of temporary roads. All temporary road construction would be pulled back to the slope contour and revegetated. The key to revegetation success is the storing of topsoil and organic material as a growth medium on the recontoured slope. Visually obtrusive elements of temporary road construction should be short-term with successful recontouring and revegetation.

Cumulative Effects

Alternative 2 would change the visual condition of the East Reservoir area. Drier habitats found on south and west aspects of the analysis area would have subtle texture changes as tree densities were reduced following tree harvest and hazard fuel reduction. Minimal new line and form would be introduced with shelterwood and intermediate stand treatments. All but six (6) regeneration (seedtree, clearcut for 686 acres) harvest treatments would meet or positively exceed KNFP VQOs. This is due to leave tree densities, vegetative screening, blending with natural openings and topographic positioning. Within 15-25 years of the proposed treatments, intermediate/tall shrubs and tree regeneration would be noticeable in the treated areas. Scenic resource effects associated with temporary road construction (approx. 4 miles) to access tree harvest areas would be short-term. Temporary road segments would be pulled back to natural slope contours and revegetated. The effects of permanent road construction would depend upon successful revegetation of cut and fill slopes.

Scenic Quality Management Measures

All of the intermediate stand treatments are forecasted to meet or positively exceed KNFP Visual Quality Objectives. Sixty-six (66) of the 72 regeneration treatment areas would meet or positively exceed the KNFP VQOs. Six (6) regeneration units (clearcut, seedtree) would require modification to meet KNFP VQOs or seek an exemption from KNFP standards. Unit layout could utilize smaller areas, irregular shapes/edges, leave tree islands and gentle slope angles. Units could be marked to leave residual trees with the largest/best formed crowns. Units could be positioned to take advantage of inferior viewer positions, oblique view angles, topographic/vegetative screening, natural openings and revegetated tree harvest areas. The use of these techniques singularly or in combination would yield positive results related to VQOs/SIOs.

Slash disposal adjacent to the Lake Koocanusa Scenic Byway (MSH 37) and Lake Koocanusa is critical to meeting KNFP VQOs.

CONSISTENCY with the FOREST PLAN

All of Alternative 2 proposals meet or positively exceed KNFP VQOs except six (6) proposed regeneration (seedtree, clearcut) harvests totaling 686 acres (Table 3.117). These six units would need to be modified satisfactorily or dropped from Alternative 2 to be consistent with the Forest Plan.

ALTERNATIVE 3

Alternative 3 consists of 124 tree harvest areas for 5,817 acres (Tables 2.15, 2.17), 13 fuel treatment areas for 1,309 acres (Table 2.18), 33 fuels and wildlife treatment areas for 10,049 acres (Table 2.5), precommercial thinning for 5,563 acres (Table 2.16) and 25 commercial thinning areas for 1,965 acres (Table 2.17). The purpose of these treatments is to regenerate decadent stands, improve forest health by reducing tree density, and reduce fuel loadings to more natural historic levels. To facilitate access to treatment areas, nineteen segments of new permanent specified road totaling 8.06 miles (Table 2.19A) would be constructed, and 14 segments of temporary road totaling 4.05 (Table 2.20) miles would be constructed. Following treatment, all temporary roads would be recontoured to slope and revegetated.

Direct and Indirect Effects

Table 3.118 displays, by unit, the scenic resource effects of Alternative 3. Only those units that are a change from Alternative 2 are displayed in Table 3.118.

Table 3.118 - Scenic Resource Effects and Rationale for Alternative 3

UNIT #	ACRES	MA	VQO/SI.	Rx	VQO ACHIEVED	RATIONALE
18	32	17	PR/Mod	ISW	PR	Proposed irregular shelterwood treatment is located north of Cripple Horse Creek and adjacent to MSH 37. It is positioned low on the slope on gentle terrain with a southwest aspect. Such treatments regenerate a stand by removing 85% of the canopy and leave 15-20 of the largest, best quality trees/acre for restocking. Treatment would be viewed from MSH 37 at a foreground distance. Due to leave trees and gentle terrain, this treatment would not attract viewer attention. **Marking guides would focus on irregular spacing/clumping of leave trees and the proposed treatment would achieve an enhancement objective. A high level of slash disposal along MSH 37 would be required to meet KNFP scenic resource objectives.**
40	40	15	MM/VL	ST	MM	Proposed seedtree treatment is located south of Canyon Creek near its headwaters. It is positioned at mid-slope on gentle terrain with a northeast aspect. Such treatments regenerate a stand by removing 95% of the canopy and leave 5-10 of the largest, best quality trees/acre for reseeding. Treatment would be viewed from the open Canyon Creek Road #4912 at a middle-ground distance. Due to leave trees, and gentle terrain, this proposed treatment would not attract viewer attention.
62	40	15	MM/VL	ST	Mod	Proposed seedtree treatment is located northwest of Davis Mountain. It is positioned at mid-slope on gentle terrain with a west aspect. Such treatments regenerate a stand by removing 95% of the canopy and leave 5-10 of the largest, best quality trees/acre for reseeding. Treatment would be viewed from the open Lake Creek Road #4424 at a middle ground distance. Due to leave trees, gentle terrain and view from a SL3 road, this proposed treatment would not attract viewer attention. **The upper level (10-12** trees/acre**) of leave trees would be left in this proposed unit to achieve KNFP scenic resource objectives.**
80	40	16	Mod/lOW	ST	PR	Proposed seedtree treatment is located south of Cripple Horse Creek and 1.5 miles east of MSH 37. It is positioned low on the slope on steep terrain with a northwest aspect. Such treatments regenerate a

UNIT #	ACRES	MA	VQO/SI.	Rx	VQO ACHIEVED	RATIONALE
						stand by removing 95% of the canopy and leave 5-10 of the largest, best quality trees/acre for reseeding. Treatment would be viewed from MSH 37 south bound at a middle-ground distance. Due to leave trees and leave islands, this proposed treatment would not attract viewer attention. **The upper level (10-15** trees/acre**) of leave trees would be left in this proposed unit to achieve KNFP scenic resource objectives.**
143A	9	16	Mod/Low	ST	Mod	Proposed seedtree treatment is located south of Fivemile Creek and two miles east of MSH 37. It is positioned at mid-slope on gentle terrain with a northeast aspect. Such treatments regenerate a stand by removing 95% of the canopy and leave 5-10 of the largest, best quality trees/acre for reseeding. Treatment would be viewed from the open Fivemile Creek Road #48 at a middle ground distance. Due to leave trees, unit shape, and small unit size this proposed treatment would not attract viewer attention.
147	40	15	MM/VL	ST	MM	Proposed seedtree treatment is located south of Fivemile Creek and just below the South Fork headwaters. It is positioned low on the slope on steep terrain with a northwest aspect. Such treatments regenerate a stand by removing 95% of the canopy and leave 5-10 of the largest, best quality trees/acre for reseeding. Treatment would be viewed from the open Fivemile Creek Road #4893 at a foreground distance. Due to leave trees, this proposed treatment would not attract viewer attention. **The upper level (10-12** trees/acre**) of leave trees would be left in this proposed unit to achieve KNFP scenic resource objectives.**
148	40	15	MM/VL	ST	MM	Proposed seedtree treatment is located south of Fivemile Creek and just below the South Fork headwaters. It is positioned low on the slope on steep terrain with a northwest aspect. Such treatments regenerate a stand by removing 95% of the canopy and leave 5-10 of the largest, best quality trees/acre for reseeding. Treatment would be viewed from the open Fivemile Creek Road #4893 at a foreground distance. Due to leave trees, this proposed treatment would not attract viewer attention. **The upper level (10-12** trees/acre**) of leave trees would be left in this proposed unit. Effort should be made to modify the geometric shape (square) of this proposed unit.**
149	40	15	MM/VL	ST	MM	Proposed seedtree treatment is located south of Fivemile Creek and just below the South Fork headwaters. It is positioned low on the slope on steep terrain with a north aspect. Such treatments regenerate a stand by removing 95% of the canopy and leave 5-10 of the largest, best quality trees/acre for reseeding. Treatment would be viewed from the open Fivemile Creek Road #4893 at a foreground distance. Due to leave trees, this proposed treatment would not attract viewer attention. **The upper level (10-12** trees/acre**) of leave trees would be left in this proposed unit. Effort should be made to modify the geometric (square) shape of this proposed unit.**
150	40	15	MM/VL	ST	Mod	Proposed seedtree treatment is located south of Fivemile Creek in the South Fork headwaters. It is positioned at mid-slope on gentle terrain with a northwest aspect. Such treatments regenerate a stand by removing 95% of the canopy and leave 5-10 of the largest, best quality trees/acre for reseeding. Treatment would be viewed from the open Fivemile Creek Road #4893 at a foreground distance. Due to leave trees, this proposed treatment would not attract viewer attention. **The upper level (10-12** trees/acre**) of leave trees would be left in this proposed unit. Effort should be made to modify the geometric (square) shape of this proposed unit.**
170	40	15	MM/VL	ST	MM	Proposed seedtree treatment is located south of Warland Creek and three miles east of MSH 37. It is positioned at mid-slope on gentle terrain with a north aspect. Such treatments regenerate a stand by removing 95% of the canopy and leave 5-10 of the largest, best quality trees/acre for reseeding. Treatment would be viewed from

UNIT #	ACRES	MA	VQO/SI.	Rx	VQO ACHIEVED	RATIONALE
						Warland Creek Road 566 at a middle ground distance. Due to leave trees, this proposed treatment would not attract viewer attention. **Effort would be made to modify the straight line west boundary of this proposed unit.**
188S	10	16	Mod/lOW	ST	Mod	Proposed seedtree treatment is located south of Cripple Horse Creek and two miles east of MSH 37. It is positioned low on the slope on steep terrain on a north aspect. Such treatments regenerate a stand by removing 95% of the canopy and leave 5-10 of the largest, best quality trees/acre for reseeding. Treatment would be viewed from Cripple Horse Creek Road #835 at a middle-ground distance. Due to leave trees and view from a SL 3 route this proposed treatment would not attract viewer attention. **Proposed unit adjoins 73T, a 31 acre seedtree unit.**
220	35	12	MM/VL	CC	MM	Proposed clearcut treatment is located at the end of the Dunn Creek Road 525 just upslope of the Dunn Creek trailhead. It is positioned near the toe of the slope on gentle terrain with a southwest aspect. Such treatments regenerate a stand by removing 98% of the canopy and leave 2-3 trees/acre for wildlife habitat. Treatment would be viewed from the open Dunn Creek Road #525 and Trail #25 at a foreground distance. Due to remote location and gentle terrain this treatment would not attract viewer attention. **The Dunn Creek Trail #25 must be protected during all proposed activities.**
362A	40	12	MM/VL	CC	MM	Proposed clearcut treatment is located in the headwaters of Wyoma Creek. It is positioned near the ridge line on gentle terrain with a southwest aspect. Such treatments regenerate a stand by removing 98% of the canopy and leave 2-3 trees/acre for wildlife habitat. Treatment would be viewed from the closed Hornet Ridge Powerline Road #2364 at a foreground distance. Due to remote location and gentle terrain this treatment would not attract viewer attention. Effort should be made to modify the straight line east boundary.
362B	40	12	MM/VL	CC	MM	Proposed clearcut treatment is located in the headwaters of Wyoma Creek. It is positioned near the ridge line on gentle terrain with a southwest aspect. Such treatments regenerate a stand by removing 98% of the canopy and leave 2-3 trees/acre for wildlife habitat. Treatment would be viewed from the closed Hornet Ridge Powerline Road #2364 at a foreground distance. Due to remote location and gentle terrain this treatment would not attract viewer attention. Effort should be made to modify the straight line west and south boundaries.
362C	39	12	MM/VL	CC	MM	Proposed clearcut treatment is located in the headwaters of Wyoma Creek. It is positioned near the ridge line on gentle terrain with a west aspect. Such treatments regenerate a stand by removing 98% of the canopy and leave 2-3 trees/acre for wildlife habitat. Treatment would be viewed from the closed Hornet Ridge Powerline Road #2364 at a foreground distance. Due to remote location and gentle terrain this treatment would not attract viewer attention. Effort should be made to modify the straight line north boundary.
368	40	12	MM/VL	CC	MM	Proposed clearcut treatment is located north of Dunn Creek. It is positioned at mid-slope on gentle terrain with a southwest aspect. Such treatments regenerate a stand by removing 98% of the canopy and leave 2-3 trees/acre for wildlife habitat. Treatment would be viewed from the closed Snag Gulch Road #4922 at a foreground distance. Due to remote location, and gentle terrain this treatment would not attract viewer attention. Effort should be made to modify the straight line east boundary.

