

Chapter 3 Affected Environment and Environmental Consequences

3.1 Introduction

This chapter describes the existing environment and environmental components and resources in the analysis area that would be affected either by the Proposed Action or by the Agency-Mitigated Alternative. **Figure 1-1** and **Figure 1-2** give an overview of the analysis area. The No Action Alternative is described in the following sections solely as a baseline for comparison with the Proposed Action and the Agency-Mitigated Alternative. The No Action Alternative is not a feasible alternative because it would not meet current water quality standards for discharge of adit water to Stanley Creek.

In addition to describing existing conditions, this chapter analyzes the potential impacts that would result from implementation either of the Proposed Action or of the Agency-Mitigated Alternative. Environmental components related to major issues identified in Chapter 2 are also described in more detail while other resources are described briefly. Major issues include the following:

Water Management

- adit closure and mine water distribution;
- water treatment and disposal;
- groundwater quality;
- surface water quality; and
- long-term monitoring of water quality.

Reclamation

- reclamation materials;
- subsidence;
- revegetation;
- infrastructure; and
- topography.

3.2 Past and Current Actions

Past and current actions are important to consider in evaluating the potential cumulative direct and indirect impacts of the proposed project. Cumulative impacts are impacts on the environment, that result from the combination of potential impacts from the project with impacts from other closely-related past, present, and reasonably foreseeable future projects. Cumulative impacts are the result of individually minor, but collectively significant, actions taking place over a period of time, regardless of the agency or person undertaking the project. This section describes those past and current actions within the Lake Creek watershed that could be relevant to the proposed project.

3.2.1 KNF Management Activities

Two projects are located in the Three Rivers Ranger District of the Kootenai National Forest (KNF) and are briefly described below. Additionally, past timber harvest activities are included below.

3.2.1.1 Motor Vehicle Use Map Project

Following analysis in an Environmental Assessment (EA), a Decision Notice (DN) and Finding of No Significant Impact (FONSI) were issued September 2009 for the Motor Vehicle Use Map Project situated within the Three Rivers Ranger District of KNF. The alternative selected for this project prohibits motorized use of all the District's trails, prohibits cross-country motor vehicle use on NFSL located in Idaho (excluding over-snow vehicles), designates approximately 500 miles of currently open National Forest System Roads (NFSR) open to highway legal vehicles, and allows 300 feet of cross-country motor vehicle use off designated NFSR to access dispersed camping in specific locations (KNF 2009a).

3.2.1.2 Kootenai National Forest Invasive Plant Management

In 2007, USFS made a decision to implement an invasive plant management plan for 2,225,000 acres of KNF, including Lincoln County. A maximum of 30,000 acres of noxious weed infestations may be treated annually for up to 15 years. As stated in the project decision notice, this "decision will also allow for an adaptive and integrated weed management strategy which includes: treatment of new weed species, new weed patches, and new control methods (biological control agents, hand-pulling, cultivation, cultural, mechanical treatment, and new herbicides)" (USFS 2007).

3.2.1.3 Timber Harvest

The most recent large timber sale projects in the Lake Creek watershed are described in the Sparring Bulls Draft EIS and are shown in **Table 3-1**. The Spar and Lake Subunits Record of Decision (ROD) authorized approximately 2,173 acres of harvest; approximately 70 percent was intermediate harvest methods and 30 percent regeneration harvest methods (KNF 2010).

In 2006-2007, the State of Montana harvested 587 acres on the east side of the Lake Creek watershed in Township 31 North, Range 34 West, Section 16; approximately 65 percent used regeneration harvest methods and 35 percent used intermediate harvest methods. Previously in 2001-2002, the state harvested 380 acres on the west side of the Lake Creek watershed in Township 30 North, Range 34 West, Section 36 (Keeler Mountain); approximately 10 percent were regeneration harvests and 90 percent were intermediate harvests (KNF 2010).

Table 3-1. Recent Timber Sales within Lake Creek Watershed

Timber Sale	Timber Sale Date	NEPA Decision Document
Keeled Over	2007-2009	Forest-wide Blowdown EA
Spar Copter	2004-2005	Spar and Lake Subunits ROD 2001
Keeler Heli	2002-2004	Spar and Lake Subunits ROD 2001
Keeler Bottoms	2005	Spar and Lake Subunits ROD 2001
Whitetail Salvage/ Shimmering Grouse	2002	Spar and Lake Subunits ROD 2001
Hiatt Ho Salvage	2000-2004	Hiatt Ho Decision Memo Decision Memo 1997
Plopped Pony Salvage	1998	Plopped Pony Salvage Decision Memo 1997
Imadgine Salvage	1998	Imadgine Salvage Decision Memo 1995

Source: Sparring Bulls Draft EIS, KNF, 2010.

3.2.2 Private and State Land Actions

DEQ reviews all preliminary plats and certificate of surveys for suitability for septic or community water systems in the unincorporated areas in Lincoln County. Between 1999 and 2006, DEQ approved an average of 45 septic permits per year near the Troy and Bull Lake areas (Lincoln County 2009).

On December 15, 2009, an application was submitted for a 6.62 acre, two-lot, residential subdivision known as the O’Neal Subdivision to be located east of MT 56 near the Troy Mine tailings impoundment area. Lot 1 consists of timbered land with an existing home, shop, and business, all known as Ray O’Neal Welding and Exhaust, and Lot 2 is vacant. Both lots propose to use existing roads and access to MT 56. The Final Lincoln County Subdivision Planning Staff Report for the O’Neal subdivision notes that mitigation measures would be applied to reduce subdivision effects on the natural environment including, but not limited to, wildfire protection standards, noxious weed control, floodplain management, and state and local sewage disposal requirements. Because this area may contain winter and general range for big game, restrictive covenants intended to protect wildlife and wildlife habitat would reduce potential wildlife conflicts (Lincoln County Planning Department 2010).

3.3 Reasonably Foreseeable Future Actions

Reasonably foreseeable future actions are important to consider in evaluating potential cumulative direct and indirect effects of the proposed project. This section describes reasonably foreseeable future actions that could incrementally contribute to the cumulative effects on resources affected by the proposed project.

3.3.1 Kootenai National Forest

3.3.1.1 Troy Mine Mining and Exploration

Troy Mine, Inc. expects to continue mining operations at the Troy Mine at its current rate of production for another 5-7 years and has been conducting exploration drilling for additional ore reserves from 2004 to the present. These exploration projects have been approved by the USFS and DEQ as addendums to Troy Mine, Inc.'s approved plan of operation for drilling. Troy Mine, Inc. also continues to explore ore bodies below and adjacent to the ore body currently being mined that may extend mining activity.

3.3.1.2 Sparring Bulls Draft EIS

In February of 2010, the USFS distributed a Draft EIS analyzing commercial and non-commercial vegetation management and road stabilization activities for a project area located south of Troy, Montana. The proposed action includes approximately 690 acres of intermediate harvest, 704 acres of regeneration harvest, 216 acres of non-commercial fuels reduction, 3,820 acres of prescribed burning, and 34 miles of roadway for watershed improvements (KNF 2010).

3.3.1.3 Forest Plan Revision

The Kootenai and Idaho Panhandle National Forests are currently in the preliminary stages of preparing an EIS for a revised land management plan. The intent of the revised plan is to achieve quality land management for the forests over the next 10 to 15 years. The EIS process will help develop alternatives and provide the basis for a decision on which alternative best meets the stated needs. A proposed plan and Draft EIS are expected to be completed in 2011 with a final plan and Final EIS completed within the following year.

3.3.1.4 Motorized Access Management within Selkirk and Cabinet-Yaak Grizzly Bear Recovery Zones

A Draft Supplemental EIS (USFS 2008) was prepared to analyze proposed amendments to the Forest Plans and includes motorized access and security guidelines to meet USFS's responsibilities under the Endangered Species Act (ESA) in order to enhance recovery of grizzly bears. These plans encompass 4,560 square miles of habitat of the Selkirk and Cabinet-Yaak Recovery Zones. The Draft Supplemental EIS addresses amendments to the Forest Plans for the Kootenai, Lolo, and Idaho Panhandle National Forests. A Final Supplemental EIS and Record of Decision are anticipated for early spring 2011.

3.3.1.5 Draft EIS for the Montanore Project

The Draft EIS (KNF and DEQ 2009) for the Montanore Project describes the land, people, and resources potentially affected by the Montanore Minerals Corporation's (MMC) proposed copper and silver mine, which is located about 18 miles south of Libby under the Cabinet Mountains of northwestern Montana. As proposed, this project would consist of eight primary components: the use of an existing evaluation adit, an underground mine, a mill, three additional adits and portals, a tailings impoundment, access roads, a transmission line, and a rail loadout. Both DEQ and KNF are currently preparing responses to public comments and are preparing a Supplemental Draft EIS.

3.3.1.6 Rock Creek Mine

The 2001 Rock Creek Final EIS (KNF and DEQ 2001) describes the proposed Rock Creek Project as an underground copper and silver mine in northwestern Montana under the Cabinet Mountain Wilderness, located in Sanders County near Noxon, Montana. The project would be operated by Revett Mining Company (Revett), and the purpose of the proposed action is to develop the mineral interest. The project would include building a mill for ore processing and associated mine development rock disposal facilities. Both a rail loadout for transportation of concentrate and appropriate water treatment facilities are also proposed. DEQ and KNF approved the project. The USFS is currently preparing a Supplemental EIS to address the May 4, 2010, U.S. District Court ruling on the Final EIS and 2003 Record of Decision for the project.

3.3.2 Private and State Lands

The Montana Department of Transportation (MDT) has not allocated any funding for highway projects on MT 56 in its 2010-2014 Statewide Transportation Improvements Program (STIP).

Private development within the Lake Creek watershed is expected to continue. Development is expected to include, but is not limited to, septic and community water system permits, subdivision of land, home construction, land clearing, and commercial timber harvest.

3.4 Air Quality

3.4.1 Introduction

Air quality refers to the condition of the air and includes levels of pollutants measured over a period of time in the surrounding environment. This section reviews operational air quality conditions in both the Troy and general northwest Montana areas and discusses monitor locations and data.

3.4.2 Regulatory Framework

The Clean Air Act (CAA), as amended (42 USC 7401), is intended to achieve and maintain levels of air quality that will protect human health and safety. The U.S. Environmental Protection Agency (EPA) has established maximum concentrations for pollutants that are referred to as the National Ambient Air Quality Standards (NAAQS). Six "criteria pollutants" are used as indicators of air quality: ozone, carbon monoxide, nitrogen dioxide, sulfur dioxide, particulate matter, and lead. EPA has designated areas around the country that do not meet these standards as "nonattainment areas."

The CAA is a federal law that DEQ enforces. The Clean Air Act of Montana (72-2-101 *et seq.*, MCA) allows development of local air pollution control programs to develop control strategies for nonattainment areas. Agencies develop and maintain air pollution control plans, which are frequently referred to as State Implementation Plans (SIPs). These control plans explain how an agency will protect against air pollution under the CAA. Montana allows any city or county to establish its own local air pollution control program. Seven counties currently operate local air pollution control programs that encompass the following communities: Billings, Butte, Great Falls, Helena, the northern Flathead Valley, Libby, and Missoula.