Alternative 3 proposes 69 regeneration harvest treatments (shelterwood, seedtree, and clearcut). Twenty-six of these treatments are forecasted to positively exceed the KNFP Visual Quality Objectives (VQO). Example: a VQO of partial retention is achieved where a VQO of modification is prescribed. Forty-three

proposed treatments are forecasted to meet the prescribed KNFP VQO.

Intermediate Stand Treatments are being proposed to modify existing forest conditions in order to enhance growth, quality, vigor and composition. Such treatments occur prior to stand maturity and are not intended to promote regeneration. The following descriptions are examples of intermediate treatments proposed with this project:

Improvement Harvest is being proposed to improve forest resiliency, composition and quality by reducing tree density. This treatment would retain 50-70% of the existing forest canopy and promote a more open stand structure. The largest, healthiest and best quality trees of desired species would be retained. Alternative 3 proposes 51 improvement harvest treatments totaling 3,738 acres. All of these proposed treatments are forecasted to meet or positively exceed KNFP VQOs due to leave tree quality and density.

Sanitation-Salvage is being proposed to remove diseased trees prior to re-infection and to capture mortality prior to loss of product marketability. Dead and down merchantable trees would be harvested. Western larch, with high levels of dwarf mistletoe infection, would be removed. This proposed treatment often results in very small openings (1-2 acres) in the forest canopy. Alternative 3 proposes four (4) sanitation-salvage treatments totaling 345 acres. All of these proposed treatments are forecasted to meet or positively exceed KNFP VQOs due to leave tree density and small opening size.

Commercial Thinning is being proposed to improve tree growth and enhance forest health by reducing stand density. Thinning normally removes suppressed trees from below the dominant tree canopy. The largest, best quality trees are retained in a fully stocked stand following treatment. Alternative 3 proposes 25 commercial thinning treatments totaling 1,965 acres (Table 2.17). All of these proposed treatments are forecasted to meet or positively exceed KNFP VQOs due leave tree quality and density.

Precommercial Thinning is being proposed to reduce tree density and improve growing conditions of the retained trees by reducing the competition for light and nutrients. The largest, best quality trees of the desired species are retained in a fully stocked stand following treatment. Alternative 3 proposes 5,563 acres of precommercial thinning in overstocked, sapling sized trees that were established 15-25 years prior. All of these proposed treatments are forecasted to meet or positively exceed KNFP VQOs due to leave tree quality and density.

Fuel Treatment is being proposed to reduce hazardous fuels by utilizing a combination of prescribed fire and/or mechanical treatments. These treatments are located adjacent to private property and are intended to reduce hazardous fuels in the wild land-urban interface. Such treatments would promote a more open stand structure resistant to crown fire. Small diameter forest products may be removed to enhance burning conditions. Alternative 3 proposes 13 fuel treatments totaling 1,309 acres (Table 2.18). All of these proposed treatments are forecasted to meet or positively exceed the KNFP VQO due to leave tree density and slash disposal.

Fuel and Wildlife Treatment is being proposed to reduce hazardous fuels and enhance wildlife habitat by utilizing prescribed fire and mechanical slashing. Some of the proposed treatments may have small diameter forest product removal from gentle slopes. Alternative 3 proposes 33 fuel treatments on wildlife ranges totaling 10,049 acres (Table 2.19). All of these proposed treatments are forecasted to meet or positively exceed the KNFP VQO due leave trees, slash disposal and irregular treatment patterns.

New Road Construction is being proposed to access nine treatment proposals and to allow DNRC to access their lands. This proposed construction would result 19 new roads and 8.06 miles (Table 2.19A) of new permanent roads in the analysis area. Road construction in this area typically results in the exposure of light colored sub-soils on cut and fill slopes. Such construction can be visually obtrusive unless cut and

fill slopes are successfully revegetated. Revegetation would be required of any permanent road construction. However, post-treatment monitoring is the only way to assess revegetation success.

Temporary Road Construction is being proposed to access tree treatment proposals. This proposed construction would result in14 segments totaling 4.05 miles (Table 2.20) of temporary roads. All temporary road construction would be pulled back to the slope contour and revegetated. The key to revegetation success is the storing of topsoil and organic material as a growth medium on the recontoured slope. Visually obtrusive elements of temporary road construction should be short-term with successful recontouring and revegetation.

Cumulative Effects

Alternative 3 would change the visual condition of the East Reservoir area. Drier habitats found on south and west aspects of the analysis area would have subtle texture changes as tree densities were reduced following tree harvest and hazard fuel reduction. Minimal new line and form would be introduced with shelterwood and intermediate stand treatments. All regeneration (seedtree, clearcut) harvest treatments would meet or positively exceed KNFP VQOs. This is due to leave tree densities, vegetative screening, blending with natural openings, and topographic positioning. Within 15-25 years of the proposed treatments, intermediate/tall shrubs and tree regeneration would be noticeable in the treated areas. Scenic resource effects associated with temporary road construction (approx. 4 miles) to access tree harvest areas would be short-term. Temporary road segments would be pulled back to natural slope contours and revegetated. The effects of temporary road construction would depend upon successful revegetation of cut and fill slopes.

Scenic Quality Management Measures

All of the intermediate stand treatments are forecasted to meet or positively exceed KNFP VQOs. All of the 66 regeneration treatment areas would meet or positively exceed the KNFP VQOs. Regeneration units may require modification to meet KNFP VQOs. These specific management measures are displayed in the unit descriptions (Table 3.118). Unit layout would utilize smaller areas, irregular shapes or edge, leave tree islands and gentle slope angles. Units would be marked to leave residual trees with the largest/best formed crowns. Units would be positioned to take advantage of inferior viewer positions, oblique view angles, topographic/vegetative screening, natural openings and revegetated tree harvest areas. The use of these techniques singularly or in combination would yield positive results related to Visual Quality Objectives/Scenic Integrity Objectives.

Slash disposal adjacent to the Lake Koocanusa Scenic Byway (MSH 37) and Lake Koocanusa is critical to meeting KNFP VQOs.

CONSISTENCY with the FOREST PLAN

All of Alternative 3 proposed activities meet or positively exceed KNFP Visual Quality Objectives.

CULTURAL RESOURCE INTRODUCTION

The activities proposed under the East Reservoir project have the potential to affect Cultural Resources. These activities are described in detail in Chapter 2 of the DEIS.

The purpose of this analysis is to determine if any of the alternatives will directly or indirectly affect cultural resources through complying with Federal laws and policies that manage Cultural Resources.

REGULATORY FRAMEWORK and AGENCY DIRECTION

Federal and State Agencies are required to follow the guidelines of the National Historic Preservation Act which is the Federal law governing preservation of historic and archaeological resources of national, regional, state, and local significance for all proposed ground disturbing activities. Forest Service (FS) Manual 2300 provides the laws and guidelines for employees to follow when managing any site. In addition, the laws and policies that govern Cultural Resource protection on Federal and State lands are coordinated with the State Historic Preservation Officer (SHPO) of Montana, who serves in an advisory capacity.

Field inventories are conducted in accordance with the Kootenai National Forest (KNF) 2009 Heritage Guidelines for Site Survey Strategy (Timmons et al, 2009), Section 106 of the National Historic Preservation Act (NHPA), and the Programmatic Agreement between the USDA, FS Northern Region (Montana), the Advisory Council on Historic Preservation, and the Montana State Historic Preservation Office (MTSHPO) Regarding Cultural Resource Management on National Forests in the State of Montana.

ANALYSIS METHODS

Field inventories include a review of all high and medium probability areas for the occurrence of cultural resources as well as, locating known site leads. The definitions for high and medium probability areas are contained in the KNF 2009 Heritage Guidelines for Site Survey Strategy (Timmons et al, 2009). The field inventories are documented and forwarded to the MTSHPO. Inventory reports include management recommendations for any cultural resource sites located. For the East Reservoir analysis area, archaeologists worked directly with foresters to design alternative actions that either excluded or have minimal effects on cultural resources.

Cultural resource inventory and site reports are housed in the Heritage Resource shop in the Supervisor's Office and at the Canoe Gulch Ranger Station. Specific site location information is confidential and not subject to public disclosure as per Public Law 94-456, [16U.S.C. 470 Sec. 9 (a) (1) (2)].

ANALYSIS AREA

The analysis area for Heritage resources is the same the Cripple Planning Subunit. This analysis area includes 802 acres of U. S. Army Corps of Engineers (COE) lands. The COE is collaborating with the Forest to complete cultural resource surveys on COE lands.

AFFECTED ENVIRONMENT / EXISTING CONDITION

The analysis area contains benches, hills, and mountain slopes adjacent to permanent flowing water. It has a low-to-high probability of containing cultural resources. Level lands adjacent to permanent water have a high probability while steep mountain slopes have a low probability of containing sites.

District and Forest records provide an understanding of all expected heritage resources within the Analysis Area. On KNF lands, a total of 34 cultural resource inventories have occurred in the past within the analysis area. A total of 24 sites and one historic railroad logging district eligible to the National Register of Historic Places lie within the analysis area.

The COE manages 802 acres adjacent to Libby Dam that is included in the analysis area. Archaeologists surveyed most of these lands in preparation for construction of Libby Dam in the late 1970s. They located a total of nine sites that are eligible to the National Register of Historic Places. COE and FS Archaeologists conducted a field inventory of the remainder of COE land within the analysis area during the summer 2011. No new cultural resources were located.

Information concerning the nature and location of heritage resources is confidential, and is not subject to public disclosure per Public Law 94-456 (16 U.S.C.470 sec. 9 (a) (1) (2)) in order to protect sites from vandalism, and to retain the confidentiality of site locations.

ENVIRONMENTAL CONSEQUENCES

ALTERNATIVE 1 (No-Action)

Direct and Indirect Effects

Alternative 1 has no ground-disturbing activities. If no ground disturbing activities take place, then cultural resource sites would continue to naturally deteriorate. However, the increased risk of stand-replacing wildfire associated with this alternative could result in indirect effects. Wildfire may destroy or damage above-ground cultural resources. Burning tree roots or suppression efforts may expose and impact subsurface cultural resources.

ALTERNATIVES 2 and 3

Direct and Indirect Effects

Alternatives 2 and 3 propose ground-disturbing activities and increase access to areas that have the potential to affect historic and prehistoric sites. Ground-disturbing activities could result in direct impact to the sites, while increased access can lead to vandalism, theft and other indirect impacts. All areas proposed for ground-disturbing activities have been inventoried prior to the implementation of any activity that has the potential to impact cultural resource sites.

Although management's intent is to identify all cultural resource sites, and avoid or mitigate prior to proposed ground-disturbing activities, there is the potential for unidentified sites to be located during project implementation. If this occurs, a Timber Sale Contract Provision for - Protection of Cultural Resources provides the FS the opportunity to modify or cancel the contract to protect cultural resources, regardless of when identified. The discovery of any cultural resource sites during the implementation of the proposed project could result in implementation delays (USDA Forest Service 1987b Appendix 19.)

Forest archaeologists would notify and consult with the SHPO, as required by law, to determine the significance of the discovery and the effects of the project upon them. The Confederated Salish and Kootenai Tribes and the Kootenai Tribe of Idaho would be included in discussions where Native American sites are involved.

Cumulative Effects

All cumulative effects to cultural resources will be the same under any of the alternatives.

Actions on Private Lands:

Private: The government has no jurisdiction over private lands. Actions or projects by private individuals would occur regardless of which alternative is selected for implementation. Impacts to any potential historic property located on private property would not be addressed unless affected by a federally permitted or funded undertaking. There would be no cumulative effects to cultural resources.

State of Montana Department of Natural Resources: (DNRC): The actions or projects by the DNRC would have no cumulative effects to cultural resources unless a cultural resource extends onto Montana Land. In those cases, the FS would inform the State about the cultural resource. In the case that the State of Montana would need to construct a road across FS land to access their land then, a FS archaeologist

would conduct a field inventory to determine if a cultural resource exists. If a cultural resource does exist then the FS would work directly with the DNRC to either avoid or mitigate the road prior to its construction. There would be no cumulative effects to cultural resources.

U.S. Corps of Engineers: COE archaeologists know the location of cultural resources along the length of Dunn Creek on COE land. They are responsible for writing the report, working directly with the project coordinators to avoid or mitigate sites affected by the project, and consulting with the MTSHPO. Currently, the project is designed to protect eligible cultural resources and would have no cumulative effects to cultural resources on Forest Service land.

Vegetation Management: The activities for management of vegetation include timber harvest, timber sales and precommercial thinning. The units associated with the East Reservoir analysis area have received a cultural resource survey prior to project implementation. Project implementation would avoid sites whenever possible. If avoidance is not possible then sites would be protected or mitigated. There would be no cumulative effects to cultural resources.

Fuels Reduction Activities: All areas proposed for ground-disturbing activities have been inventoried prior to implementation. Sites eligible to the National Register of Historic Places will be avoided, mitigated or protected. There would be no cumulative effects to cultural resources.

Outfitter and Guide Activities: Each proposal would be reviewed by a FS archaeologist to determine if the project has the potential to effect cultural resources. Those proposals that may affect cultural resources have been field inventoried. Known or newly identified sites would be avoided, mitigated or protected. There would be no cumulative effects to cultural resources.

Data Gathering Activities: Field surveys are likely to occur. There would be no cumulative effects to cultural resources.

Road Activities: Road maintenance and use associated with permit administration, data collection, monitoring and administration of National Forest Service (NFS) lands does not involve the use of heavy equipment other than on existing road surfaces. Based on the types and extent of these uses in the analysis area, there would be no impacts to cultural resources eligible to the National Register of Historic Places. There would be no cumulative effects to cultural resources.

Fire Suppression: Fire suppression and rehabilitation activities may affect cultural resource sites. An archeologist would be available to provide information regarding known sites. When avoidance during a wildland fire is not possible, management would follow measures outlined in the Region 1 Programmatic Agreement to minimize effects to cultural resources.

Weed Control: Most noxious weed treatment is along roadways. This activity does not include any ground disturbing activities, and would not involve the use of heavy equipment other than on existing road surfaces. There would be no effects to cultural resources.

Mineral Activities: Each proposal would be reviewed by a FS archaeologist to determine if the project has the potential to effect cultural resources. Those proposals that may affect cultural resources would be field inventoried. Known or newly identified sites would be avoided, mitigated or protected. There would be no cumulative effects to cultural resources.

Special Use Permits: Each proposal would be reviewed by a FS archaeologist to determine if the project has the potential to effect cultural resources. Those proposals that may affect cultural resources would be field inventoried. Known or newly identified sites would be avoided, mitigated or protected. There would be no cumulative effects to cultural resources

Grazing: Any livestock grazing within the analysis area may have impacts (lightly worn trails and trampling) to cultural resources. Currently, archaeologists located no impacts. There would be no cumulative effects to cultural resources.

Public Activities Likely to Occur: Recreational use including hiking, dispersed camping, fishing, photography, berry picking and driving for pleasure occurs mainly off existing road surfaces and are small in scale. Based on the types and extent of these uses, there would be no cumulative effects to cultural resources. Forest product gathering (Christmas trees, boughs, mushrooms, cones) and firewood cutting would be expected to continue. There would be no cumulative effects to cultural resources.

CONSISTENCY with the FOREST PLAN and other MANAGEMENT DIRECTION

Forest Plan

The Forest Plan provides goals, objectives and standards for cultural resource management in order to satisfy federal guidelines, laws and FS policy concerning cultural resource sites (USDA Forest Service 1987a II-2 5 25-26.) The Forest Service Manual Chapter 2360 and the Code of Federal Regulations (36 CFR 800) provide directives to accomplish this. The Kootenai National Forest Plan (KNFP) requires integration of cultural resource management into the overall multiple resource management effort. In addition, the Forest must work closely with the appropriate scientific communities and American Indian tribes concerning this resource.

To meet these objectives and standards, all areas would receive a cultural resource inventory prior to the implementation of any proposed project that has the potential to impact cultural resource sites. All associated cultural sites would be recorded, and either avoided or mitigated. The KNFP provides direction to manage sites, whether discovered during the inventory or implementation of proposed activities. In addition, consultation, with the Confederated Salish and Kootenai Tribes, is ongoing to ensure their known interests. Therefore, all action alternatives would be consistent with KNFP direction.

Other Laws and Regulations

Antiquities Act of 1906

The Antiquities Act provides for the protection of historic or prehistoric remains, or any object of antiquity, on Federal lands.

National Historic Preservation Act (NHPA, as amended 16 USC 470-470 t, 110)

The NHPA is the Federal law governing the preservation of historic and archeological resources of national, regional, state, and local significance on all proposed ground disturbing activities. Section 106 of the NHPA requires that the head of a Federal agency having any jurisdiction over an undertaking, or authority to license any undertaking, shall take into account the effect of the undertaking on any site, district, building, structure, or object that is included in, or eligible to, the National Register of Historic Places. This is the standard review process described in federal regulations issued by the Advisory Council on Historic Preservation. Entitled, "Protection of Historic Properties," the regulations also appear in the U.S. Code of Federal Regulations at 36 CFR Part 800.

In addition, the laws and policies that govern cultural resource protection on Federal and State lands are coordinated with the SHPO of Montana, who serves in an advisory capacity. The policies of the FS and SHPO are consistent. The implementation of all alternatives would be in compliance with the appropriate cultural resource guidelines.

RECREATION RESOURCE INTRODUCTION

This section discusses the existing condition and the effects of the alternatives on the recreation resource.

ANALYSIS AREA

The analysis area for the East Reservoir Project is bounded on the east by the Fivemile, Warland, Cripple Horse, Canyon and Dunn Creek hydrologic boundaries, on the west by Koocanusa Reservoir, on the north by the Libby Ranger District boundary with Rexford Ranger District, and on the south by the Richards Mountain/Dunn Peak Divide. The analysis area can be geographically characterized as low gradient stream courses bounded by long spur ridges.

ANALYSIS METHODS

The Recreation Opportunity Spectrum (ROS Primer and Field Guide, R -6-REC-021-90, USDA Forest Service, April 1990) provides the framework to understand how resource management affects settings, activities and ultimately the experience levels of recreationists. Experience levels are defined as highly probable outcomes of participating in recreation activities in specific recreation settings. The key to providing most experiences is the setting and how it is managed. As resource managers, the Forest Service (FS) can facilitate (or hamper) many desired experiences by the way setting indicators are managed. These indicators are:

1. **Access** - includes type and mode of travel.
2. **Remoteness** - refers to the extent to which individuals perceive themselves removed from the sights and sounds of human activity.
3. **Social Encounters**- refers to the number and type of other recreationists met along travelways and at destinations.
4. **Visitor Management** - includes the degree to which visitors are regulated and controlled, as well as the level of information and services provided.
5. **Facilities and Site Management** - refers to the level of site development.
6. **Visitor Impacts** - refers to the impacts of visitor use on the environment.
7. **Naturalness**- refers to the degree of naturalness of the setting; it affects the psychological outcomes associated with enjoying nature.

SETTING CHARACTERIZATIONS

Primitive Setting - Area is characterized by essentially unmodified natural environment of fairly large size. Interaction between users is very low and evidence of other users is minimal. The area is managed to be essentially free from the evidence of human-induced restrictions and controls. Motorized use within the area is not permitted.

Semi-Primitive Non-Motorized Setting - Area is characterized by a predominantly natural or natural-appearing environment of moderate to large size. Interaction between users is low, but there is often evidence of other users. The area is managed, in such a way that minimum on-site controls and restrictions may be present but are subtle. Motorized use is not permitted.

Semi-Primitive Motorized Setting - Area is characterized by predominantly natural or natural-appearing environment of moderate to large size. Concentration of users is low, but there is often evidence of other users. The area is managed in such a way that minimum on-site controls and restrictions may be present, but are subtle. Motorized use is permitted.

Roaded Natural Setting - Area is characterized by predominantly natural appearing environment with moderate evidences of the sights and sounds of man. Such evidences harmonize with the natural environment. Interaction between users may be low to moderate, but with the evidence of other users prevalent. Resource modification and utilization practices are evident, but harmonize with the natural environment. Conventional motorized use is provided for in construction standards and design of facilities.

Rural Setting- Area is characterized by substantially modified natural environment. Resource modification and utilization practices are to enhance specific recreation activities and to maintain

vegetative cover and soils. Sights and sounds of humans are readily evident, and the interaction between users is often moderate to high. A considerable number of facilities are designed for use by a large number of people. Facilities are often provided for special activities. Moderate densities are provided for away from developed sites. Facilities for intensified motorized use and parking are available.

Urban Setting- Area is characterized by a substantially urbanized environment, although the background may have natural appearing elements. Renewable resource modification and utilization practices are to enhance specific recreation activities. Vegetative cover is often exotic and manicured. Sights and sounds of humans, on site, are predominant. Large numbers of users can be expected, both on site and in nearby areas. Facilities for highly intensified motor use and parking are available with forms of mass transit often available to carry people throughout the site.

IMPACT LEVELS

Impacts would be high where actions would preclude existing or planned recreational uses after implementation or permanently negatively affect recreation experiences.

Impacts would be moderate where actions would temporarily preclude existing recreation uses during peak use periods during implementation or temporarily negatively affect recreation experiences.

Impacts would be low where actions would temporarily preclude existing recreation uses during non-peak user periods during implementation or temporarily negatively affect recreation experiences.

Within the above framework, the inverse or positive impacts can also be forecasted as high, moderate or low as well.

AFFECTED ENVIRONMENT

1) Access - The East Reservoir analysis area has a high density of roads (seasonally open and seasonally designated) that were constructed for a variety of purposes. Many roads are open to motorized vehicle travel year around. Most spur roads are closed year-round to achieve water quality goals and big game habitat effectiveness. Snowmobile use is restricted to open roads due to big game winter range values. Off-road vehicle (ORV) trespass of closed roads is very common (weekly during snow-free period). Closed roads are used extensively by walk-in hunters during the fall. Motorized trails located in the analysis area are #279 Warland Ridge 10.70mi; #280 Warland Peak, 2.30mi; #281 Cripple Horse, 6.22mi; #420 Canyon Divide, 9.83mi; #426 Fivemile, 1.82mi; and #500 Hornet Ridge, 5.69mi (total 36.56 miles). These trails are open to motorcycles and snowmobiles. Non-motorized trails in the analysis area are #25 Dunn Creek, 6.02mi; #97 Richards Mountain, 8.41mi; #241 North Fork of Canyon Creek, 3.71mi; #242 Sugarloaf Lookout, 4.00mi; and #425 Boundary Mountain, 0.66mi (total 22.80 miles). These trails facilitate hiking, horseback riding and cross-country (x-c) skiing.

2) Remoteness - Due to the high density of roads and traffic levels, the perceived condition of remoteness is not easily achieved in the East Reservoir area. Exceptions would be cross-country travel, the non-motorized hiking trails of the area, and roads that have been closed for long periods with dense revegetation.

3) Social Encounters – Contact between recreationists is low to moderate along open roads and seasonally on trails. Contacts are highest during peak seasons examples: driving to view scenery and wildlife during the summer and hunting during the fall. Contact on closed roads is low, as most recreationists respect another person's desire for space and will bypass the road if a vehicle is parked there. Encounters by season are often by people pursuing the same recreation activity.

4) Visitor Management - The most common control on recreationists in the East Reservoir area is road closures to motorized vehicle travel. Over half the road mileage in the area has been closed yearlong to benefit big game or watershed health. The information most commonly provided to visitors is related to vehicle travel, i.e. road numbers, mile markers, traffic control signs.

5) Facilities and Site Management - There is one FS developed recreation facility within the East Reservoir area. This is the Cripple Horse Boat Ramp which has toilets and parking areas. This site is managed for April through October activities. Koocanusa Marina, attached to this boat ramp, is managed by a private party under a special use permit. Private facilities at the Marina include: store, restaurant, showers, laundry, campground, RV-Park and rental cabins. FS high use dispersed sites located along Koocanusa Reservoirs' east shoreline have concrete vault toilets. These sites are at Warland Creek and Canyon Creek. Five scenic turnouts are located along MSH 37. Developments include parking, signs and vegetation clearing for vistas.

6) Visitor Impacts - The most common impacts of visitors are littering and spread of noxious weeds. Vandalism to gates, once common, is now declining. Cross-country Off-Road Vehicle (ORV) use has resulted in the creation of new travel ways, vegetation elimination, soil erosion and weed spread. Nearly all signs, regardless of message, have several to numerous bullet holes in them.

7) Naturalness - Visual quality objectives are used to quantify the degree of landscape naturalness. See the Scenic Resource analysis (Chapter3) for more information.

The East Reservoir analysis area provides important recreation settings, ranging from semi-primitive to roaded natural to rural, for a wide spectrum of recreation activities. The area is important due to the ease of access year-round from Libby and Eureka. Important dispersed recreation activities are viewing/ photographing scenery and wildlife, hiking, hunting and fishing (Koocanusa Reservoir). There is one outfitter/guide permitted in the analysis area for hunting activities.

Desired future condition for National Forest System (NFS) land within the East Reservoir analysis area is described by Kootenai National Forest Plan (KNFP) management allocation. The future condition utilizes the Recreation Opportunity Spectrum model to classify lands along a scale from Primitive (least development) to Urban (most development).