The area around Libby, nine miles east of the permit area, is in nonattainment (*i.e.* it does not meet the standards) for particulate matter (PM) less than 2.5 micrometers in diameter (PM_{2.5}) and less than 10 micrometers in diameter (PM₁₀). Although the Libby loadout facility is within this nonattainment area, the remainder of the county, including the Troy Mine Permit Area, is in compliance with the NAAQS.

The 1987 KNF Forest Plan includes air quality goals for activities on KNF lands. The 1987 Forest Plan serves as the guiding management document until a new Forest Plan is completed. The 1987 Plan's goal is to maintain the existing excellent air quality on KNF lands and to cooperate with DEQ to protect local and regional air quality through DEQ programs.

The 1977 amendments of the Clean Air Act established the Prevention of Significant Deterioration (PSD) Program to prevent stationary industrial sources from causing a significant deterioration of air quality in areas that meet present air quality standards or NAAQS (attainment areas). Areas of the country were designated as belonging in Class I, II, or III airsheds for PSD purposes. Class I areas are all international parks, national parks greater than 6,000 acres, and national wilderness areas greater than 5,000 acres which existed on August 7, 1977. This class provides the most protection to pristine lands by severely limiting the amount of human-induced air pollution that can be added to these areas. Class II areas are currently all other areas of the country that are not Class I. Class III areas are areas that states may designate for development and new sources of air pollution. However, none have been designated to date. Under the PSD program, the Cabinet Mountain Wilderness is a Class I Federal Area where visibility is an important value (40 CFR 81.417). The remainder of the KNF is a Class II Federal Area.

3.4.3 Analysis Area

The analysis area for air quality is Idaho Airshed 11 and Montana Airsheds 1 and 2. The area outside the operating permit boundary in the general vicinity of the tailings impoundment is also included, because it could be affected by blowing dust during reclamation of the impoundment. The Libby loadout facility (located in Libby, Montana) is included in this analysis due to its relation to the Troy Mine mining activities. Public comments were received during the scoping process on potential effects of blowing dust.

3.4.4 Affected Environment

An air quality monitoring station, located in Libby at the Courthouse Annex, monitors for PM-2.5 and PM-10. According to 40 CFR 81.327 (Designation of Areas for Air Quality Planning Purposes), parts of Lincoln County are in nonattainment for particulate matter. The Libby loadout facility is located within the Libby PM-10 and PM-2.5 nonattainment area boundaries (Thunstrom 2006). The remainder of the county, including the Troy Mine Permit Area and general tailings impoundment vicinity outside the permit boundary, meet the NAAQS.

Based on a 14-month observation and complaints received regarding potential fugitive emissions, DEQ required Troy Mine to install, operate, and maintain at least one continuous particulate monitor to measure ambient air beyond Troy Mine, Inc.'s property boundary in the area of the tailings impoundment. On January 19, 2010, a PM-10 Ambient Air Monitoring Station was installed north of the permit boundary in the prevailing wind corridor. Monitoring began the same day (Genesis 2010).

The Spar Lake EIS discussed air quality within the area (KNF 2001). In forested areas, road dust is a source for particulates during dry periods in summer and fall, and it is a year-round source of particulates in the town of Troy due to the winter sanding of roads. Air pollution from this source is generally localized, as dust usually settles within close proximity of the road itself except on windy days. Outside influences on the local airshed include dust and smoke from areas to the west. Much of the impact comes from dust off the Palouse prairie and smoke from industrial grass burning which takes place in eastern Washington and northern Idaho. Forest fire smoke can also be a source of air pollution. Asbestiform minerals in particulate matter are also an issue in the Libby-Troy area from historic vermiculite mining.

The Troy Mine has a paved road to the mine to control road dust during operations from mine traffic. The Troy Mine has had a sprinkler system available to control dust operationally, but sometimes it has been disassembled or shut down due to cold weather. Windstorms in the impoundment area result in tailings blowing from the impoundment surface. Due to complaints from neighbors downwind, Genesis (now Troy Mine, Inc.) began several activities to control fugitive emissions from the tailings impoundment in the summer of 2008. Activities included applying chemical dust suppression to roads and berms and applying more water to the tailings impoundment.

The Troy Mine is currently covered by Montana Air Quality Permit #1690-02 – Genesis – Troy Mine. Within the last five years, EPA's Enforcement and Compliance History Online resource notes there has been one formal enforcement action related to violation of the CAA. A state Administrative Order was issued to the Troy Mine on July 25, 2010, and a \$6,431 penalty was issued for this violation.

Air quality is generally considered an operational issue, because emissions regulated by EPA and DEQ typically occur only during mining operations. However, disturbed areas such as the tailings areas can also be a source of air pollutants post-closure until reclamation measures such as plantings are established. The 1978 EIS predicted that the most significant overall impact to air quality from the proposed facilities would come from increased population and traffic in the area. Mine and mill site pollutants were expected to be minimal due to the confined nature of the mining process. An active tailings impoundment was expected to have little effect on air quality due to the high precipitation rate of the area (DSL and KNF 1978, page 299). However, blowing dust has been a problem operationally when the irrigation system is down. Cell 2 of the tailings impoundment was reclaimed as part of a reclamation test that controlled blowing dust from the revegetated areas. This test has not been accepted by the Agencies as the final reclamation for Cell 2. In 2010, approximately half of tailings impoundment Cell 3 was covered with borrow material to control blowing dust.

3.4.5 Environmental Consequences

Methods for assessing potential air quality impacts generally include analyzing each alternative's potential (basically its location or associated activities) to introduce new or increased air pollution to an area above the levels experienced during operation.

In general, all three alternatives would cause air quality to return to pre-operational levels as mill emissions cease. Reclamation of the impoundment would provide a short-term negative air quality

impact, largely due to heavy equipment use during grading and covering with growth medium. Reclamation would establish vegetation on the tailings surface, and air quality would return to pre-operational levels as blowing dust from the tailings impoundment ceases. Specific potential impacts of each alternative are discussed in further detail below.

Upon mine closure and commencement of reclamation, impacts to air quality may occur from disturbed ground and windborne dust resulting from earthmoving activities. Reclamation areas that would incorporate earthmoving activities would include the tailings impoundment, borrow areas, roads that would be removed, buildings or other infrastructure that would be removed, and areas where the ground would be regraded, such as the mill site.

3.4.5.1 No Action Alternative

Under the No Action Alternative, impacts of reclamation activities on air quality would occur according to the specifications of the 1978 Reclamation Plan. The No Action Alternative also includes reclamation activities completed through 2010. Completed reclamation activities include using several activities to control fugitive emissions from the tailings impoundment by means of applying chemical dust suppression to roads and berms and applying more water to the tailings impoundment. During operations, the mining company has reclaimed soil stockpiles and the tailings embankment. The tailings impoundment Cell 2 was reclaimed as a reclamation test plot, but this has not been accepted by the Agencies as the final cover for Cell 2. In 2010, one-half of Cell 3 in the tailings impoundment was covered with borrow material to control blowing dust.

During reclamation activities, the existing mine infrastructure would be demolished and removed, adits would be sealed, and disturbed areas would be regraded and revegetated. **Sections 3.9, 3.15, and 3.16** describe how roads would be regraded and revegetated. The Libby loadout facility is not addressed in the No Action Alternative. In general, the KNF portion of the Troy Mine Permit Area would be returned to a revegetated state that would be visited only intermittently, largely by foot or single vehicle traffic for recreational purposes. The private portion of the Troy Mine would be revegetated, and if the reclamation bond was released, the site could be used for whatever purpose the landowner wanted so long as that use complied with existing statutes.

During reclamation, a negative air quality impact would be expected because of blowing dust from the use of heavy equipment for activities such as regrading and covering the area with soil and other growth media. In addition to these temporary effects from reclamation activities, the potential for wind erosion and dust pollution would remain until vegetation is established. Also, potential negative air quality impacts may occur during revegetation periods (1-3 years) in addition to those occurring during reclamation activities (1-2 years). The tailings embankment slopes and benches have been reclaimed and would not need to be irrigated to control dust.

After reclamation, heavy equipment would be removed from the site, and human-related activities on the site would drop both in scope and frequency. The permit area, especially the KNF portion, would primarily return to recreational use, with related air quality impacts occurring at reduced levels. After reclamation, air quality would largely return to pre-operational conditions within the Troy Mine Permit

Area. Over time, the air pollutant levels of the mine permit area would be indistinguishable from the surrounding forest lands. Potential impacts on air quality from the No Action Alternative would not be adverse if dust is controlled during reclamation activities.

3.4.5.2 Proposed Action

Under the Proposed Action, the *2006 Revised Reclamation Plan* would be implemented and on-going, and future reclamation activities on the Troy Mine Permit Area would follow the specifications of the updated plan. At the mill site, the domestic water well would be used for irrigation during the first growing season after reclamation, if needed. BMPs and irrigation using mine water would be used at the tailings facility to suppress dust until vegetation is established.

The Proposed Action is similar to the No Action Alternative in that after reclamation activities, the permit area would revert to a revegetated area primarily used for recreation and wildlife habitat purposes. The potential impact of both the Proposed Action and the No Action Alternative reclamation plans would largely be the same. The Proposed Action would lengthen the time required for reclamation activities because facilities and access would be needed for long-term mine water management. Similar to the No Action Alternative, the Proposed Action would result in a short-term negative impact during reclamation-related earth-moving activities. Long-term, however, air quality would largely return to pre-operational levels due to reduced motorized and human-related activities. Likewise, fewer haul truck trips to the Libby loadout facility would decrease diesel emissions in the nonattainment area. Over time, the air pollutant levels of the Troy Mine Permit Area should be indistinguishable from the surrounding forest lands. Like the No Action Alternative, potential impacts on air quality from the Proposed Action would not be adverse since dust would be controlled through BMPs during reclamation activities.

3.4.5.3 Agency-Mitigated Alternative

Under the Agency-Mitigated Alternative, the *2006 Revised Reclamation Plan* would be implemented and the proposed mitigations expanded to address issues identified during the public scoping and agency review processes. Under the Agency-Mitigated Alternative, reclamation activities would be conducted, and the Troy Mine Permit Area would revert to a revegetated area primarily used for recreation and wildlife habitat purposes. The temporary, open-air Libby loadout facility was used until a new covered facility was constructed in 2011. The covered loadout facility would decrease the potential for fugitive emissions. Construction and use of a new covered facility is an operational issue and is not part of the proposed reclamation plan.

While there are differences in the details of the reclamation plan of the Agency-Mitigated Alternative when compared to the Proposed Action and the No Action Alternative, the potential effects on air quality would largely be the same. The irrigation system at the tailings impoundment would be used to irrigate the reclaimed tailings surface. BMPs for dust control, such as dampening disturbed areas, would be used to minimize the potential for air quality related impacts on surrounding areas and people (e.g., neighbors, recreationists) during reclamation activities.