The majority of the analysis area is inventoried as roaded natural. There are no inventoried roadless areas within East Reservoir analysis area. There is one area (MA-2 Semi-Primitive Non-Motorized Recreation) associated with the Richards Mountain-Dunn Peak Divide that totals approximately 4,000 acres. There are no tree harvest or road construction proposals in this area. Fuels treatment burning to benefit wildlife habitat is proposed in Sections 11 and 13 associated with this area. Primitive recreation settings are lacking due to the high level of development (road construction and tree harvest).

Managed trails in the area are: #25 Dunn Creek, #97 Richards Mountain, #241 North Fork of Canyon Creek, #242 Sugarloaf Lookout, #279 Warland Ridge, #280 Warland Peak, #281 Cripple Horse, #420 Canyon Divide, #425 Boundary Mountain, #426 Fivemile and #500 Hornet Ridge. There are vistas along these trails which offer panoramic views of Koocanusa Reservoir, Salish Mountains, Purcell Mountains and Cabinet Mountains.

Currently, stock use of the East Reservoir area is low. Favored riding areas are associated with closed roads. Loop opportunities are present by traversing areas between trails and roads which allow a rider to cover new terrain for most of a ride.

ORV use within the analysis area is presently moderate. Four wheelers and motorcycles are the two major ORV types. Use is concentrated near Koocanusa Reservoir. ORV trespass use of roads which are closed to motor vehicles is very common.
Snowmobile use is light with touring on open/closed roads the most common activity. There are no concentrated high elevation play areas.

People participating in activities where a semi-primitive, non-motorized experience is desired are, for the

most part, dependent upon road closures and trail management. Currently, the yearlong and seasonal closures on spur roads are doing a marginal job of maintaining this setting. Violations of road closures by four-wheelers and motorcycles are common and limit the opportunity for a semi-primitive experience in the area.

The East Reservoir area is used by recreationists in all seasons. Peak use periods are during the spring-summer for fishing and driving to view scenery/wildlife, and fall for hunting. Recreation activities are dispersed over time and space.

ENVIRONMENTAL CONSEQUENCES

ALTERNATIVE 1 (No-Action)

Direct and Indirect Effects

The no-action alternative would see a very slow change to setting indicators and characterizations. As vegetation growth increases on closed roads and prior tree harvest areas, All-Terrain Vehicle (ATV) trespass would be less likely. For these indicators, low level, long-term positive impacts are estimated.

ALTERNATIVES 2, 3 and 4

Direct and Indirect Effects

Alternatives 2 and 3 propose 131 to 124 tree harvest treatments on 6,589 to 5,817 acres, 27 to 25 commercial thinning areas on 2,256 to 1,965 acres, 18 to 13 fuel treatments on 1,378 to 1,309 acres, 33 fuel and wildlife treatments on 10,049 acres, precommercial thinning on 5,563 acres, and 13.51 to 12.11 miles of temporary/permanent road construction. Road access and site improvement is proposed at the Fivemile and Yarnell dispersed recreation sites along Koocanusa Reservoir. This would include pre-cast vault toilet installation. All existing closed access roads on NFS lands would remain closed seasonally/ yearlong by gate/barrier to public motorized travel to meet watershed and big game security goals. ORV trespass of access roads would continue to be common. On the NFS land, access management is the focus of public attention and agency analysis as well.

Alternative 2 proposes to close, by Forest Supervisor Order, six trails (Warland Ridge, Warland Peak, Cripple Horse, Canyon Divide, Fivemile and Hornet Ridge) totaling approximately 37 miles to motorized vehicle use yearlong. Protecting big game summer range habitat effectiveness is the rationale for these proposed closures. These trails are currently open to motorcycles and over snow vehicles. These trails, when constructed in 1930-1950, were designed for stock traffic and today do not safely support OHV use. Motor vehicle use of these trails is light.

Alternative 3 proposes to create an OHV loop that starts on the Boundary Mountain road #4904 (approx. 1.5 miles) proceeds on the Cripple Horse trail #281(6.22 miles), intersects the Canyon Divide trail #420 (approx. 2.5 miles), continues on Canyon Creek road #4912 (approx. 4 miles), and ends on the Cripple-Canyon Connector road #4925 (approx. 3.5 miles) for an approximate total distance of 17.72 miles. The Cripple Horse trail mileage is marginally suited for motorcycles currently and unsuitable for all other OHV traffic. Implementation of this proposal would require partnership cooperation to improve trail standards for OHV safety.

Alternative 3 proposes to create a non-motorized loop trail around Cripple Hill located in Section 2 just south of the outlet of Cripple Horse Creek to Koocanusa Reservoir. The proposed trail location is positioned between Koocanusa Reservoir and Montana State Highway 37. The trail would be approximately 2.75 miles in length with 1.75 miles on existing historic railroad grade. The remaining mile of trail would utilize a temporary road location that would access a proposed harvest unit. This trail would be suitable for hiking, biking and horseback riding. Implementation of this proposal would require minimal clearing and tread construction

Alternative 3 proposes to close, by Forest Supervisor Order five trails, (Warland Ridge, Warland Peak, Canyon Divide (partial), Fivemile and Hornet Ridge) totaling approximately 27 miles to motorized vehicle use yearlong. Protecting big game summer range habitat effectiveness is the rationale for these proposed closures. These trails are currently open to motorcycles and over snow vehicles. These trails, when constructed in 1930-1950, were designed for stock traffic and today do not safely support motor vehicle use. Motor vehicle use of these trails is low.

1Access – In 2006, Dale Bosworth Chief of the US Forest Service identified "Unmanaged Recreation" as one of four threats facing the Agency in the near future. He stated "We believe the off-highway vehicles are a legitimate use of the National Forest System. But it's a use that should be managed carefully. That's what our new rule for OHV use on national forest system lands is all about: providing access that can be used and enjoyed into the future. And if we want to sustain that use, then have got to work together." Providing for the long-term sustainability of the NFS lands and resources is essential to maintaining the quality of the recreation experience in the national forests for all users. Dramatic increase in OHV use coupled with impressive advances in motor vehicle technology is prompting the Forest Service to take a closer look at its management of this use.

Alternative 2 would change settings for a variety of activities and ultimately the experience derived by recreationists. Public use of several roads would likely be restricted for safety reasons where proposed tree harvest units adjoin the road. This is judged to be a low level, short-term negative impact to access. All temporary road construction would be recontoured and revegetated following treatment activities. New tree harvest areas could enhance gathering forest products (berry/mushroom picking, Christmas tree, firewood cutting). Proposed tree harvest treatments would enhance hunting opportunities by allowing easier travel by hunters, and easier viewing of big game animals. Within the East Reservoir analysis area, six of the 11 FS managed trails are currently open to public motorized travel by motorcycle or snowmobile. Under Alternative 2, six trails currently open to motorized access would be closed to that activity (i.e. 36.56 miles or 69% of the motorized trails on the Libby Ranger District). Alternative 3 proposes closing five trails to motorized access for a total of 26.89 miles.

Proposed access improvement to dispersed recreation sites near Koocanusa Reservoir would be a long-term positive effect. Effects analysis often looks at access management to determine if a balance of recreation opportunity is available. In the East Reservoir analysis area, a balance of open and closed road-related recreation settings would be available under the action alternatives.

Alternatives 2 and 3 are judged to provide a moderate-term positive impact to public access when taken in total.

Management measures could include bi-annual monitoring of motorized vehicle closure devices and effective closure of ATV trespass trails.

2) Remoteness- During tree harvest and temporary road construction, the public would see and hear these activities over time and space. Therefore, a low-level, short-term negative impact is anticipated for the public's sense of remoteness. The long-term impact relates to the time it takes vegetation to recover to a natural appearing state. As management measures for public safety, use of several roads may be restricted during operations.

3) Social Encounters - Public use of several roads would likely be restricted during tree harvest operations adjacent to the road for safety reasons. Following tree harvest activities, social encounters are anticipated to increase slightly due to the increase in huntable acres. Under this scenario, impacts are judged to low-level and short-term. No management measure is proposed to address social encounters.

4) Visitor Management -Visitor regulation and control would be increased under the Alternatives 2 and 3. These alternatives have several proposed tree harvest treatments adjacent to roads. Therefore, public

access could be restricted for safety reasons on those roads. This is judged to be a low level, short-term negative impact. Temporary roads would be recontoured and revegetated following tree harvest to protect wildlife and watershed values. These roads would provide new non-motorized travel route for a variety of activities, however, fall hunting would likely dominate use. Public perception of regulation and control is largely negative. Where new road closures are implemented, the impacts would be low level and long-term. Management measures would include biannual monitoring of closure devices to assure effectiveness. Care would need to be exercised during treatments along several of the area roads to not facilitate ATV trespass.

5) **Facilities and Site Management -** One managed site is positioned along the west portion of the analysis area (Koocanusa Marina/Cripple Horse Boat Ramp). One improvement tree harvest (57 acres) is proposed adjacent to this site. Treatment area slash could be deposited on site travel ways and would be a direct impact. Design criteria would exclude activity slash and equipment from travel ways. Impacts are judged to be low level and short term. There is an opportunity to use activity slash to limit use of trespass ORV routes near the Marina. This opportunity would need to be coordinated with the Marina permittee.

6) **Visitor Impacts -** Under Alternatives 2 and 3, each segment of new temporary road required for proposed treatments would be recontoured and revegetated to protect wildlife and watershed values. Signs placed on the Forest for management of resources or regulation of the public may be vandalized. ATV users would circumvent barriers to use new roads and develop new routes from the roads where terrain is suitable. Such use would spread noxious weeds, eliminate vegetation and result in erosion. This is judged to be a low-level, long-term impact. Management measures would include biannual monitoring to assure closure effectiveness and repair of structure and resource damages.

7) **Naturalness-** The scenic quality of tree harvest treatments, fuel treatments, precommercial thinning and road construction is discussed in the Scenic Resource analysis (Chapter3). However, the psychological effect on recreation experiences of encountering heavily manipulated settings (regeneration harvest areas) could be high level and long-term until vegetation recovers to a natural appearing condition.

Recreation opportunities would continue to be varied and dispersed through the area. Trails located in the analysis area would be maintained at longer intervals as the FS manages decreasing maintenance budgets. The need for public outfitter/guide services would remain low due to the areas' high level of accessibility. Proposed activities would have indirect effects on recreationists and their activities. Increased traffic levels would be expected on many of the area roads during implementation. There would be short-term displacement of recreationists from activity areas due to noise, traffic, dust and for safety reasons. These would be low to moderate, short-term negative impacts depending on activity during peak recreation seasons.

Cumulative Effects

In 2007, Abigail Kimball, Chief of the US Forest Service, identified "Loss of Open Space" as one of four threats facing the Agency in the near future. She stated "The loss of open space is an urgent and important problem, and the Forest Service clearly has a role in helping balance growth and development with open space conservation. We can work with others as a conservation partner to help conserve critical open space across the landscape." The main threat to open space is subdivision and residential development on private forest lands.

Within the East Reservoir analysis area, the FS is the major land owner followed by the Montana Department of Natural Resources and Conservation (DNRC) and Plum Creek Timber Company (PCTC). All of PCTC ownership is found in the Dunn Creek watershed at the south end of the analysis area. Neither owner (DNRC or PCTC) is currently seeking to dispose of their land holdings in this analysis

area. In the past 25 years, historic homesteads located in major drainage bottoms (Fivemile, Warland Creek) and adjacent to Lake Koocanusa have been subdivided. Sale and development of these parcels has proceeded slowly as a result of economic conditions in the area. The DNRC plans to initiate tree harvest in the area in the next decade whereas the FS and PCTC started tree harvest in the 1920s. Transportation development coincided with these dates and utilized railroad technology first, followed by truck transport. This transportation system was unavailable to the general public, and hiking/pack trails were therefore used for recreation access. By the 1960s, road development for tree harvest had replaced rail lines. These roads were now available to the recreating public. From 1960 to 1990, the area of tree harvest on FS land was greatly expanded spatially. The public was afforded motorized access to a high percentage of the area during this period. Since 1990, the FS has realized the benefit of road management to a variety of resources. Over 50% of all roads constructed in the area are currently closed seasonally to motorized travel. This brief history will provide the basis for cumulative effects analysis using the setting indicators of the Recreation Opportunity Spectrum (ROS).

1) **Access-** From early European settlement to 1950, recreationist used game trails and pack trails to access settings for recreation activities. From 1950 to 1990, motorized access on roads constructed for tree removal expanded rapidly. Pack trails during this period were often obliterated or abandoned. Few trails were maintained for recreation access. With the advent of road closures in 1990, the FS launched a program of trail restoration to facilitate recreation access. In 2013, the public enjoys both motorized and non-motorized access to recreation settings.

2) **Remoteness-** Primitive and semi-primitive non-motorized settings dominated the East Reservoir area up to 1950. With greatly expanded tree harvest and road construction from 1950 to 1990, the sights and sound of human activity were common. The 1950s semi-primitive motorized settings associated with primitive roads and vehicles by 1990 had, with higher standard roads and improved technology in vehicles, evolved to roaded natural settings. From 1990 to present, recreation settings have shown a slight movement to the more primitive side of the spectrum with road closures and revegetation of harvest areas.

3) **Social Encounters -** Up to 1950, social encounters were rare except at the most popular destinations. Even with a low population of recreationists, encounters increased from 1950 to 1990 due to the ease of motorized access afforded by road construction and more available free time. With road closures starting in 1990, social encounters in semi-primitive settings have been reduced. Overall, the recreation population has aged and with more available free time, encounters are not expected to decrease.

4) **Visitor Management -** Up to 1950, visitor management was virtually non-existent except for a few fire prevention posters. From 1950 to present, visitor management has steadily increased with the most visible being road closures. Since1990, permits for a variety of activities (firewood gathering, Christmas tree cutting, etc.) have been used by the Forest Service.

5) **Facilities and Site Management -** Prior to 1950, the FS maintained a vast network of pack trails primarily for fire suppression. Recreationists used these trails as well. From 1950 to present, roads have become the major facility within the East Reservoir area. Beyond restored pack trails, very few recreation-specific facilities exist within the area. Dispersed campsites can be found throughout the area. User created developments (e g. fire rings) are common at campsites.

6) **Visitor Impacts-** Prior to 1950, few impacts from recreationists could be found on the environment. From 1950 to present impacts are wide ranging (weeds, litter) and localized (vandalism to gates, signs). In the future, visitor created trails from ATV use is expected to accelerate in the East Reservoir area.

7) **Naturalness -** Prior to 1950, the degree of setting naturalness was very high. From 1950 to 1990, naturalness declined with large geometric patterns of tree harvest and road construction to access harvest areas. From 1990 to present, tree harvest has been reduced and has utilized smaller unit sizes and irregular shapes. Few new roads have been constructed and other yarding systems (helicopter,

skyline) have been employed. The proposed action would likely continue this trend started in 1990. In the future, recreation setting naturalness is expected to increase as tree harvest areas and closed road surfaces revegetate.

In addition to the proposed tree harvest and fuel treatments, a number of proposed actions, in or close to the East Reservoir area would impact public recreation settings, activities and experiences. These are:

1) US Army Corps of Engineers plans intermediate tree harvest treatments on approximately 400 acres of their lands. These lands are located downstream of Libby Dam between MSH 37 and the Kootenai River. Such activities could impact naturalness, public perception of remoteness and facilitate ATV trespass through their lands.

2) Montana DNRC plans road construction and extensive tree harvest in their Sections located in the lower Warland, Cripple Horse and Canyon Creek areas. Such activities could impact naturalness, public perception of remoteness and facilitate ATV trespass through their lands and adjacent ownerships.

3) PCTC owns approximately 10 sections in the headwaters and lower reaches of Dunn Creek. Those sections, suitable for private development, would be sold through their real estate division. All other sections have been harvested in the last 20 years and limited harvest activity is anticipated in the next decade. Such activities would impact naturalness and public perception of remoteness. Private developments are usually accompanied by fencing or signing to prohibit public access.

FOREST PLAN CONSISTENCY

The NFS lands where tree harvest is proposed is allocated MA-l1, Big Game Winter Range (suitable timberland); MA-12, Big Game Summer Range (suitable timberland); MA-15, Timber Production; MA-16, Timber with Viewing (suitable timberland) and M A-17, Viewing with Timber (suitable timberland). Within these allocations, tree harvest and road construction would be implemented. However, provisions for scheduling to prevent conflicts during periods of wildlife use and management measures to protect scenic resources would be implemented. Motorized access is generally not permitted during important wintering periods (usually December 1 through April 30). The environmental consequences of the action alternative on recreation settings, activities, and experiences would be consistent with goals, objectives and standards of the Kootenai National Forest Plan.

TRANSPORTATION INTRODUCTION

Forest roads are an essential part of the transportation system designed to support multiple use of National Forest System (NFS) lands. They help to meet recreational demands and facilitate access to forest commodities. Forest roads provide access needed to manage the many resources of each forest ecosystem.

The goal of the interdisciplinary transportation analyses is to identify a road system that:

- Meets management objectives and needs;
- Is safe and responsive to public needs and desires;
- Is affordable and efficiently managed;
- Has minimal negative ecological effects on the land;
- Is in balance with available funding for needed management actions.

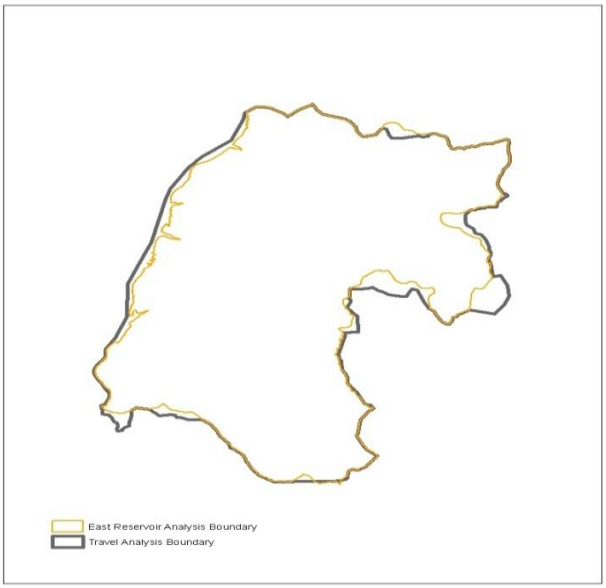
The East Reservoir Travel Analysis Process (TAP) was completed in the winter of 2013. The TAP Report is a separate, independent document, resulting from an interdisciplinary analysis of the existing road system. The TAP produced a list of opportunities that could reduce the environmental risk of roads and bring the road system closer to desired management goals, examined the current road management and resulted in recommended road management changes that would provide a full range of motorized and non-motorized opportunities balanced with any legal and environmental constraints.

The East Reservoir TAP provides a detailed road-by-road analysis of the existing condition. Therefore, this section will only summarize information that can be found in greater detail in the East Reservoir TAP. The East Reservoir Travel Analysis Report can be found in the Project File.

ANALYSIS AREA

The roads for the East Reservoir Project were analyzed using the travel analysis boundary which is different from the analysis area boundary for all alternatives. The analysis area boundary is equivalent to the Cripple Planning Subunit boundary. The travel analysis boundary includes some roads that fall outside the Cripple Planning Subunit boundary. These roads are exclusively connected to roads in the Cripple Planning Subunit boundary and are only accessed through the Cripple Planning Subunit. Figure 1 depicts the difference between the Cripple Planning Subunit boundary and the travel analysis boundary.

Figure 1 – Map - Boundary Difference



REGULATORY FRAMEWORK

The TAP complies with 36 CFR Part 212 Administration of the Forest Transportation System Final Rule and with the Forest Service (FS) Transportation Administrative Policy FSM Chapter 7700 (2001). The final rule is intended to help ensure that additions to the NFS road network are those deemed essential for resource management and use; that construction, reconstruction and maintenance of roads minimize adverse environmental impacts; and that unneeded roads are decommissioned and restoration of ecological processes are initiated.

On November 9, 2005, the new final rule for 36 CFR Parts 212, 251, 261 and 295 was issued to address travel management and designated routes for motor vehicle use. This rule establishes the development of a Motor Vehicle Use Map for each Administrative Unit. The East Reservoir Interdisciplinary Team (IDT) completed a TAP under the requirements of this new final rule. The travel management decisions in the East Reservoir EIS Record of Decision would be used in updating the Motor Vehicle Use Map.

Forest Plan Direction

The Kootenai National Forest Plan (KNFP) gives goals, objectives and standards for resource management for the entire Forest in general and for specific subdivisions of the Forest called Management Areas (MAs). Goals, objectives and standards that apply to NFS roads (roads wholly or partly within or adjacent to and serving the NFS and which are necessary for the protection, administration and utilization of the NFS and the use and development of its resources) are listed. A glossary to assist in the understanding of certain terms used to describe or categorize roads is also included in the Transportation Section of the Project File.

Goals

Goals are KNFP management directions as expressed in broad general terms that describe a desired condition to be achieved sometime in the future. General forestwide goals that apply to roads include the following and may be found on page II-1 of the KNFP:

1) Construct the minimum number of roads necessary to permit the efficient removal of timber and mineral resources. Construct and reconstruct roads only to the minimum standards necessary to prevent soil loss, maintain water quality, minimize safety hazards for a reasonable and prudent Forest user, and provide access for fire protection where needed to meet MA goals.

2) Maintain a balance of open and closed roads to continue present levels of motorized access, insure big-game habitat security, insure grizzly bear security to meet recovery goals, and reduce road maintenance costs.

Objectives

KNFP management objectives are concise statements of measurable results that respond to pre-established goals and are classified in the KNFP by various resources. General forestwide objectives relating to roads include the following and may be found on pages II-4, 5, 7 and 10 of the KNFP:

1) Roads, including capital investment roads (those built with specially appropriated funds) will be built to access harvest areas on schedule (Timber).

2) The Forest Travel Planning (TAP) process will be used to review, evaluate and implement the goals and standards of the MAs, with regard to roads, trails and motorized vehicle use (Recreation).

3) Ground disturbing activities such as road construction, road reconstruction, and timber harvest will be accompanied by mitigating measures to prevent or reduce increases in sedimentation and stream channel erosion. The soil and water conservation practices specified in Forest Service Handbook (FSH) 2509.22 and/or those activities that prevent or reduce stream sedimentation will be implemented. Examples include: location of roadbeds out of stream bottoms, design of stream crossing structures to allow water to freely pass, rock surfacing of roads at stream crossings, keeping equipment from operating in or alongside streams and maintenance of roads to allow proper drainage (Soil and Water).

4) Each project plan for which the use of heavy equipment is required shall evaluate the effect of

operating that equipment on soil productivity. When it is determined that equipment operation is a hazard to soil productivity, the project plan shall establish a standard for how much of the analysis area will be allocated to skid trails, landings, temporary roads or similar areas of concentrated equipment travel. The standard shall minimize the area allocated to those uses to the extent practical (Soil and Water).

5) Transportation facilities including roads, trails and bridges will be constructed and maintained to meet the objectives of the KNFP (Roads and Trails).

Standards

The KNFP also contains standards that supplement National and Regional policies, standards and guidelines found in FS Manuals, Handbooks and the Northern Regional Guide. These are also classified by the various resource or function. Those pertaining to roads include the following and can be found in the KNFP on pages II-21, 25 and 30:

1) The most cost effective logging system (including associated roads) that meets the MA standards will be used (Timber).

2) Developmental activities will be rigorously examined to insure that the minimum number and length of roads are constructed to the minimum standard necessary (Roads).

3) The Forest Travel Planning Process will be used to review, evaluate, and implement the goals and standards of the MAs in the KNFP with regard to road, trail and area wide motorized vehicle use (Off-Road Vehicles).

The KNFP also contains specific standards for riparian areas, which include water features (e.g. perennial streams, lakes, ponds) and the transition zone between the water feature and adjacent terrestrial habitat. Riparian zones include areas at least 100’ from the aquatic feature and can be a greater distance depending on recognizable soil characteristics and distinctive vegetative communities that require free and unbound water. Riparian areas include intermittent streams or those which flow only as a direct response to rainfall or snowmelt events, bogs, marshes, sloughs, potholes, mud flats, springs, wet meadows, seeps and floodplains or side channels of perennial streams. Riparian area standards, which apply to roads, include the following and may be found in the KNFP on pages II-30 and 33:

1) Improvements such as boat ramps, roads and trails that exist or are planned in riparian areas will have surfaces designed to minimize sedimentation (e.g. paving, seeding, or gravelling).

2) Roads that parallel streams will be located at a distance determined by sediment transport models, and outside the 100-year floodplain.

3) Active construction projects will be completed or treated before expected peak runoff times to minimize sediment yield.

4) When funds for road maintenance are limited, roads and drainage structures in riparian zones will be a top priority.

5) Necessary stream course crossings will insure fish passage, non-erosive water velocities and channel stability and insure erosion control on cuts, fills and road surfaces.

6) Eliminate or replace existing structures that are identified as fish barriers or sediment sources.

7) Roads will be located to avoid key riparian habitats such as wallows, bogs and wet meadows unless there is no reasonable alternative. In any case, as much screening, cover and distance as possible will be retained.

8) Road closures will be used to protect riparian habitat and values.