3.4.6 Resource Impact Summary

All three alternatives would largely cause air quality in the Troy Mine Permit Area and generally in the region to return to pre-operational levels. While a minor negative air quality impact is anticipated during reclamation activities, potential air pollution is not expected to be greater in duration, frequency, or intensity than historical levels during mining activities. After reclamation, air quality is expected to return to pre-operational levels over the long term. The overall, potential air quality impact of all three alternatives is generally neutral, due to a reduction in operational human use in the Troy Mine Permit Area and the resulting reduction in air pollutant levels to the pre-operational levels of the surrounding forest land and the Libby loadout facility.

3.4.7 Effectiveness of Mitigation Measures

Revegetating surface disturbed areas is an effective method to control dust and, therefore, to improve air quality. This is accomplished by stabilizing the surface and creating a root mass and plant cover which minimizes wind velocities across the surface and thus reduces the potential for blowing dust. In addition to the reclamation activities described above, BMPs for dust control, such as dampening disturbed areas, would be used to minimize potential air quality impacts on surrounding areas and people (*e.g.*, neighbors, recreationists) during reclamation activities.

3.4.8 Cumulative Effects

Past actions in the analysis area have had little effect on ambient air quality. The potential increase of highway-legal vehicles traveling to dispersed camping locations within the Lake Creek watershed would be minimal in comparison to overall annual traffic traversing MT 56. Of the reasonably foreseeable future actions described in **Section 3.3**, the prescribed burns proposed in the Sparring Bulls Draft EIS would have the potential to add smoke emissions to the area. The USFS receives an annual permit to burn from the Montana Air Resources Management Bureau. This issuance is based on participation in and compliance with burning restrictions issued by the Montana Airshed Group (KNF 2010, page 232). The Rock Creek Mine and Montanore Mine would add operational air emissions during mining activities if permitted. The Montana Air Quality Bureau would issue permits for both past and reasonably foreseeable future actions to ensure that each project does not diminish air quality within the airshed. All three alternatives would have the same cumulative effects in consideration with past, present, and reasonably foreseeable future actions. Cumulative and additive air quality effects would be minimal for all three alternatives. A net neutral effect would occur from all three alternatives because all would return air emission loads to pre-operational levels.

3.4.9 Regulatory Compliance

All three alternatives would comply with the Clean Air Act, the Clean Air Act of Montana, and the 1987 KNF Forest Plan because air emission loads would return to pre-operational levels after reclamation. Reclamation activities would not exceed the NAAQS and would not cause the Troy Mine Permit Area to become a nonattainment area.

3.5 American Indian Consultation

3.5.1 Introduction

Federal agencies are required to consult with American Indian tribes when an agency undertaking may have the potential to affect historic properties affiliated with their American Indian past. The 1987 Kootenai Forest Plan recognizes American Indian cultural integrity and political status and recognizes USFS's responsibility for government-to-government consultation with all federally-recognized tribes. As provided by tribes, traditional and cultural use issues are integrated into federal resource management decisions. Thus, American Indian interests are fully considered in planning proposed actions on National Forests. The KNF provides sustainable natural resources that may contribute to a way of life, cultural integrity, social cohesion, and to the economic well-being of treaty tribes.

3.5.2 Regulatory Framework

The National Historic Preservation Act (NHPA), as amended in 1992 (16 United States Code (USC) 470), establishes the federal government's policy to protect and preserve significant cultural resources. Section 106 of the NHPA requires federal agencies to take into account the effects of their undertakings on historic properties, which are defined to include cultural resources affiliated (culturally affiliated) with American Indian use and traditional cultural properties (TCP). If cultural resources might be affected by a proposed project, then consultation is required to identify appropriate avoidance and mitigation measures. The NHPA is discussed in more detail in **Section 3.6**.

The American Indian Religious Freedom Act (AIRFA) of 1978 (42 USC 1996) affirms the right of American Indians to access their traditional sacred places. If a place of religious importance to American Indians may be affected by an undertaking, AIRFA requires a consultation with Indian religious practitioners, which may be coordinated with the Section 106 consultation.

The Native American Graves Protection and Repatriation Act (NAGPRA) of 1990 (25 USC 3001) addresses the rights of lineal descendants and members of Indian tribes, Alaska Native, and native Hawaiian organizations to certain human remains and precisely defined cultural items. It covers items currently in federal repositories as well as future discoveries. The law requires federal agencies and museums to provide an inventory and summary of human remains and associated funerary objects. The law also provides for criminal penalties in the illegal trafficking in Native American human remains and cultural items.

The Montana Human Skeletal Remains and Burial Site Protection Act (22-3-802 *et. seq.* MCA) provides legal protection to all unmarked burial sites regardless of age, ethnic origin, or religious affiliation by prohibiting unnecessary disturbance and unregulated display of human skeletal remains.

The Archaeological Resources Protection Act of 1979 (ARPA) (Public Law (P.L.) 96-95) and Regulations 43 CFR Part 7 establish a permit process for extending permits for work on cultural sites on federal lands. When those sites are culturally affiliated, consultation with affected tribal governments must occur.

The Religious Freedom Restoration Act of 1993 (P.L. 103-141) establishes a higher standard for justifying government actions that may impact religious liberties.

The Indian Sacred Sites Executive Order 13007 of June 1996 directs federal land managers to "(1) accommodate access to and ceremonial use of Indian sacred sites by Indian religious practitioners and (2) avoid adversely affecting the physical integrity of such sacred sites," and to "maintain the confidentiality of sacred sites" where appropriate.

DEQ considers impacts to cultural resources in all of its environmental documents.

3.5.3 Analysis Area

In October of 2007, KNF sent scoping letters to the Confederated Salish and Kootenai Tribes, Kalispel Tribe, Kootenai Tribe of Idaho, and Coeur d'Alene Tribe notifying them of the upcoming analysis for the Troy Mine Revised Reclamation Plan. No responses have yet been received from the tribes.

The analysis area is located within lands encompassed by the Hellgate Treaty of 1855. The Hellgate Treaty was signed between the United States and the Flathead, Upper Pend d'Oreilles, and Kootenai Tribes to ensure that the Tribes' reserved rights were protected. These rights include the "right of taking fish at all usual and accustomed places, in common with citizens of the Territory, and of erecting temporary buildings for curing; together with the privilege of hunting, gathering roots and berries, and pasturing their horses and cattle upon open and unclaimed land." The federal government has trust responsibilities to Tribes under a government-to-government relationship to ensure that the Tribes' reserved rights are protected. Consultation with the Tribes in early phases of project planning assures that USFS meets its trust responsibilities.

3.5.4 Affected Environment

The affected environment typically includes traditional use areas that could be impacted by any new surface disturbance required for reclamation activities, such as religious practices, other traditional cultural uses, and cultural resource sites and remains associated with American Indian ancestors. The analysis area includes the Troy Mine Permit Area.

3.5.5 Environmental Consequences

The aforementioned tribes were afforded an opportunity to provide comments and concerns regarding the analysis for the Troy Mine Revised Reclamation Plan and the 1978 Reclamation Plan. Since the tribes have not yet provided traditional and cultural use data required to set a threshold for determining the effect on American Indian resources, it is not possible to analyze potential direct, indirect, and cumulative effects. All three alternatives would result in eventual reclamation of the disturbed areas after mine closure.

Reclamation and closure activities would primarily occur on or within areas that were previously disturbed during mining activities. If additional growth medium is needed for reclamation under either the Proposed Action or the Agency-Mitigated Alternative, the borrow site on private land east of the impoundment would be expanded by as much as 16 acres. The Forest Plan states that cultural resources

would be inventoried and evaluated before ground disturbing activities take place and that all significant resources identified would be protected or mitigation actions would be taken. Until a cultural resource survey of previously undisturbed areas is performed, it is assumed that all three alternatives would have minimal direct and indirect effects on cultural resources affiliated with tribal groups or traditional cultural properties.

3.6 Cultural Resources

3.6.1 Introduction

Cultural resources consist of a wide range of resources and places having historic, cultural, archaeological, or architectural significance and places from the past having important public and scientific uses. Cultural resources result from human activity and are typically unique, fragile, and nonrenewable.

3.6.2 Regulatory Framework

NEPA requires that federal agencies analyze the impacts of their activities on the environment, which includes cultural resources. To an extent, NEPA addresses some of the same concerns as the NHPA such as identification of irreversible effects. NEPA and the Section 106 processes can be synchronized.

The NHPA established the federal government's policy on protection and preservation of significant historic properties, which are cultural resources that are eligible for the National Register of Historic Places. The NHPA authorized the creation of the National Register of Historic Places (NRHP), which is an inventory of cultural resources that meet the National Register Criteria. The NRHP is maintained by the Secretary of the Interior and contains a broad range of property types. NHPA also created an Advisory Council on Historic Preservation (ACHP), which serves the public's interest by curtailing unnecessary government sponsored destruction of important cultural properties. ACHP works closely with State Historic Preservation Offices (SHPOs) to advise agencies on how to mitigate the effects of federal undertakings upon significant cultural features and landscapes.

36 CFR 800 reflects Section 106 of the NHPA and requires federal agencies to take into account the effects of their undertakings on historic properties (see Glossary) and to afford the SHPO and ACHP a reasonable opportunity to comment.

36 CFR 79 establishes standards, procedures, and guidelines to be followed by federal agencies to preserve collections of prehistoric and historic material, remains, and associated records that are recovered in conjunction with federal projects and programs under certain federal statutes. Proposed actions should ensure that federally-owned and administered collections of prehistoric and historic materials, remains, and associated records are deposited in repositories that have the capability to provide adequate long-term curatorial services.

Executive Order 11593 of 1971, Protection and Enhancement of the Cultural Environment, states that the federal government will provide leadership on preserving, restoring, and maintaining the historic and cultural environment of the Nation. The Executive Order directs federal agencies, through federal

plans and programs, to preserve cultural resources and to contribute to the preservation and enhancement of non-federally owned sites, structures, and objects of historic, architectural, or archaeological significance. It orders federal agencies to locate, inventory, and nominate to the National Register all properties under their control or jurisdiction that meet the criteria for nomination. It also directs federal agencies to exercise caution during the interim period so that cultural resources under their control are not inadvertently damaged, destroyed, or transferred.

ARPA and 36 CFR Part 7 Sec 2a provide protection for those archaeological resources found on public lands and Indian lands of the United States. This legislation provides civil and criminal penalties for those who remove or damage archaeological resources in violation of the prohibitions contained in the bill. The bill prohibits removing of archaeological resources from either public lands or Indian lands without first obtaining a permit from the affected federal land manager or Indian Tribe.

Executive Order 13287 of 2000, Preserve America, reinforces the federal government policy for “protection and enhancement of America’s historic treasures, and to recognize and treat cultural resources as assets. Federal agencies shall advance this policy through the protection of, continued use of, and reinvestment in, the Federal government’s historic buildings and sites and by conforming to the highest standards of care for, and consideration of, the unique cultural heritage of communities, and of the Nation.”