Other Regulatory Framework

Factors of consideration for how roads relate to other resources follow the legally mandated processes of the Endangered Species Act, the Clean Water Act, State-Adopted Best Management Practices, the Clean Air Act, the NFS Land Resource Management Planning Rule and relevant administrative policy. The IDT would work to develop opportunities that meet the KNFP goals and standards as they relate to the transportation system.

Applicable Laws, Regulations and Policies
The East Reservoir analysis area has some unique restrictions due to the presence of a grizzly bear reoccurring use area outside the recovery zones (BORZ). The following are some laws, regulations and policies associated with these characteristics.

Interagency Grizzly Bear Committee (IGBC) Direction
In 1998, the U.S. Fish and Wildlife Service (FWS) issued an Interim Access Management Rule Set to guide motorized access decisions for the Northern Continental Divide Ecosystem (NCDE) Grizzly Bear Recovery Areas. Standards for open road densities, core areas, and habitat security were established that superseded management area direction for road density standards and uses.

Grizzly bear reoccurring use areas outside the recovery zones (BORZ polygons) have been identified (Wittinger et al. 2002). The FWS has identified three factors falling under FS jurisdiction that contribute to "taking" (ESA Section 9) of grizzly bears that apply in these areas. They are access management, food attractants (human and livestock food storage and garbage) and livestock presence. The proposed project includes portions of the Tobacco BORZ.

The FWS, using baseline information from Johnson (2003), established access management desired conditions for areas outside the BORZ, with reoccurring grizzly bear use. The baseline conditions for access management in the Tobacco BORZ polygon are 2.0 mi/mi^2 of linear open road density and 3.0 mi/mi^2 of linear total road density.

Access Amendment
In November, 2011, The Kootenai National Forest (KNF) adopted the Addendum to KNFP Appendix 8 which replaces the KNFP standard for linear open road density with the Motorized Access Management Direction. This direction provides standards for both Bear Management Units (BMUs) and BORZ occupancy areas.

Under Alternative 2, the East Reservoir Project has a cumulative reduction of 4.1 miles of linear total road during operation and 7.1 miles following implementation in the Tobacco BORZ area.

Similarly, for Alternatives 3, the East Reservoir Project has a cumulative reduction of 6.4 miles of linear total road during operation and 7.9 miles following implementation and Alternative 4 has a cumulative reduction of 5.7 miles during with 7.9 miles following implementation.

Measurement Indicators
Road miles are used to measure and quantify all facets of the transportation analysis.

REFERENCE CONDITIONS/HISTORICAL REFERENCE

The first travel routes in the East Reservoir analysis area were skid trails and railroads associated with the Warland Lumber Company and later the Baird & Harper Lumber Company developed between 1906 and 1926.

Timber harvesting activities and recreational uses resulted in other road and trail development within the analysis area from that time through the 1990s.

Existing Condition
Within the East Reservoir travel analysis area, there are approximately 443 miles of existing road (mixed ownership). This total includes private (65 miles), State (29 miles), other federal (Corps of Engineers/BPA, 10 miles), undetermined on NFS lands (18 miles), and National Forest Service (320 miles) jurisdictions. Table 3.119 displays information on the existing characteristics of the current East Reservoir road system.

Table 3.119 - East Reservoir Road System Existing Characteristics

EAST RESERVOIR ANALYSIS AREA ROADS	MILES
Total Miles of All Roads In The East Reservoir Travel Analysis Area	439.16
National Forest System Roads (NFSR)	324.25
State Roads/Highway 37	27.89
COE/BPA Roads	11.58
Private Roads	55.34
Undetermined Roads on Forest Service Land	20.11
NATIONAL FOREST SYSTEM ROADS – EXISTING ROAD STANDARDS and CHARACTERISTICS	
EXISTING ROAD MANAGEMENT	
NFSR Restricted Yearlong	170.58
NFSR Open Yearlong	126.66
NFSR Restricted Seasonally	27.02
Undetermined Roads Closed Yearlong	5.04
FUNCTIONAL CLASS	
Arterial	22.81
Collector	111.00
Local	190.44
OBJECTIVE MAINTENANCE LEVELS	
Maintenance Level 5	0
Maintenance Level 4	0.98
Maintenance Level 3	102.94
Maintenance Level 2	19.63
Maintenance Level 1	200.70
ROAD SURFACING	
Native	232.40
Aggregate	89.86
Bituminous	1.99
CRITICAL TRAFFIC	
Pickup Truck	2.24
Log Truck	242.67
Lowboy	62.59
Motorhome	0.79

Open Road Densities (ORDs)

The MAs on FS lands in the East Reservoir analysis area consist of MA 2, 3, 5,6, 10, 11, 12, 13, 15, 16, 17, 18, 18og, 19, 24 and 30. Table 3.120 describes the ORDs of these management areas.

Table 3.120 - Management Area Open Road Densities

MA	ACRES	SQUARE MILES	OPEN ROADS (miles)	SEASONAL ROAD RESTRICTIONS (miles)	CURRENT ORD	ORD during RESTRICTED SEASON	KNFP ORD STANDARDS
2	1,552	2.43	0	0	0.00	0.00	NA
2og	101	0.16	0	0	0.00	0.00	NA
3	1,544	2.41	0	0	0.00	0.00	NA
3og	2	0.003	0	0	0.00	0.00	NA
5	1,220	1.91	1.83	0	0.96	0.96	NA
5og	51	0.08	0	0	0.00	0.00	NA
6	126	0.20	0.87	0	4.42	4.42	NA
10	4,008	6.26	0.07	1.60	0.27	0.01	12/1-4/30
10og	284	0.44	0	0	0.00	0.00	12/1-4/30
11	8,683	13.57	26.08	14.89	3.02	1.92	12/1-4/30
12	21,061	32.91	14.15	5.12	0.59	0.43	0.75
13	7,894	12.33	6.82	0.98	0.63	0.55	NA

MA	ACRES	SQUARE MILES	OPEN ROADS (miles)	SEASONAL ROAD RESTRICTIONS (miles)	CURRENT ORD	ORD during RESTRICTED SEASON	KNFP ORD STANDARDS
15	20,679	32.31	40.86	0.32	1.27	1.26	3
16	2,651	4.14	5.89	1.53	1.79	1.42	3
17	2,848	4.45	5.30	0	1.19	1.19	3
18	2,198	3.43	1.55	0	0.45	0.45	NA
18og	135	0.21	0.86	0	4.10	4.10	NA
19	2,370	3.70	1.05	1.00	0.55	0.28	NA
19og	62	0.10	0	0	0.00	0.00	NA
24	1,105	1.73	0.57	0.09	0.38	0.33	NA
24og	5	0.01	0	0	0.00	0.00	NA
30	6	0.01	0.04	0.00	4.00	4.00	NA
Private	13,962	21.82	20.72	1.48	1.02	0.95	NA

In MA 11, the KNFP management direction states that motorized access is generally not permitted during the big game wintering period from December 1 through April 30 (KNFP Vol. 1, p. III-45). Currently, there are approximately 6.27 miles of road restricted yearlong in MA 11 and 26.06 miles of road open yearlong and 15.06 miles of seasonally open roads in the analysis area. The open roads are needed for yearlong access to private lands, administrative sites, utilities and roads that have traditionally remained open for access to higher elevations. KNFP direction states that while motorized access is generally not permitted during important wintering periods, roads that have traditionally been used as snowmobile routes to higher elevations may remain open unless it is determined that continued snowmobile use limits use of the area by big game.

In MA 13, there are currently 8.31 miles of open or seasonally open roads in the East Reservoir analysis area. All of these are main collector or arterial roads.

Physical Condition of the Roads

The overall condition of the existing NFS roads in the East Reservoir analysis area is satisfactory. BMPs have been performed on portions of the main roads, but have not been completed for the full length of most roads. The needed BMPs include adding culverts to relieve long ditch sections, installing additional surface drainage structures such as drain dips and surface water deflectors, and other minor work items. These items include cleaning ditches and catch basins, reshaping out-sloped roads, and placing geo-fabric and aggregate to bridge wet areas on roads.

Road maintenance is regularly performed on NFS roads with an objective maintenance level of 2 or higher. Brushing, road grading, slough removal and ditch cleaning are part of the regular maintenance schedule for these roads. Occasionally, the maintenance crew will perform BMPs. This usually involves adding culverts, surface water deflectors or drain dips to correct obvious drainage problems. Some of the local roads in the analysis area have recently been used for timber sales and brought up to current BMPs. The only maintenance scheduled for roads that are restricted yearlong is to inspect the road for drainage problems.

Efficiency of the Road System

The existing road system in the East Reservoir analysis area has been evaluated for road necessity. Many roads have already been treated to apply State of Montana BMPs to minimize sediment transport. The IDT determined that additional road storage until the roads are needed and road decommissioning where roads are no longer needed would result in the minimum road system needed to meet objectives of the KNFP.

Adding Existing Roads to the National Forest System

During the analysis process, several roads were found in the East Reservoir analysis area for which the

purpose and need was undetermined. These roads cross NFS lands, but for various reasons, had never been included as a part of the NFSR system. Inventory of the roads for the East Reservoir TAP revealed several forest roads that should have been listed as NFS roads, but were not designated as NFSR in the INFRA database or the Transportation Atlas when it was completed.

The IDT analyzed and evaluated any and all resource needs for each existing road, whether they were NFS roads or "Undetermined Roads". Any obvious skid trails or illegally developed roads, for which the FS already has the authority to eliminate traffic, were not analyzed, or considered as roads. Twenty-seven undetermined roads totaling approximately 13.5 miles were determined as needed for the long-term transportation system and are recommended to become NFS roads in Alternative 2 and 3.

Placing Roads into Intermittent Stored Service
The analysis for Alternative 2 identified 17 roads (16 miles) while Alternative 3 identified 23 roads (17.6 miles), which would not be needed for resource access during the next 10 to 20 years. All of these roads (except for 4885C, 4885H, 4885I) are currently restricted yearlong. The IDT recommends putting them in intermittent stored service to reduce the risk these roads have to watersheds and to reduce road maintenance costs.

Road Management
The existing road system in the East Reservoir analysis area has a good balance of open and restricted roads. Several major roads provide adequate access through the area. Many of the spur roads in the upper elevations of the analysis area are restricted yearlong.

Desired Future Conditions
The minimum necessary transportation system of NFS Roads has been identified and managed so:

- There is safe and efficient access for Forest Service land management activities.
- There is suitable and safe access for recreation and other public access values.
- Threatened, endangered, sensitive, and management indicator species habitat needs, as defined by research and science, have been met.
- Sediment, water quality, and water quantity effects from roads to streams, riparian areas, and wetlands have been reduced.
- Road maintenance costs have been reduced.
- The travel plan within the East Reservoir analysis area is easily understood and enforceable.

Actions needed to achieve the optimal road system include:

- Evaluate and determine the minimum road system necessary for resource and public access.
- Decommission unneeded roads or convert them to other uses, such as trails.
- Bring roads up to BMP standards.
- Regularly monitor all roads for maintenance needs.
- Manage each road according to the road management objective.

With roads identified to be placed into intermittent stored service, and numerous roads needing BMP improvements, it is apparent that the existing road system in the East Reservoir analysis area does not meet our desired future condition. The following proposed alternatives and associated effects will address the needed strategies to bring the roads in the analysis area closer to the optimal road system.

Develop a Travel Plan
The East Reservoir TAP provided the framework for travel management planning. This framework identified opportunities and set priorities for motorized use within the analysis area. The clear identification of roads, trails and areas for motor vehicle use would enhance management of NFS lands, sustain natural resource values through more effective management of motor vehicle use, enhance

opportunities for motorized recreation experiences on NFS lands, address needs for access to private lands, and preserve areas of opportunity on each National Forest for non-motorized travel and experiences. During the East Reservoir planning process, KNF specialists identified a variety of resource concerns related to travel management including conflicts between recreational uses, and impacts to wildlife, fish and water quality from motorized travel, and economic impact to the community. These concerns were captured in the East Reservoir TAP as "Risks and Benefits" (TAP page 13 through 15).

The alternatives being considered identify specific levels and seasons of use for all NFS roads within the analysis area. All of the action alternatives would allow motorized access to dispersed campsites via routes that terminate in dispersed campsites as well as within 300 feet of most designated system roads and motorized trails where slope, vegetation type and resource conditions would permit such use without causing unacceptable levels of damage.

ENVIRONMENTAL CONSEQUENCES

To meet the desired future condition, all action alternatives propose similar activities to implement. The direct and indirect effects would also be similar, but differing by quantity. Therefore, the effects will first be analyzed by proposed activities to achieve the optimal road system and then compared by alternatives.