In addition, the 1987 KNF Forest Plan states that cultural resource management shall be integrated into the overall National Forest multiple resource management effort and that cultural resources should be inventoried and evaluated before any activities disturb the ground. All significant resources identified would be protected or else mitigation actions would be taken. Appendix 19 of the Forest Plan summarizes the policy for managing and protecting cultural resources on KNF lands.

3.6.3 Analysis Area

The analysis area for cultural resources includes the area within the Troy Mine Permit Area and includes any borrow sources proposed to be used for reclamation materials. Borrow areas proposed for use include the East Borrow Pit. Other borrow areas cited in the Revised Reclamation Plan are located within the permit area or consist of lacustrine and volcanic ash-derived soil materials stockpiled during construction of the tailings impoundment. Areas within the permit boundary are subject to federal laws protecting cultural resources.

3.6.4 Affected Environment

According to the 1978 Draft EIS prepared for the Troy Mine project, an archaeological reconnaissance was made of KNF lands in the Troy Mine Permit Area. A previous survey of the area that included private land was done in 1975. None of these studies identified cultural resources in the area proposed for disturbance. The area of the tailings impoundment was noted to have been extensively disturbed by the landowner during management of the area for timber production (DSL and KNF 1978).

No cultural resources were discovered during construction of the tailings embankment or the operation of the mine. Additionally, the 1978 Draft EIS states that there are no known historic sites within the area

proposed to be disturbed by mining development. There are no built environment elements that are older than 50 years within the project area (built prior to 1960).

3.6.5 Environmental Consequences

No historic properties were identified prior to mine development, and no historic or archeological resources have been identified during mine operation. As discussed in **Section 3.5**, tribal consultation did not identify any potential cultural resources within the project area. There are no structures that would be old enough to warrant evaluation as potential historic properties. Additionally, reclamation and closure activities would occur primarily on or within areas that were previously disturbed during mining activities. If additional cover materials are needed for reclamation, the borrow site east of the impoundment on private land would be expanded. The Forest Plan states that cultural resources would be inventoried and evaluated before ground disturbing activities take place. All significant resources identified would be protected, or else mitigation actions would be taken. There are no known environmental direct, indirect, or cumulative effects related to cultural resources under any of the alternatives.

3.6.6 Regulatory Compliance

All three alternatives would be in compliance with the NHPA, Executive Order 11593, ARPA, Executive Order 13287, and the 1987 KNF Forest Plan because no cultural resources would be affected by the proposed activities.

3.7 Fish Habitat

3.7.1 Introduction

This section reviews fisheries and aquatic habitat and species population status by subwatershed within the analysis area that could be affected by reclamation activities or long-term adit and tailings water quality. This section also discusses the population status of threatened, endangered, and sensitive fish species within the analysis area. Potential impacts to these resources under each of the reclamation alternatives are identified. Additional information relevant to fish habitat conditions and water quality is found in **Section 3.9**.

3.7.2 Regulatory Framework

The regulatory framework for this section includes:

- Endangered Species Act (ESA) of 1973
- The National Forest Management Act (NFMA) (36 CFR 219.19)
- The KNF Forest Plan of 1987

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 ESA, 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 listed as threatened and endangered, respectively, under the ESA. Effective September 30, 2010, the USFWS designated critical habitat for bull trout throughout their U.S. range (USFWS 2010). Under the ESA, critical habitat identifies geographic areas that contain features essential to conservation of a listed species. Critical habitat designations provide extra regulatory protection that may require special management considerations. Habitats are then prioritized for recovery actions. In addition, agencies are required to analyze effects of proposed actions on primary constituent elements (PCEs) for bull trout critical habitat. The Troy Mine Permit Area is included in Critical Habitat Unit 30, Kootenai River Basin. Specific water bodies with critical habitat designation within the analysis area include Bull Lake and Lake Creek.

Sensitive species are managed under the authority of NFMA and are administratively designated by the Regional Forester (FSM 2670.5). FSM 2670.22 requires the maintenance of viable populations of native and desired non-native species and the avoidance of actions that may cause a species to become threatened or endangered. NFMA directs the USFS 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 USC 1604(g)(3)(B)). Providing ecological conditions to support a diversity of native plant and animal species in the planning area satisfies the statutory requirements. To meet the requirements of NFMA and its implementing regulations, USFS assesses habitat for its ability to provide for a diversity of species.

FSM 2672.42 directs USFS to conduct a biological assessment (BA) to analyze impacts on sensitive species. If any unmitigated, significant effects are identified in the BA, the Forest Supervisor must make a decision to allow or disallow the impact. If the significant effects would result in a trend toward federal listing, the Forest Supervisor cannot allow the project to proceed. The sensitive species analysis in this document meets the requirements for a BA as outlined in FSM 2672.42. The westslope cutthroat trout (*Oncorhynchus clarki lewisi*) is the only sensitive fish species identified within the analysis area.

The Forest Plan establishes forest-wide objectives, standards, guidelines, and monitoring requirements for KNF sensitive species. Forest Plan direction for sensitive species includes both determining the status of sensitive species and providing for their environmental needs as necessary to prevent a trend toward federal listing.

The 1987 Forest Plan established management areas within the forest with different goals and objectives based on the capabilities of lands within this area (USFS 1987). The Inland Native Fish Strategy (INFISH) amended the Forest Plan in 1995 (USFS 1995). INFISH established standards and guidelines to protect riparian and aquatic resources on NFSL. As part of this strategy, the Regional Forester designated a network of priority watersheds which includes Lake Creek and all of its tributaries with surface water connections.

INFISH established stream, wetland, and landslide-prone-area protection zones called Riparian Habitat Conservation Areas (RHCA) on NFSL. RHCA are broken into four categories (**Table 3-2**).

Table 3-2. RHCA Categories and Standard Widths.

Stream or Waterbody Category	Standard Width
Fish-bearing streams	Minimum 300 feet each side of the stream
Perennial, non-fish bearing streams	Minimum 150 feet each side of stream
Ponds, lakes, and wetlands greater than 1 acre	Minimum 150 feet from maximum pool elevation
Intermittent and seasonally flowing streams, wetlands less than 1 acre, landslides, and landslide prone areas	Minimum 50 feet from edge (except in priority watersheds such as Lake Creek, where the minimum is 100 feet)

Source: USFS 1995

INFISH also identifies riparian management objectives (RMOs) for forested systems that include pool frequency, large woody debris (LWD) frequency, width/ mean depth ratio, and water temperature (**Table 3-3**). Bank Stability is also addressed but is not a required RMO for forested systems. Actions that retard attainment of these RMOs, whether existing conditions are better or worse than objective values, are considered to be inconsistent with the Forest Plan.

Table 3-3. Interim Riparian Management Objective Standards by Stream Width.

Wetted Width	Pools/mile	LWD/mile	Bank Stability %	Width/Mean Depth Ratio (Pools)	Water Temperature
< 10 feet	96	20 pieces > 12-inch diameter and 35-foot length.	> 80	< 10	No increase, < 59 ° F
10-20 feet	56				
21-25 feet	47				
26-50 feet	26				

Source: USFS 1995.

3.7.3 Analysis Area

The analysis area for evaluating direct, indirect, and cumulative effects includes the Stanley Creek, Ross Creek, and upper Lake Creek sub-watersheds within the Lake Creek watershed (as shown on **Figure 3-2** in **Section 3.9**). The extent of the analysis area was determined by the expected extent of hydrologic (water quantity and quality) influence related to the reclamation alternatives and associated activities.

3.7.4 Affected Environment

3.7.4.1 Fish Population Status

The Lake Creek Dam near the confluence of Lake Creek with the Kootenai River prevents fish from migrating upstream from the Kootenai River. Falls at the dam site were potentially a natural barrier to upstream fish passage prior to dam construction. Currently, a viable, disjunct population of bull trout (*Salvelinus confluentus*) exists in the Lake Creek drainage as well as kokanee salmon (*Oncorhynchus nerka*), largemouth bass (*Micropterus salmoides*), yellow perch (*Perca flavescens*), longnose dace (*Rhinichthys cataractae*), pygmy whitefish (*Prosopium coulteri*), slimy sculpin (*Cottus cognatus*), lake trout (*S. namaycush*), westlope cutthroat trout (*O. clarkii lewisi*), brook trout (*S. fontinalis*), and possibly torrent sculpin (*C. rhotheus*). Brook trout were introduced into the region in lower Lake Creek and Bull Lake and are currently distributed throughout much of the area. Hybridization between brook trout and bull trout has occurred (KNF 2001).

Threatened, endangered, and proposed species are those federally listed species which are either protected or proposed for protection under the ESA. Sensitive species are those species identified on the Regional Forester's Sensitive Species List.

3.7.4.2 Threatened, Endangered, and Proposed Species

White Sturgeon

The white sturgeon (*Acipenser transmontanus*), endangered, is a slow growing, late maturing, long-lived anadromous fish that relies upon large, fast-moving rivers with large cobble for spawning. Although this species occurs in the vicinity, no suitable white sturgeon habitat occurs within the analysis area. As such, the white sturgeon would not be affected by the Troy Mine reclamation activities and will not be discussed further in the analysis.

Bull Trout

Bull trout, threatened, are native to the upper Columbia River basin in northwestern Montana. This species requires clean, cold, complex, and connected habitat. Bull trout populations have declined because of land management practices, expansion of introduced fish populations, non-sustainable recreational harvest, and loss of habitat connectivity. Forest management activities, mining, and dam operations have also negatively impacted spawning and rearing habitat conditions in the lower Kootenai River metapopulation. Additionally, non-native brook trout threaten bull trout populations due to hybridization and interspecific competition. This bull trout population was listed as threatened in the conterminous U.S. in June of 1998.

Historically, bull trout likely occurred throughout the analysis area including Stanley Creek, Lake Creek, and Bull Lake. However, the current bull trout population in the analysis area is adfluvial, rearing in Bull Lake and in lower Lake Creek. These fish spawn in the Keeler Creek drainage. Currently, there is no evidence of a resident bull trout population in other tributaries of Lake Creek, nor is there evidence of recent use of Stanley Creek (KNF 2001).

3.7.4.3 Sensitive Species

Westslope Cutthroat Trout

The historic range of westslope cutthroat trout once included western Montana, central and northern Idaho, extreme northwestern Wyoming, and the southern portions of British Columbia, Alberta, and Saskatchewan (Liknes and Graham 1988). The distribution and abundance of westslope cutthroat trout have declined across their original range due primarily to hybridization with rainbow trout and displacement by brook trout (Behnke 1992; Rieman and Apperson 1989). In streams where brook trout and westslope cutthroat trout coexist, westslope cutthroat trout are typically confined to higher gradient reaches. Whereas, brook trout predominate in lower gradient reaches that were historically occupied by westslope cutthroat trout (Griffith 1988). This spatial segregation further isolates westslope cutthroat trout populations and can increase the risk of local extinctions due to genetic and stochastic factors (McIntyre and Rieman 1995).

Within the analysis area, genetically pure populations of westslope cutthroat trout persist in Ross Creek (Ross Creek sub-watershed) as well as in Spring Creek, Dry Creek, Camp Creek, Madge Creek, and in Porcupine Creek (upper Lake Creek sub-watershed) (KNF 1994; KNF 2010). Some of these 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. Habitat quality and the proximity to other populations are also critical factors in the persistence of local populations (Rieman and McIntyre 1993). Habitat fragmentation and subsequent isolation of conspecific populations may increase the risk of local extinctions. Conversely, this spatial isolation also protects their genetic integrity.

Westslope cutthroat trout were historically present in Stanley Creek (USFS 1977), but appear to have been displaced or replaced by brook trout in association with habitat degradation (Carlson 2010). Several other small, isolated populations remaining in the Lake Creek drainage are at moderate risk of local extirpation due to disturbance events.

Interior Redband Trout

The interior redband trout (*Oncorhynchus mykiss gairdneri*), a subspecies of rainbow trout, is not present within the analysis area; therefore, it would not be affected by the Troy Mine reclamation activities and will not be discussed further in the analysis.

3.7.5 Environmental Consequences

Potential impacts to fisheries resources from mine closure and reclamation activities would include modifications to existing water quality (e.g., sedimentation, erosion, or metal contamination) or to water quantity (e.g., streamflow). Water quality and quantity issues are further discussed in **Section 3.9**.

In general, the proposed reclamation activities under any alternative would have no effect on habitat fragmentation. Increased sedimentation due to regrading roads and other disturbed areas and subsequent erosion of applied growth media could decrease suitable spawning substrate and reduce overwintering habitat for juvenile fish. This in turn could reduce spawning success and overwinter

survival. The presence of roads can also increase peak flows by altering the drainage network within a watershed. These increased peak flows can decrease channel stability and accelerate erosion and result in habitat degradation. However, there would be no new roads proposed under any of the alternatives.

The greatest risks to fisheries from the Troy Mine reclamation alternatives would be potential water quality impacts from sedimentation and from mine adit water discharge that contains copper and other metals. Sedimentation impacts would come from regrading, placement, and erosion of reclamation materials, and from reclaiming roads if BMPs are not properly implemented. Toxicity from metals such as cadmium and copper can decrease growth and survival of trout and has been identified as a potential contributor to bull trout declines (Hansen *et al.* 2002; 63 FR 31647). Heavy metals can also be toxic to some macroinvertebrate taxa (Kiffney and Clements 1994), thereby decreasing forage availability for fish. The following analysis will focus on anticipated effects of reclamation and associated activities on sediment and water quality.

3.7.5.1 No Action Alternative

Under the No Action Alternative, mine closure and reclamation would be conducted according to the 1978 Reclamation Plan. Potential short-term sedimentation and erosion associated with the removal and reclamation of mine facilities (including some roads, buildings, development rock fill, portal patios, and tailings and reclaim water pipelines) could impact fisheries. These activities could result in entrainment of fine sediment in pools and channel margins in lower gradient reaches of Stanley Creek and Lake Creek (see **Section 3.9**). Application of BMPs (*e.g.*, erosion control) would be assumed as part of Montana's legal requirements for storm water pollution prevention planning and permitting. To maintain compliance with Montana pollution prevention laws, a Storm Water Pollution Prevention Plan (SWPPP), which includes BMPs for use during ground disturbing activities, would also be required during reclamation. Because maintenance and/or modification of the existing storm water collection and diversion system at closure was not addressed in the 1978 Plan, lack of maintenance of this system could result in long-term erosion potential associated with these structures.

Mine adit water at closure would contain elevated levels of metals (primarily copper and antimony) and, initially, nitrates (**Section 3.9**). Post-closure water routing as proposed in the 1978 EIS would allow mine water flowing out of adit portals to naturally infiltrate through the development rock adjacent to the mine portals or to be discharged directly into Stanley Creek. This discharge could exceed current surface water quality standards and could potentially impact macroinvertebrate, tailed frog, and brook trout abundance in Stanley Creek. Bull trout and westslope cutthroat trout are not known to be present in the Stanley Creek drainage and would not be affected. However, as a result of dilution, dissolved copper levels in Lake Creek where bull trout and cutthroat trout are present would be at sublethal levels for those species and would meet water quality standards under typical streamflow and mine discharge conditions.

Table 3-4 compares potential copper concentrations in Lake Creek with no discharge of mine water and with a discharge of mine water under the No Action Alternative. These predicted values are estimated for the lowest annual flow period which is in August. The predicted values are compared to the chronic aquatic life criterion for copper.

Table 3-4. Potential Copper Concentrations in Lake Creek Under the No Action Alternative

Monitoring Site	Cu mg/L No Mine Discharge	Cu mg/L Mine Discharge	Cu mg/L Chronic Aquatic Life Criterion
LC-01	0.0010	0.0018	0.0030
LC-02	0.0010	0.0018	0.0030
LC-04	0.0010	0.0016	0.0030

Source: Data from Troy Mine, Inc. Water Quality Data Base.

Note: Cu = copper

Bull Trout Critical Habitat

The No Action Alternative would minimally affect primary constituent elements (PCE) and associated habitat indicators for bull trout critical habitat. Minimally affected PCE would include migration habitats with minimal physical, biological, or water quality impediments among spawning, rearing, overwintering, and freshwater and marine foraging habitats. These impediments include but are not limited to permanent, partial intermittent, or seasonal barriers. The associated habitat indicators would consist of chemical contamination and nutrient concentrations.

Sediment quantities generated from reclamation activities and delivered to Lake Creek under the No Action Alternative would be small and of short duration. Sediment inputs of a more chronic nature could be generated from the existing storm water collection and diversion system. These increases would be expected to be small relative to the existing sediment load in Lake Creek, and measurable impacts to spawning and rearing habitat or macroinvertebrate food sources would not be anticipated. Presently, bull trout are thought to spawn exclusively in the Keeler Creek drainage. Spawning in Lake Creek has not been confirmed. Therefore, it is unlikely that spawning habitat would be affected. The potentially affected reach in Lake Creek is known to be utilized primarily as a migratory corridor, and there is no evidence of bull trout spawning there. Increases in metal concentrations in Lake Creek under typical flow conditions would not be sufficient to pose a chemical migration barrier, or to affect reproduction, growth, or survival (**Table 3-4**).

The overall effects to threatened and sensitive fish species habitat under the No Action Alternative would be minimal because of the absence of bull trout and cutthroat trout in Stanley Creek, the dilution of contaminants in Lake Creek, and the relatively small anticipated increases in fine sediment to Lake Creek.

3.7.5.2 Proposed Action

Potential fisheries impacts resulting from implementation of the Proposed Action would include the potential for temporary erosion and sediment delivery to area streams near facilities to be removed or reclaimed, as well as from borrow areas. However, implementation of BMPs would reduce or eliminate this potential effect.

Disposal of post-closure mine water via pipeline to the tailings facility for infiltration would limit the potential for water quality impacts to Stanley and Lake creeks, unless the pipelines fail over time due to wear or vandalism. Potential erosion issues could occur in the vicinity of the mill site, office area, and

areas associated with the storm water collection and diversion system. These potential issues would be minimized by reconstructing stream channels, armoring them with coarse rock, revegetating stream banks, and including velocity control structures where needed along the storm water collection and diversion system (Genesis 2006).

Under the Proposed Action, unneeded roads that pose a resource risk would not be treated, and restoration work on needed roads would not be implemented. Any additional sediment from these sources would add to the already elevated sediment load that currently exists in Stanley Creek and would adversely impact water quality for an extended period of time. Some of this sediment would also be expected to reach Lake Creek, which is listed as impaired for sediment.

In the event of a break in the pipeline carrying mine water to the tailings impoundment, a large volume of adit water and sediment could reach Stanley Creek and/or Lake Creek until the pipeline could be shut off and repaired. Water would be rerouted from the old tailings lines to the reclaim water pipeline while the old tailings pipeline is repaired. Under the Proposed Action, these spills would potentially impact fisheries in Stanley and Lake creeks until the water is re-routed and the pipelines repaired. Potential impacts to fisheries and habitat under the Proposed Action would be expected to be minimized by proposed erosion control, revegetation, and by water management activities during and after reclamation.

Bull Trout Critical Habitat

The Proposed Action has the potential to affect PCE and associated habitat indicators. Affected PCE would include an abundant food base, including terrestrial organisms of riparian origin, aquatic macroinvertebrates, and forage fish. The associated habitat indicators would be sediment and substrate embeddedness.

Reclamation activities under the Proposed Action may result in a temporary increase in sediment delivered to Lake Creek, but would decrease sediment contributions over the long-term. These temporary sediment increases would be expected to be small relative to the existing sediment load in Lake Creek, and measurable impacts to spawning and rearing habitat or macroinvertebrate food sources would not be anticipated. Bull trout are thought to spawn exclusively in the Keeler Creek drainage. Spawning in Lake Creek has not been confirmed. Therefore, it is unlikely that spawning habitat would be affected. Moreover, the potentially affected reach is utilized primarily as a migratory corridor, and there has been no confirmation of bull trout spawning there. Therefore, it is unlikely that spawning habitat would be affected.

Due to the absence of bull trout and cutthroat trout in Stanley Creek and the relatively small potential increases in fine sediment in Lake and Ross creeks, measurable effects to occupied bull trout and westslope cutthroat trout habitat under the Proposed Action would not be anticipated.

3.7.5.3 Agency-Mitigated Alternative

Potential impacts to fisheries resources from implementation of the Agency-Mitigated Alternative would be similar to those discussed for the Proposed Action, but the potential for pipeline failure and mine

water discharge would be minimized by building a new buried water pipeline to the decant ponds. Both this new buried pipeline and the old reclaim water pipeline would be equipped with automated sensors to reduce potential pipeline spills that could impact water quality in Stanley and Lake creeks. This alternative would also include retaining the buried reclaim water line as a backup pipeline to handle flows in situations when the new pipeline is down for repairs or to handle flows over the capacity of the new pipeline.

Maintenance of long-term water management facilities would be required as part of the Agency-Mitigated Alternative. The Agency-Mitigated Alternative also includes water quality monitoring of springs in the analysis area to validate the prediction that water quality standards would be met post-closure.

The Agency-Mitigated Alternative provides for more diligence in avoiding surface water impacts by proposing to use only rock with little or no potential for near-neutral metal leaching in reconstructed stream channels and by providing more engineering in final design of the post-closure storm water collection and diversion system. These approaches would minimize potential erosion (see Appendix E). To protect spawning and incubating westslope cutthroat trout, sediment-generating activities within RHCAs in the Ross Creek drainage would occur after July 15th or when intermittent channels are dry, whichever comes first. To protect bull trout rearing habitat in Lake Creek, sediment-generating activities occurring within RHCAs in Ross and Stanley creeks, and the upper Lake Creek subwatershed would not occur before July 15th or after October 15th unless activities are separated from lower Stanley Creek and Lake Creek by segments of dry channel. Regrading work at the tailings impoundment area would be exempt from this timing restriction because appropriate BMPs would be installed to prevent sediment delivery to Lake Creek (see **Section 3.18.5.10**). Sediment-generating activities would be subject to state and federal permits that may include additional timing restrictions for protection of water quality.