ALTERNATIVE 1 (No-Action)

Direct and Indirect Effects

If the strategies to address the Purpose and Need in Chapter 1 are not realized, the desired future condition of the East Reservoir analysis area would not be met. All of the proposed road management actions were developed to reduce risks and effects and to achieve the optimal road system. If these actions were not accomplished, the road system would continue to generate risks and effects to water quality, wildlife security and transportation efficiency.

ALTERNATIVE 2 and 3

Direct and Indirect Effects

Road Decommissioning

Routes proposed for decommissioning are those roads that are no longer needed and can be removed from service. Removing these roads from service would improve watershed conditions and maintenance dollars would not be needed. These roads, proposed for decommissioning, are NFS roads and undetermined roads. The undetermined roads are roads that exist but are not part of the NFS of roads. See Table 3.121 for miles of road to be decommissioned by alternative.

Intermittent Stored Service

Roads continue to affect water quality and wildlife security, and incur maintenance costs even when restricted yearlong. Placing roads that are not needed for resource management purposes for the next ten to 20 years into intermittent stored service can reduce these effects through implementation of Water Quality BMP's. Treatment activities for intermittent stored service may include removing culverts, restoring stream crossings and natural drainage patterns, out-sloping the road surface, installing water bars, and seeding and fertilizing the roadbed. Each road would be stored in accordance with the KNF road storage policy that is adopted and in place at the time this document is signed. The road prism would remain on the landscape.

Placing a road into intermittent stored service allows the watershed risks posed by the road to be minimized and maintenance costs deferred while the road remains on the NFSR system for future use.

Placing 16 miles for Alternative 2 and 17.62 miles for Alternative 3, into intermittent stored service would reduce road maintenance costs, reduce road-related effects to water quality and would help provide for wildlife security.

Additions to the National Forest Road System

The undetermined roads that are proposed as additions to the transportation system are, in fact, existing

forest roads that have been shown through a roads analysis to be needed for the protection, administration and utilization of the NFS and the use and development of its resources. The effects of not having these needed roads as NFS roads include the lack of any authorized funding to maintain the road. These existing roads provide the most efficient location for access to timber resources and recreational sites. If they were decommissioned, there would be no feasible access to these resources. Because these roads are already on the landscape and generating risk and effects to other resources, adding them to the system would not increase any of these effects. In fact, adding them would allow for funded road maintenance and management that would reduce these existing risks and effects.

Adding these undetermined roads to the NFSR system would achieve the minimum road system necessary for efficient access to manage the resource and recreational opportunities of the East Reservoir analysis area. This action would directly and beneficially affect the efficiency and practicality of the transportation system. See Table 3.121 for miles of road to be added to the system by alternative.

Table 3.121 lists the proposed road management for the alternatives. The direct and indirect effects incurred by road management proposals in Alternatives 2 and 3 are positive and beneficial to the transportation system, the watersheds and wildlife resources.

Table 3.121 – Comparing Road Related Actions by Alternatives (miles)

PROPOSED ROAD MANAGEMENT ACTIONS	ALT 1	ALT 2	ALT 3
Roads to be included in Cost Share Agreement with MT DNRC	0	29.72	29.72
Newly Constructed Roads Added to NFSR	0	9.25	8.06
Temporary Roads to be Constructed	0	4.26	4.05
Roads Proposed For Intermittent Stored Service	0	16.00	17.62
NFS Roads Proposed For Decommissioning	0	5.93	5.93
Undetermined Roads To Be Added To The National Forest Road System	0	13.50	13.50
Undetermined Roads To Be Decommissioned	0	6.24	6.48
Trails: Currently Motorized Trails Converted to Non-Motorized Trails	0	36.56	26.89
Road Access Changes, from Seasonal Restrictions to Open Yearlong.	0	1.79	1.64
Road Access Changes, From Closed Yearlong to Closed Seasonally	0	0	3.70

Cumulative Effects
No measurable increase in long-term negative effects would result from the implementation of any proposed or on-going road management activities. It is, however, recognized that most road management activities that provide long-term benefits also create some minor and acceptable short-term negative effects.

All current, proposed and foreseeable road-related activities would have beneficial cumulative effects to the transportation system, wildlife, aquatic and recreational resources. These activities would also reduce the risks and effects created by past road construction and management.

Timber Harvest and Associated Activities
Timber sales typically require needed road improvements in order to move a road into BMP compliance. Precommercial thinning and prescribed burning do not generally require road improvement work because of the dispersed, short-term, or low impact nature of these activities on forest roads. Vegetation management activities, overall, have a beneficial effect on the road system.

Cattle Grazing
Cattle on higher volume roads continue to be a safety concern. However, cattle grazing does not have a measurable impact to road function.

Noxious Weed Treatment
Traffic continues to spread noxious weeds along roads. The treatment program is effective along

roadways, but must continue to prevent new infestations from developing along roadways. This program has beneficial effects to the road system.

Fire Suppression
Fire suppression and related activities would occur in the future. Wildfires that escape initial attack could impact the road system in the short-term. Roads that are impassable prior to a fire start may be opened with heavy equipment. This can cause short-term impacts to the roads. Following the suppression actions, these roads would be restored to a condition that allows proper drainage.

Road Management
Deferred and regular, scheduled maintenance activities continue to maintain or improve road conditions within the analysis area.

Public Use
Various roads in the analysis area are heavily used during the summer and fall months. Excessive speeds and braking activity cause corrugation and potholing in the gravel surface. Narrow road prisms can cause damage to edges of roads as traffic is forced onto road shoulders when vehicles meet. Traffic during wet periods may cause rutting and create surface drainage problems. Firewood gathering can plug road ditches and/or culverts when this activity is conducted outside the terms of the firewood permit. Other public use activities occurring throughout the year have a negligible effect to the road system. Annual maintenance of main roads is scheduled specifically to address high public use.

Recreation Maintenance
Maintenance of recreational facilities generally consists of removal of blown down timber, brush removal and minor drainage repair of trails or other recreational facilities. This activity has very little impact to the road system.

Special Uses
Special use permits (road use, water lines, utility lines, irrigation improvements, etc.) and outfitter/guide permits have not been identified as having a measurable effect on the road system. These activities have a low impact to road resources due to their dispersed nature. Cumulatively, there would be no effect.

Activities on Private Land
New residential construction would increase traffic on forest roads. These increases are gradual over time and not generally impactive unless hauling over wet roads occurs during periods of construction.

Overall, the previously described activities would have a neutral or beneficial impact to the road system. Management activities that require heavy use of roadways collect monies for maintenance activities that improve road function and reduce road-related impacts to other resources. Other activities are low impact and dispersed in nature and outside of wet periods, generally have very little impact on road systems.

CONSISTENCY with REGULATORY FRAMEWORK

The process of this analysis and the road management proposals listed in this document comply with all laws, executive orders, Forest Service directives, memorandums of understandings, and with the current KNFP goals, objectives, guidelines and standards.

ECONOMICS INTRODUCTION
INTRODUCTION

The management of the Kootenai National Forest (KNF) has the potential to affect local economies. People and economies are an important part of the ecosystem. Use of resources and recreational visitation to the KNF generate employment and income in the surrounding communities and counties and generate revenues that are returned to the federal treasury.

This section presents concepts used to delineate an affected area and methods used to analyze the economic effects of the project, including the project feasibility, financial efficiency and economic impacts. Project feasibility and financial efficiency relate to the costs and revenues of doing the action. Economic impacts relate to how the action affects the local economy in the surrounding area.

REGULATORY FRAMEWORK

The preparation of NEPA documents is guided by CEQ regulations for implementing NEPA [40 CFR 1500-1508]. NEPA requires that consequences to the human environment be analyzed and disclosed. The extent to which these environmental factors are analyzed and discussed is related to the nature of public comments received during scoping. NEPA does not require a monetary benefit-cost analysis. If an agency prepares an economic efficiency analysis, then one must be prepared and displayed for all alternatives [40 CFR 1502.23].

OMB Circular A-94 promotes efficient resource use through well-informed decision-making by the Federal Government. It suggests agencies prepare an efficiency analysis as part of project decision-making. It prescribes present net value as the criterion for an efficiency analysis.

The development of timber sale programs and individual timber sales is guided by agency direction found in Forest Service Manual (FSM) 2430. Forest Service Handbook (FSH) 2409.18 guides the financial and, if applicable, economic efficiency analysis for timber sales.

ANALYSIS AREA

The analysis area for the efficiency analysis is the project area. All costs and revenues associated with the project decision were included.

Timber management activities within the analysis area have the potential to impact the economic conditions of local communities and counties. To estimate the potential effect on jobs and income, a zone of influence (or impact area) was delineated. Counties were selected based on commuting data suggesting a functioning economy and where the timber is likely to be processed (log flows). Recent data on log flows from the KNF was provided by the University of Montana's Bureau of Business and Economic Research. The zone of influence for this project is comprised of Lincoln, Sanders, and Flathead counties in Montana and Boundary and Bonner counties in Idaho.

AFFECTED ENVIRONMENT

The combination of small towns and rural settings, along with people from a wide variety of backgrounds, provide a diverse social environment for the geographical region around the KNF. Local residents pursue a wide variety of life-styles, but many share a common theme, an orientation to the outdoors and natural resources. This is reflected in both vocational and recreational pursuits including employment in logging and milling operations, outfitter and guide businesses, hiking, hunting, fishing, camping and many other recreational activities.

Timber, tourism and agricultural industries are important to the economy of local areas. Despite the common concern for, and dependence on, natural resources within the local communities, social attitudes vary widely with respect to their management. Local residents hold a broad spectrum of perspectives and preferences ranging from complete preservation to maximum development and utilization of natural resources.

A comprehensive socio-economic analysis was recently completed for the KNF. See the document "Social and Economic Systems: Conditions and Trends" (available at http://www.fs.usda.gov/Internet/FSE_DOCUMENTS/stelprdb5345935.pdf) (Russell et al, 2006). This document provides a description of the employment, income and social composition of the counties comprising the analysis area and the impact on counties from management of the KNF. This analysis indicates the counties within the analysis area are affected by timber management on the forest. In addition, the draft Environmental Impact Statement for the Draft Forest Plan described the affected environment for the planning area and the effect of forest management on the local communities and economy. See pages 397 – 401 of the draft Environmental Impact Statement (USDA Forest Service 2011).

There is local demand for stumpage from the KNF, as evidenced by the amount of timber sales sold on the Kootenai in recent years. In addition, recent analysis indicates timber processing capacity is well above timber supply for the analysis area (Sorenson et al. 2012). Most sales offered have been sold with strong competition. The outlook for the timber market is to improve over the next several years, with modest improvement in 2013 and more substantial improvements in 2014 and beyond (Sorenson et al. 2012).

Methodology

Three measures are appropriate for the economic analysis: project feasibility, financial efficiency, and economic impacts. These measures are described including methodologies.

Project feasibility is used to determine if a project is feasible – will it sell, given current market conditions. It relies on the Region 1 Transaction Evidence Appraisal (TEA) System and delivered log prices. The TEA uses regression analysis of recently sold timber sales to predict bid prices. The most recent appraisal and feasibility model for the area of interest was used to estimate the stumpage value (expected high bid resulting from the timber sale auction) for the timber project. The estimated stumpage value for each alternative was compared to the base rates (revenues considered essential to cover regeneration plus minimum return to the federal treasury) for that alternative. The project is considered to be feasible if the estimated stumpage value exceeds the base rates. If the feasibility analysis indicates that the project is not feasible (estimated stumpage value is less than the base rates), the project may need to be modified. The infeasibility indicates an increased risk that the project may not attract bids and may not be implemented.

Financial efficiency provides information relevant to the future financial position of the program if the project is implemented. Financial efficiency considers anticipated costs and revenues that are part of Forest Service (FS) monetary transactions. Present net value (PNV) is used as an indicator of financial efficiency and presents one tool to be used in conjunction with many other factors in the decision-making process. PNV combines benefits and costs that occur at different times and discounts them into an amount that is equivalent to all economic activity in a single year. A positive PNV indicates that the alternative is financially efficient.

Many of the costs and benefits associated with a project are not quantifiable**.** For example, the benefits to wildlife from prescribed burning to stimulate browse and reduced fuel loadings, are not quantifiable. These costs and benefits are described qualitatively, in the individual resource sections of this document. Title 40, Code of Federal Regulations for NEPA (40 CFR 1502.23) indicates "For the purposes of complying with the Act, the weighing of the merits and drawbacks of the various alternatives need not be displayed in a monetary cost-benefit analysis and should not be when there are qualitative considerations."
Management of the forest is expected to yield positive benefits, but not necessarily financial benefits. Costs for various vegetation, recreation, wildlife, road and burning activities are based on recent experienced costs and professional estimates. Non-harvest related costs are included in the PNV analysis,

but they are not included in appraised timber value.