Potential short-term water quality impacts to fisheries and/or aquatic habitat in Stanley and Lake creeks under the Agency-Mitigated Alternative would be minimized by implementing BMPs, revegetating, and managing water to control erosion both during and after reclamation. Adding a new buried pipeline and automated controls on both the new and old reclaim water pipelines would limit the potential for metals toxicity impacts to the creeks in the event of a pipeline break as compared to the Proposed Action.

The Agency-Mitigated Alternative would reduce sediment loading both by implementing reclamation actions and by treating mining road-related sediment sources. Thus, sediment levels in Stanley and Lake creeks would be expected to decline over time.

Bull Trout Critical Habitat

The Agency-Mitigated Alternative has the potential to minimally affect PCE and associated habitat indicators. Affected PCE include an abundant food base, including terrestrial organisms of riparian origin, aquatic macroinvertebrates, and forage fish. The associated habitat indicators would be sediment and substrate embeddedness.

Reclamation activities may result in a temporary increase in sediment delivered to Lake Creek, but would decrease sediment contributions over the long-term. These temporary sediment increases would be expected to be unmeasurable relative to the existing sediment load in Lake Creek. Measurable impacts to spawning and rearing habitat or macroinvertebrate food sources would not be anticipated. Bull trout are thought to spawn exclusively in the Keeler Creek drainage. Since there would be no effect to Keeler Creek associated with this alternative, it would be unlikely that spawning habitat would be affected. Moreover, the potentially affected reach in Lake Creek is used primarily as a migratory corridor, and there has been no confirmation of bull trout spawning there. Therefore, it is unlikely that spawning habitat would be affected.

Due to the absence of bull trout and cutthroat trout in Stanley Creek and the relatively small anticipated increases in fine sediment in Lake and Ross creeks, measurable effects to occupied bull trout and westslope cutthroat trout habitat under the Agency-Mitigated Alternative would not be anticipated.

3.7.6 Resource Impact Summary

The No Action Alternative would potentially impact water quality in Stanley Creek and Lake Creek from mine water discharging into Stanley Creek. Dissolved metals in Stanley Creek would exceed aquatic life criteria but would meet water quality standards in Lake Creek due to dilution. Because westslope cutthroat and bull trout are not known to be present in Stanley Creek, there would be no effect to occupied habitat or populations. The Proposed Action would reduce the potential for water quality impacts to Stanley and Lake creeks by routing mine water via pipelines to the impoundment decant ponds. Pipeline leaks could result in temporary exceedance of aquatic life criteria for heavy metals in Stanley and Lake creeks. The Agency-Mitigated Alternative would further reduce potential effects by adding a new buried mine water pipeline and automated controls on both the new and old reclaim water pipelines. These pipelines would reduce the potential for toxic metals to impact Stanley or Lake creeks in the event of a pipeline break as compared to the Proposed Action. Under the Agency-Mitigated Alternative, implementing water quality protection measures, including the use of non-metal-leaching rock in stream channels, would further reduce the potential for water quality impacts to fisheries.

The Proposed Action would increase sediment delivery in the short-term through reclamation activities and would not reduce road-related sediment loading because roads would not be treated under this alternative. The No Action Alternative and the Agency-Mitigated Alternative would temporarily increase sediment delivery to Stanley, Ross, and Lake creeks during reclamation activities but would reduce sediment loads and improve fish habitat over the long-term through road treatment. Sediment increases in Ross and Lake creeks would be small relative to existing sediment loads and would not result in measurable effects to cutthroat or bull trout habitat or populations. The Agency-Mitigated Alternative would introduce the smallest amount of sediment to stream channels due to design features and mitigation measures such as timing restrictions within RHCAs.

3.7.7 Effectiveness of Mitigation Measures

The No Action Alternative does not include mitigation measures to address the potential for discharged mine water to impact water quality in Stanley and Lake creeks. The Proposed Action would protect Stanley and Lake creeks by discharging mine water to the decant ponds where metals would be attenuated prior to reaching surface water. This approach would protect fisheries from metals toxicity. The long-term effectiveness of this mitigation is dependent on the integrity of the discharge pipeline. The Agency-Mitigated Alternative would address this concern by requiring a new buried pipeline which is sized to meet anticipated flows from the mine. In addition, the pipelines would include automated leak detection mitigation systems. These measures would reduce the chance of mine water discharging into surface water, and therefore, would reduce the potential for metals toxicity to fish.

Under the Agency-Mitigated Alternative, construction timing restrictions in RHCAs would reduce the potential for sediment delivery to stream channels, thus minimizing potential impacts to fish spawning and rearing habitat.

3.7.8 Cumulative Effects

Except for potential pipeline spills, cumulative effects from past, present, and reasonably foreseeable future actions in the watershed would be minimal with regard to fisheries and fishery habitat from the Proposed Action. Mitigation measures associated with the Agency-Mitigated Alternative would address the potential for mine water pipeline leaks and the potential for issues associated with water quality degradation from discharged mine water. Cumulative effects associated with the Agency-Mitigated Alternative would be minimal. The Agency-Mitigated Alternative would not result in degradation of fish habitat and associated RMOs for Ross, Stanley, and Lake creeks.

3.7.9 Regulatory Compliance

The No Action Alternative is consistent with INFISH, as it would not retard the attainment of RMOs. Effects associated with culvert failure and sediment delivery to streams would need to be addressed in the future to promote long-term recovery of the watersheds.

Both the Proposed Action and the Agency-Mitigated Alternative would be consistent with the Forest Plan as amended by INFISH because they would design and implement reclamation activities to promote the long-term ecological integrity of ecosystems, conserve the genetic integrity of native species, and contribute to attainment of Riparian Management Objectives.

3.7.10 Statement of Findings

3.7.10.1 Threatened and Endangered Species

The No Action Alternative, Proposed Action, and Agency-Mitigated Alternative would all result in a determination of *“May Affect, but is Not Likely to Adversely Affect”* bull trout. This determination is based on the lack of potential for take (harm or harassment of individual fish) and the lack of effects on occupied habitat. More specifically it is based on the following considerations: 1) Bull trout are not present in Stanley Creek where sediment inputs would occur; 2) BMPs and other mitigation measures,

coupled with the distance to occupied bull trout habitat in Lake Creek, would prevent measurable increases in sediment in rearing habitats; and 3) Bull trout are not known to spawn in Lake Creek. A stand alone biological assessment will be submitted to the USFWS to be consistent with the requirements of the ESA.

3.7.10.2 Critical Habitat

The No Action Alternative, Proposed Action, and Agency-Mitigated Alternative would all result in a determination of “May Affect, but is Not Likely to Adversely Affect” bull trout critical habitat. This determination is based on the limited potential for reclamation activities to generate sufficient amounts of sediment to measurably affect rearing habitat in Lake Creek.

3.7.10.3 Sensitive Species

The No Action Alternative, Proposed Action, and Agency-Mitigated Alternative would all result in *No Impact* for the westslope cutthroat trout. This determination is based on the lack of potential effects to individual fish, populations, and habitat. Because westslope cutthroat trout are not present in Stanley Creek, potential effects would be limited to relatively small temporary increases in fine sediment in Ross Creek. Mitigation measures would reduce the potential for measurable amounts of fine sediment to enter Stanley and Ross creeks during reclamation activities. Fine sediment would not limit fish habitat quality or populations in Ross Creek, and the small temporary fine sediment increases would be negligible. This evaluation constitutes the biological assessment for westslope cutthroat trout.

3.8 Geology

3.8.1 Introduction

This section characterizes the geology in the vicinity of the Troy Mine Permit Area and identifies the potential impacts related to geology for each of the reclamation alternatives. Slope stability of the tailings embankment was eliminated from further consideration in Chapter 2 (**Section 2.3.2**). The geochemical composition of bedrock, surficial deposits, and reclamation materials could affect post-closure water quality and quantity. Water quality issues are further discussed in **Section 3.9**.

3.8.2 Regulatory Framework

The Montana Metal Mine Reclamation Act (MMRA) and the USFS mineral regulations at 36 CFR 228.8 (g) are intended to prevent land and surface water degradation by requiring lands disturbed by mining, whether they are federal, state, or private, to be reclaimed to comparable stability and utility. DEQ and USFS interpret comparable stability and utility to include both geochemical conditions and physical stability.

3.8.3 Analysis Area

The analysis area for this section considers the geologic conditions and surface topography found within the Lake Creek watershed with an emphasis on the vicinity of the Troy Mine Permit Area. The analysis area for mining-induced subsidence is within the perimeter of the mine workings (**Figure 2-3**).

3.8.4 Affected Environment

3.8.4.1 Regional Geology

The Cabinet Mountains and surrounding areas are composed of a thick series of metasedimentary rocks referred to as the Belt Supergroup. These Belt rocks were deposited in a basin about 1,450 to 850 million years ago (Harrison 1972). Originally deposited as a series of muds, silts, and sands, the deposits were metamorphosed to argillites, siltites, and quartzites, respectively.

The Belt Supergroup can be divided into four major groups (**Figure 3-1**). In ascending order, these are the Lower Belt, Ravalli Group, Middle Belt carbonate, and the Missoula Group. Regionally, the Lower Belt is represented by the Prichard Formation which consists mostly of argillites, with some interbedded siltite and quartzite units. It is the lowest formation within the Belt supergroup in this area and is mapped as the thickest at 25,000 feet. The Ravalli Group in this part of the Belt basin consists of, from oldest to youngest, the Burke, Revett, and St. Regis Formations. The Burke is composed primarily of siltites. Its contact with the underlying Prichard Formation is gradational. The Revett Formation is a north- and east-thinning wedge of quartzite, siltite, and argillite. In the Cabinet Mountains area, the Revett is informally divided into lower, middle, and upper members. The lower and upper members are dominated by quartzites with interbedded siltite and argillite; the middle member is mostly siltite with interbedded argillite and quartzite. Facies changes, from coarse to finer sediments, are well documented. The St. Regis Formation is dominantly silty argillite and argillitic siltite.

Regionally, the bedrock has been extensively folded and faulted along generally north to northwest trends. Most of this structural activity was related to complex plate interactions which occurred between 24 and 200 million years ago and which resulted in the rocks being thrust eastward along shallow dipping faults for up to 100 miles (Harrison *et al.* 1983). These faults were superimposed on the existing compressional structures.

Quaternary age deposits are reflected in Pleistocene glacial erosion and deposition of stratified and unstratified sediments. Large areas are covered by glaciofluvial and glaciolacustrine sediments to depths up to several hundred feet. Near Libby, Montana, bluffs of lacustrine silts stand up to 200 feet above the recent flood plain. During recent times these and older materials have been eroded and reworked by stream activity.

There appear to be three ages of events for mineralization for the Belt rocks in this area. Only one is found near the Troy Mine Permit Area, the Precambrian age mineralization event. Potentially the oldest mineralizing event, the Precambrian age migration of solutions through selected formations within the Belt Supergroup (Einaudi 1986), especially the Revett Formation (Sherry 1983), occurred prior to or during lithification (Hayes 1983, Hayes and Clark 1971, Lange and Balla 1993).

Harrison (1972) described this extensive mineralization as the Western Montana Copper-sulfide Belt. Harrison observed that disseminated copper had been found in every formation in the Belt Supergroup, with the exception of the Prichard Formation. He also noted that "ore grade" copper mineralization had been found only in the Revett Formation. Additional studies by Hayes and Einaudi (1986), Hayes (1990),

and Balla (2000) generalized the regional migration of fluids and mineral zoning model for comparison of the Troy Mine deposit and the Rock Creek deposit. Hayes (1983), Lange and Sherry (1983), Clark (1971), Harrison (1972) and Bennett (1984) also concur that the Revett was mineralized on a regional scale. A similar model to Balla's is used by Clark (1971) to explain the consistent mineral zonation of the various stratabound copper and silver deposits on a worldwide basis and within the Belt rocks.

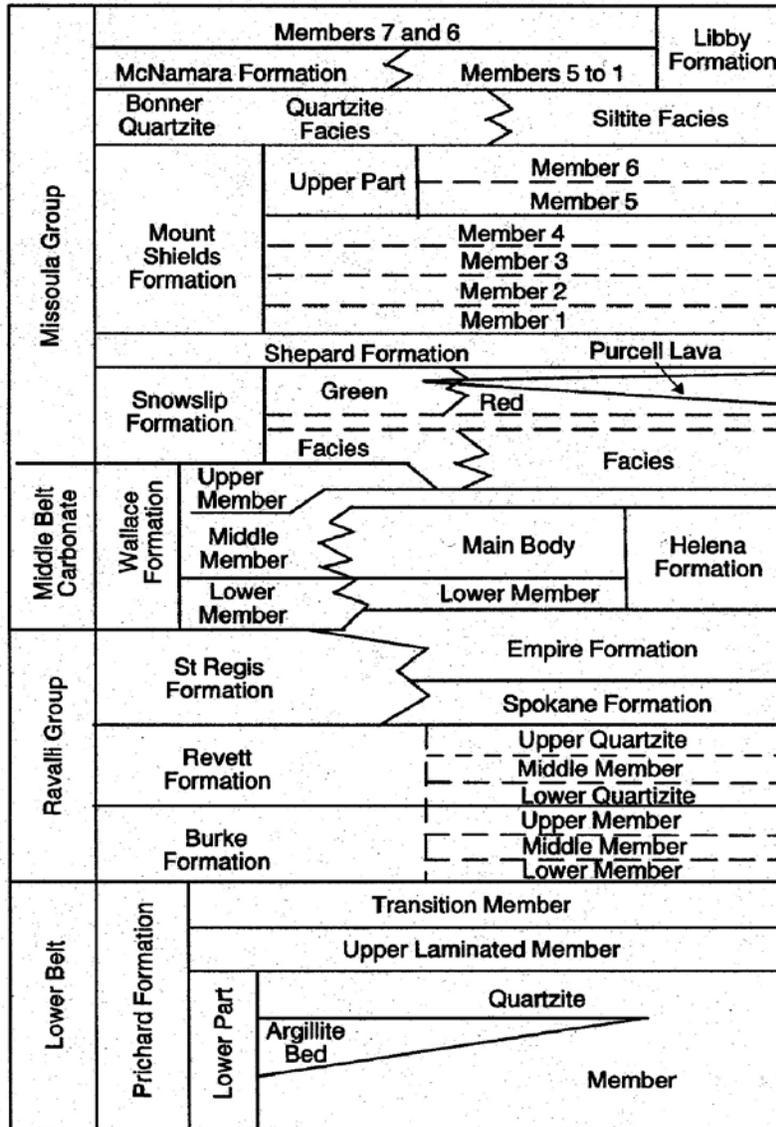
3.8.4.1 Troy Mine Area Geology

Three main items are critical in discussing the current geological make-up of the stratabound copper deposits found in the Revett Formation for this part of Montana, including the Troy Mine: 1) the paleo-environment, which includes the mineralogical make-up and permeability prior to diagenesis; 2) the diagenetic process, which includes burial depth and timing of burial, lithification, silicification and possible faulting creating conduits for remobilization of metals; and 3) the Cretaceous-age thrusting and faulting that fragmented the Revett, creating allochthonous blocks containing these isolated deposits.

Hayes (1983) and Balla (2000) describe the paleo-environment for the Revett within the Troy and Rock Creek deposits as either being a fluvial distributary channel or subtidal system or being a shoreline and barrier bar, upward fining sequence of quartz sands and silts. Hayes (1983) goes on further to describe that the sand, silt, and argillaceous silt bodies of the Revett Formation have apparent sheet geometry. This type of setting is conducive in providing longitudinal high porosity and permeable pathways that existed prior to diagenesis. The zonation (halos) is due in part to the host rock's permeability and porosity prior to or during diagenesis. The mechanism and source of mineralizing fluids is debated among the various authors, but what is noted is that it occurs on a regional scale. Balla (2000) gives a detailed comparison of the Troy deposit to the Rock Creek deposit to demonstrate the regional similarity and consistency over a large area. **Table 3-5** lists various geologic parameters of the ore bodies of both ore bodies.

The following discussion is taken, in part, from Balla (2000) where Balla describes geologic structure and the different mineral zones in the Troy Mine area in the following manner:

The Troy deposit is allochthonous. It originally formed some distance to the west of its present location. Underneath the Troy deposit at some depth is the Moyie thrust fault, which has had at least 1.53-3.08 miles of horizontal shortening (Harrison and Cressman 1993). The eastward thrusting of the Troy deposit occurred between 200 million years and 60 million years ago (Harrison and Cressman 1993). Since 60 million years ago, the deposit has been in its present geographical position. The Troy ore body occurs in the form of a very shallow syncline, with the axis of the syncline plunging gently approximately seven degrees to the south. The syncline formed sometime during the period of the eastward thrusting of the Belt sedimentary rocks (Balla 2000, p. 42).



Modified from Harrison & Cressman 1983
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Figure 3-1. Regional Geology

Table 3-5. Comparison of Troy and Rock Creek Deposits

Geological Feature	Troy Deposit	Rock Creek Deposit
Sedimentary Formation	Upper Revett	Lower Revett
Grade of Ore Body Copper (%)	0.76	0.68
Grade of Ore Body Silver (oz/ton)	1.58	1.65
Ore Zone Thickness (feet)	0 – 80	4 – 285
Ore Zone Amount* (% by volume)	0.3 – 1.0	1.0 – 3.0
Mineral Zones Pyrite (FeS ₂) Halo Zone Thickness	Regional	Regional (Variable 10 – 200+)
Amount (% by volume)	0.1 – 0.3	0.0 – 0.8
Pyrrhotite (Fe _{1-x} S)	Locally trace, in pyrite halo zone	Locally trace, in pyrite halo zone only
Galena (PbS) Halo Zone Thickness (feet)	60 – 1,100	20 – 200
Amount (% by volume)	0.0 – 0.3	0.04 – 0.08
Chalcopyrite (CuFeS ₂) Halo Zone Thickness (feet)	0 – very thin	0 – 50
Amount (% by volume)	0.3	0.3

Source: Balla 2000

*Includes Bornite (Cu₅FeS₄), Digenite (Cu_{2-x}S), Chalcocite (Cu₂S), and Native Silver (Ag). Other minerals are very minor and do not affect this quantity.

Two major faults have affected the Troy ore body, the East Fault and the Cross Fault. In addition, several more faults were encountered underground during mining. The copper-silver mineralization was introduced into the Revett sands prior to lithification and hence prior to the development of joints and fractures. Thus, all joints and fractures are post-copper-silver mineralization in age. Hayes (1983) studied the joints and veinlet mineralization. Observations underground showed that the joint surfaces were all perpendicular to the bedding and all were coated with ore minerals consistent with the adjacent mineralized zone. In many instances, it was possible to see a slight depletion zone immediately adjacent to the mineralized joint surface. Close observation of the mineralized joint surface indicated that the mineralization had only migrated a few inches, at most. These observations were confirmed by Hayes (1983) who also confirmed the post-disseminated age of the mineralization on the joints and fractures. Quartz-sulfide veinlets also occur, generally along the vertical joint planes. The sulfides are the same as

the adjacent disseminated mineral zone. As with the mineralization on the joint surfaces, the sulfides in the veinlets were derived from the adjacent wall rock (Balla 2000, pp 42-43).

Pyrite Halo Zone

The pyrite halo zone extends far beyond the limits of drilling and mapping. Within the quartzite units of the upper Revett, the pyrite content averages less than 0.3 percent by volume. The pyrrhotite occurs only in the pyrite halo zone, and does not occur in the ore body. In the siltite units, the pyrite content averages less than 0.1 percent (Hayes, 1983, p. 105). Because it extends far beyond the Troy ore body, it is suspected that it pre-dates the ore-forming mineralizing event. It may represent the initial mineralizing event on a regional scale and was subsequently followed by the main ore-forming event. The pyrite occurs as disseminated, euhedral grains located in the former pore spaces between the original quartz and feldspar grains of the sand, now quartzite deposit. The size of the pyrite is from a few microns to more than 3 mm in size (Hayes, 1983, p. 105). Quoting from Hayes, 1983, p. 106:

Minor pyrrhotite has been identified locally within rocks bearing only pyrite as another sulfide. Pyrrhotite occurrence is spotty. Its distribution appears to bear no relation to other ore-stage mineral zone boundaries (Balla 2000, p. 21, p. 26).

Galena Halo Zone

Galena occurs as a much better defined mineral zone near the bornite-digenite ore zone. Galena, similar to the pyrite, occurs in the pore space between the individual sand grains, prior to the lithification and cementing of the sand into a quartzite. The coarser the size of the sand grains and the larger the volume of the pore space between the sand grains, the larger the size of the galena. Hayes (1983) states that the galena content of the quartzites is between 0.1 - 0.3 percent by volume. In the siltites, which had much less permeability and porosity, the galena content is less, and occurs with chlorite. There is no silver associated with the galena zone (Balla 2000, p. 26).

Chalcopyrite Halo Zone

A thin zone of chalcopyrite occurs between the galena zone and the bornite-digenite ore zone. The chalcopyrite may be replacing the original pyrite. Similar to the galena, the chalcopyrite occurs as interclastic grains in between the original sand grains. Hayes (1983) estimates the chalcopyrite content as less than 0.3 percent by volume. There is no silver in the chalcopyrite zone (Balla 2000, p. 28).