Economic impacts are used to evaluate potential direct, indirect and cumulative effects on the economy. Economic impacts are estimated using input-output analysis. Input-output analysis is a means of examining relationships within an economy, both between businesses and between businesses and final consumers. It captures all monetary market transactions for consumption in a given time period. The resulting mathematical representation allows one to examine the effect of a change in one or several economic activities on an entire economy, all else constant. This examination is called impact analysis. IMPLAN translates changes in final demand for goods and services into resulting changes in economic effects, such as labor income and employment of the affected area's economy. The IMPLAN modeling system allows the user to build regional economic models of one or more counties for a particular year. The regional model for this analysis used the 2009 IMPLAN data.

The economic impact effects are measured by estimating the direct jobs and labor income generated by the 1) processing of the timber volume from the project, and 2) dollars resulting from any other activities of the project into the local economy affected by the treatments proposed. The direct employment and labor income benefit employees and their families and therefore directly affect the local economy. Additional indirect and induced, multiplier effects (ripple effects) are generated by the direct activities. Together the direct and multiplier effects comprise the total economic impacts to the local economy. The data used to estimate the direct effects from timber harvest is information provided by University of Montana's Bureau of Business and Economic Research. The economic effects tied to restoration activities and the multiplier effects (of both timber harvest and restoration activities) were estimated using IMPLAN.

Potential limitations of these estimates are the time lag in IMPLAN data and the data intensive nature of the input-output model. Significant changes in economic sectors since the latest data for IMPLAN have been adjusted using information from the University of Montana's Bureau of Business and Economic Research.

ENVIRONMENTAL CONSEQUENCES

Project Feasibility

The estimation of project feasibility was based on a transaction-evidence and delivered log price appraisal, which took into account logging system, timber species and quality, volume removed per acre, lumber market trends, costs for slash treatment, and the cost of specified roads, temporary roads and road maintenance. The estimated high bid was compared to base rates (revenues considered essential to cover regeneration plus minimum return to the federal treasury). The estimated high bid and base rates for each alternative are displayed in Table 3.122. Given the predicted high bids and the base rates, all alternatives are feasible.

The predicted high bid is the basis for the timber revenue estimate. The actual timber value would depend on the market when the timber is sold, and may be higher or lower than the predicted high bid. The analysis included a relatively low Western Wood Products Association (WWPA) average value per thousand board feet (MBF).

Financial Efficiency

The financial efficiency analysis is specific to the timber harvest and ecosystem management activities associated with the alternatives (as directed in FSM 2400, Timber Management and guidance found in the FSH 2409.18). Costs for sale preparation, sale administration, regeneration and other activities are included. All costs, timing and amounts were developed by the specialists on the project's interdisciplinary team. The expected revenue for each alternative is the corresponding predicted high bid from the transaction evidence and delivered log price appraisal. The present net value (PNV) was calculated using Quicksilver, a program for economic analysis of long-term, on-the-ground resource

management projects. A four percent discount rate was used over the 12-year project lifespan (2013-2024). For more information on the values or costs, see the project file.

This analysis is not intended to be a comprehensive benefit-cost or present net value analysis that incorporates a monetary expression of all known market and non-market benefits and costs that is generally used when economic efficiency is the sole or primary criterion upon which a decision is made. Many of the values associated with natural resource management are best handled apart from, but in conjunction with, a more limited benefit-cost framework. These values are discussed throughout this document, for each resource area.

Changes to resources like fisheries and wildlife habitats, and recreation are further discussed in the corresponding sections of this DEBE. These resources will not be described in this section in financial or economic terms. The economic efficiency analysis included costs for trail construction, prescribed burning outside the timber sale to reduce fuel loading and improve wildlife habitat, and thinning. There is no generated revenue from these activities. These activities would be funded by some means other than the timber sale.

Planning costs (NEPA) were not included in any of the alternatives since they are sunk costs at the point of alternative selection.

Table 3.122 summarizes the project feasibility and financial efficiency for each alternative. Alternative 1 is not listed, as all values would be zero (no costs or revenues). The no-action alternative would not harvest, plant trees, enhance wildlife habitat, implement BMPs on haul routes, return fire to the landscape or take other restorative actions and, therefore, incur no costs. Because all costs of the project are not related to the timber sale, two PNVs were calculated. One PNV indicates the financial efficiency of the timber sale, including all costs and revenues associated with the timber harvest and required design criteria. A second PNV includes all costs for each alternative, including other activities that are non-timber harvest related (burning to reduce fuels, burning to improve wildlife habitat, trail construction, etc.).

Table 3.122 indicates that Alternative 3 has the highest PNV and is financially efficient for the timber harvest and required design criteria. Alternative 2 is also financially efficient for the timber harvest and required design criteria, but with a slightly lower PNV than Alternative 3. All alternatives are financially inefficient when the non-timber harvest activities are included in the PNV. Alternative 3 also has the highest PNV for the harvest plus non-timber harvest activities. For the Corps of Engineers alternatives, Alternative 3 has the highest PNV for both the timber harvest and the non-harvest activities.

A reduction of financial PNV in any alternative as compared to the most efficient solution is a component of the economic trade-off, or opportunity cost, of achieving that alternative. As indicated earlier, many of the values associated with natural resource management are non-market benefits. These benefits should be considered in conjunction with the financial efficiency information presented here. These non-market values are discussed in the various resource sections found in this document.

Table 3.122 Project Feasibility and Financial Efficiency Summary (2011 dollars)

CATEGORY	MEASURE	ALT. 2	ALT. 3	COE ALT 2	COE ALT 3
Timber Harvest Information	Acres Harvested	8,845	7,782	261	261
Volume(CCF)	Total Sawtimber Harvested	78,761	67,987	1,848	2,088
	Base Rates ($/CCF)	$23.53	$25.94	$24.80	$24.80
	Predicted High Bid ($/CCF)	$55.25	$56.47	$74.68	$74.51
	Total Revenue	$4,351,545	$3,839,225	$138,008	$155,576

CATEGORY	MEASURE	ALT. 2	ALT. 3	COE ALT 2	COE ALT 3
Timber Harvest and Required Design Criteria	PNV	$200,272	$235,143	$42,248	$47,339
Timber Harvest and Other Planned Activities	PNV	-$2,589,535	-$2,432,304	-$57,370	-$28,689

When evaluating trade-offs, the use of efficiency measures is one tool used by the decision-maker in making the decision. Many things cannot be quantified, such as effects on wildlife, impacts on local economies, and restoration of watersheds and vegetation. The decision-maker takes many factors into account in making the decision.

Economic Impact Effects (Jobs and Labor Income)
Timber production from this proposed KNF project would have direct and indirect effects on local jobs and labor income. The KNF used an input-output model, IMPLAN (Impact Analysis for Planning) to estimate effects on employment and labor income within the zone of influence (impact area).

For timber harvest, the direct employment and labor income response coefficients (e.g. jobs and labor income per million cubic feet) were derived by the University of Montana's Bureau of Business and Economic Research. The indirect and induced multiplier effects were estimated using the IMPLAN model for the economic impact area.

For restoration and reforestation activities, the direct, indirect and induced effects were derived using IMPLAN. The resulting direct, indirect and induced employment and labor income coefficients have been incorporated into a spreadsheet developed by the Regional Economist for the USFS, Northern Region.

The analysis calculated the jobs and labor income associated with timber harvest and other resource activities. In order to estimate jobs and labor income associated with timber harvest, the timber harvest levels were proportionally broken out by product type with an estimated 80% of the sale going towards sawtimber and 20% to post and poles. In order to estimate jobs and labor income associated with reforestation and restoration activities, expenditures for these activities were developed for each alternative (see Table 3.123).

Table 3.123 - Reforestation and Other Restoration Activity Expenditures by Alternative
over a 20-yr period (2012 dollars) (does not include overhead costs)

ACTIVITY	ALT. 2	ALT. 3	COE ALT. 2	COE ALT. 3
Trail Construction	0	$2,000	0	0
Road Storage/Decommissioning	$85,695	$93,570	0	0
Weed Spraying	$3,308	$3,696	0	0
Botanical Monitoring and Inventory	$8,000	$8,000	0	0
Precommercial Thinning and Pruning	$793,941	$687,741	0	0
Prescribed Fire	$2,924,840	$2,875,960	$104,550	$69,870
Site prep and planting	$875,750	$767,700	0	0
Grapple Pile Fuels	0	0	0	$3,680
Total	**$4,691,534**	**$4,438,667**	**$104,550**	**$73,550**

Table 3.124 displays both direct and total estimates for employment (part and full-time) and labor income that may be attributed to each alternative. Alternative 1 is not listed, as all values would be zero, with no jobs or labor income generated. Since the expenditures occur over a twenty-year period, the estimated impacts of jobs and labor income would be spread out over the life of the project. These are not new jobs or income, but rather jobs and income that can be attributed to this project.

Table 3.124 – Total Employment and Income Over the Life of the Project (2010 dollars)

ANALYSIS ITEM	ALT. 2	ALT. 3	COE ALT. 2	COE ALT. 3
Direct Employment (persons)	403	363	9	9
Total Employment (persons)	629	560	15	14
Direct Labor Income	$15,777,000	$13,951,000	$366,000	$375,000
Total Labor Income	$23,987,000	$21,113000	$558,000	$582,000

Definitions:
1. Employment is the total full- and part-time wage, salaried, and self-employed jobs in the region.
2. Labor income includes the wages, salaries and benefits of workers who are paid by employers and income paid to proprietors.

Estimates in Table 3.124 indicate that Alternative 2 would maintain the highest number of jobs and labor income with total employment at 629 persons and total labor income nearly $24 million dollars. Alternative 3 maintains fewer jobs and labor income. Alternative 1 maintains no jobs or income because there are no activities associated with this alternative.

Activities on the Corps of Engineers land maintains about the same number of jobs under all alternatives except alternative 1. Alternative 2 maintains 15 jobs and $558,000 in total labor income.

The analysis assumes the timber volume processed would occur within the KNF zone of influence. However, if some of the timber were processed outside the region, then a portion of the jobs and income would be lost by this regional economy.

Cumulative Effects

Management of the KNF has an impact on the economies of local counties. However, there are many additional factors that influence and affect the local economies, including changes to industry technologies, management of adjacent national forests and private lands, economic growth, and international trade.

Ongoing and reasonably foreseeable projects that may affect local economies include the following:

- The sale of timber on private lands near the analysis area would have a positive impact on the local economy, maintaining jobs and labor income in the surrounding counties.
- Large-scale mining activities take place near the analysis area. Most significant for the economy is the Troy Mine and the proposed Montanore Mine. The Troy Mine continues to bring jobs and labor income to Lincoln County. Possible development of the Montanore Mine would bring a significant amount of jobs and labor income to Lincoln County.
- Private timber lands owned by Plum Creek Timber Company are either for sale or sold and actively being subdivided in the zone of influence. Real estate transactions could potentially be a significant short-term contributor to the local economy, though the loss of natural resource management activities associated with these lands would have a negative impact to the economy.
- The analysis area is very popular for recreation activities such as hiking, hunting, camping, horseback riding and berry picking. These activities generate income in the local economy through local and non-local participants who purchase goods and services in the area.
- **For the East Reservoir project**, the jobs and labor income associated with timber harvest, restoration and reforestation activities in the action alternatives, would contribute to the stability of the local economy during the life of the project and also for the future.

OTHER REQUIRED DISCLOSURES

NEPA at 40 CFR 1502.25(a) directs “to the fullest extent possible, agencies shall prepare draft environmental impact statements concurrently with and integrated with …other environmental review laws and executive orders.”

Effects of Alternatives on Social Groups

Executive Order 12898 ordered federal agencies to identify and address the issue of environmental justice (i.e. adverse human health and environmental effects of agency programs that disproportionately impact minority and low income populations). Based on experience with similar projects on the Libby Ranger District, none of the alternatives would disproportionately affect minority or low-income individuals, Native American Indians, women, or civil rights. The implementation of this project is expected to provide job opportunities in communities such as Libby, Montana. Small or minority-owned businesses would have the opportunity to compete for some of the work, including timber sales, non-commercial thinning, and fuels reduction projects.

Effects on Floodplains and Wetlands

Floodplain areas constitute all of the wetlands in the analysis area and are protected as RHCA's. Wetlands may occur in the form of seeps, springs, and small bogs; however, the exact locations of all these have not been identified prior to unit layout. These seeps, springs, and small bogs are not evident through aerial photography and are probably less than one-quarter acre in size. These areas would be protected by adhering to the Montana Stream Management Zone regulations, Kootenai National Forest Riparian Area Guidelines as amended by INFS (USDA, Forest Service, 1987), Best Management Practices and Section 404 of the Clean Water Act (33 CFR 323). See the Water Resources section of this chapter for more specifics.