Bornite-Digenite-Chalcocite-Native Silver Zone

The bornite-digenite-chalcocite-native silver zone is the ore zone, and constitutes the Troy ore body. The three copper minerals, bornite, digenite, and chalcocite, occur together along with native silver. The bornite-digenite-chalcocite-native silver zone is also the most sulfide rich part of the entire sulfide system. Within the zone of disseminated bornite-digenite-chalcocite-native silver mineralization, the sulfide content increases from about 0.3 percent by volume to almost 1.0 percent by volume (Hayes 1983). The bornite, digenite, and chalcocite minerals occur as intergranular grains adjacent to the detrital quartz and feldspar grains of the original sand. Bornite is the more common mineral. The minerals also occur as clots (balls) within the quartzite and as "ore rods" (water release features), indicating that the mineralization was emplaced into the sands prior to the dewatering and diagenesis of

the sediments. The bornite and digenite minerals that occur between the individual sand grains and that comprise the main ore zone are not leached, as they are encapsulated by the quartz overgrowths that occurred during diagenesis and burial metamorphism. The bornite and digenite ore minerals occur in-between the original sand grains that comprise the Troy ore body. The bornite and digenite minerals were emplaced in-between the sand grains, prior to the Revett formation becoming a rock. Through the geological processes of diagenesis and burial metamorphism, the sands that now comprise the Revett formation were converted to a rock. As diagenesis, lithification, and burial metamorphism continued, quartz overgrowth surrounded the individual ore minerals, sealing the individual bornite and digenite ore minerals (Hayes 1983, Balla 2000, p. 28).

Once the Revett formation had been converted from a sand deposit to a quartzite, subsequent tectonic events slightly remobilized the sulfide grains. This remobilization of the sulfide minerals occurred only near fracture and joint surfaces and consisted of the sulfide minerals adjacent to the fractures migrating into and onto the fracture and joint surfaces. The total movement is minor and is measured as a few centimeters. Various studies at the Troy Mine have shown that about 90 percent of the total metal content of the Troy ore body is disseminated in the quartzite and perhaps as much as 10 percent has remobilized onto fracture and joint surfaces.

Chalcopyrite-Ankerite Zone

There is an unusual zone composed of chalcopyrite and ankerite that appears to be the relatively barren zone that is "behind" the bornite-digenite-chalcocite-native silver zone in the southeastern part of the Spar Lake deposit. The bornite-digenite-chalcocite-native silver zone diminishes, and only chalcopyrite and ankerite with minor bornite occur. The sulfide content has decreased and no silver is present. The chalcopyrite-ankerite zone is not part of the ore zone (Balla 2000, p. 35).

Balla (2000, p. 35) describes the post-sulfide cementation of the ore body in the following manner:

Diagenesis and lithification continued after the sulfide mineralization was emplaced into the sands of the Revett Formation. Hayes (1983) has documented the successive filling of the pore spaces that remained after the sulfide mineralization was emplaced. The lowest temperature cement was ferroan calcite. This was followed, through an orderly transition, into cementation by magnesium carbonate. It is an image that shows a pore space in the bornite-digenite-chalcocite-native silver ore zone being filled by calcite and then magnesium carbonate. The most important cementation was the development of quartz overgrowths on all of the mineral grains. This process, which volumetrically is the most important, was the result of pressure solution as lithification continued. Pressure solution in a sedimentary rock occurs when the external pressure (lithostatic loads) exceeds the hydraulic pressure of the interstitial fluid. When this occurs, the contact surfaces between the mineral grains increase, thereby reducing the pore space (and permeability) of the sediment, and effectively welding the individual grains together. The result is an impermeable rock with no porosity.

3.8.4.2 Geochemical Composition

Two geochemical processes that should be considered during mine development and reclamation are: 1) acid rock drainage (ARD) and 2) metal leaching (ML) in near-neutral pH environments. Both ARD and ML have the potential to cause serious environmental problems to water quality and aquatic life through the release of acids and metals.

Acid Rock Drainage

ARD is the product formed by oxidation of iron-sulfur minerals such as pyrite and pyrrhotite. The chemical and biological reactions involved in ARD generation are complex. Sulfide minerals are unstable at oxidizing surface environments where they are far from their kinetic equilibrium (the environment from which they were formed). Exposure to air and moisture causes mineral oxidation. Acid generation occurs from the oxidation of iron sulfide minerals to ferrous iron (Fe II), sulfate (SO_4^{2-}), and to sulfuric acid (H_2SO_4). If not neutralized, sulfuric acid will decrease the pH. Complex iron interactions increase the amount of acid that can be generated. Available water transport for the oxidized ingredients and insufficient neutralizing capacity (buffering) of the solution can suppress pH values.

Net acid production results from the relationship between the rates of time dependent reactions of acid-generating minerals and acid-consuming minerals (Saskatchewan Environment and Public Safety 1992). The net generation of acid from a rock or waste rock facility is directly related to the availability of neutralizing minerals. The pH decrease associated with ARD occurs when neutralizing minerals are consumed or become unavailable by secondary mineralization or coatings. A pH decrease will also occur if acidity is produced at a faster rate than alkalinity.

Acid production depends on the amount, type, and depositional environment of sulfides present, on the amount of neutralizing (acid-consuming) minerals available in the rock, on the degree of exposure of these minerals to oxygen, water, and to carbon dioxide, on site conditions, and on other factors.

Development of acid drainage is time dependent and, at some sites, may evolve over a period of many years (British Columbia Acid Mine Drainage Task Force 1989, Saskatchewan Environment and Public Safety 1992). Drainage from acid producing rocks typically contains elevated metals that can adversely affect water quality and aquatic life. Bacterial processes are also an important factor in the rate of acid generation. The type of bacteria that participates in sulfide oxidation is dependent on the pH environment which affects the extent of these bacterial processes and the oxidation reaction kinetic rate. At near-neutral pH, acid generation occurs primarily from chemical oxidation of pyrite (or iron sulfide). A minor amount of biological oxidation of these components to sulfuric acid also occurs from sulfur oxidizing bacteria. Near-neutral pH oxidation rates are much slower than reactions that occur at lower pH due to the dominant chemical oxidation reaction. If the neutralizing potential of a rock material is exhausted and pH values are depressed below 4, strongly oxidizing sulfur bacteria will grow and oxidize ferrous iron (Fe II) of pyrite directly to ferric iron (Fe III). Bacterial interactions can accelerate sulfide oxidation and thus increase the rate of acid generation. *Thiobacillus ferrooxidans* is a widely recognized species of sulfur/compound oxidizing bacteria that will grow in low pH environments (below pH 4).

Metal Leaching (ML)

Traditionally, mine waste characterization and management has focused on metal and sulfate release under acidic conditions. While acidic effluents present the greatest potential for environmental damage, there are also cases where elevated metal concentrations have occurred in neutral seepage from “non-acid generating” mine wastes. Certain elements remain relatively soluble at neutral pH and can occur in concentrations above water quality standards. Sulfide oxidation, in combination with neutralization by associated buffering minerals such as carbonates and to a lesser extent feldspars, can produce elevated concentrations of metals without a depression of pH. Elevated concentrations of metals can also be a result of the dissolution of secondary, non-oxidative, metal-bearing minerals such as salts, oxides, and sulfates.

Factors Influencing Acid Production, Acid Consumption, and Metal Release Rates

Mineralogic texture and chemistry must be evaluated in testing for ARD and ML potential. For example, sulfides cemented in a silica matrix, or that are large grained and have lower surface area, have slower oxidation rates than a small, high surface area sulfide mineral that is in a porous matrix such as sandstone. Decreased contact with oxygen and water due to cementation results in slower oxidation rates. Temperature, pH, and availability of water and oxygen also greatly affect the ARD and ML potential from a sulfide containing deposit or sulfide waste.

Impurities in a sulfide crystal structure or oxidative differences between iron sulfides (as compared to copper, zinc, or lead sulfides) also will determine oxidation rates. For example, in the absence of ferric iron (Fe III) at pH 2.5-3.0, sulphuric acid will dissolve some heavy metal carbonate and oxide minerals, but has little reactive effect on heavy metal sulfides. However, ferric iron ion is capable of dissolving many heavy metal sulfide minerals, including those of lead, copper, zinc, and cadmium (GARD guide 2008). Iron sulfide, particularly pyrite (FeS_2) and pyrrhotite ($\text{Fe}_{1-x}\text{S}^4$) are the most common sulfide minerals, and much research is available on the oxidation reaction of these minerals. Pyrite and pyrrhotite are the most common acid-producing sulfide minerals because of their high degree of instability in oxidizing conditions.

Sulfide mineral oxidation is a process that may occur in pH-neutral conditions and is probably the source of the elevated copper in the water that is found in the underground workings in the Troy Mine, which has developed and exposed the bornite-digenite-native silver ore zone. Bornite is a copper-iron-sulfur mineral, and digenite is a copper-sulfur mineral. The underground pillars that support the overlying sedimentary rocks are composed of ore grade bornite-digenite-native silver. In a pH-neutral oxidizing environment, the bornite-digenite-native silver minerals found on fracture and joint surfaces in the rock are oxidized in place to a mixture of various copper oxide minerals. These copper oxide minerals are exposed in the outcrops of the Troy ore body on the south side of Mt. Vernon and underground in the mine workings. The oxide minerals include tenorite, chrysocolla, brochantite, malachite, and cupriferous goethite (Hayes and Balla 1986). These are all secondary copper oxide minerals which occur in areas of low acidity. The bornite and digenite minerals that occur between the individual sand grains and that comprise the main ore zone are not leached, as they were originally encapsulated by the quartz overgrowths that occurred during diagenesis and burial metamorphism.

Subsequent melting snow water, percolating down through the various sedimentary rocks along these same fracture and joint surfaces, partially dissolved the oxidized copper oxide minerals, producing the dissolved copper detected in the underground mine waters. However, it should be noted that in the Troy Mine neither the overlying galena halo zone nor the pyrite halo zone were ever mined and are not exposed.

Moreover, the melting snow water, percolating down through the overlying galena and pyrite halo zones, is not creating acid rock conditions, for sampling of the underground mine waters consistently shows that the pH of the mine waters is 7.2 to 7.4, a near-neutral to alkaline condition.

Kirk (2003) provides a complete discussion of potential ARD and ML for the rock types described in this section.

3.8.4.3 Subsidence

The Troy Mine is a room and pillar mine with overburden thickness ranging from a few feet at the portals to over 1,200 feet. The height of the mine workings varies from about 20 feet to as much as 70 feet. Kennecott Copper Corporation (1970) conducted an evaluation to determine the appropriate room and pillar sizing for the Troy Mine. This evaluation included laboratory tests of rock samples, field tests of scaled room and pillar system, theoretical estimates of stress, and field mapping of structures.

Mining-induced surface subsidence is the lowering of the ground surface as a result of underground mine failure. The potential for surface subsidence depends on a number of factors including overburden thickness; height of the underground excavation; physical properties of the ore and overburden rock masses; and span, or width, of the mined-out area. The Troy Mine uses room and pillar mining, a method in which pillars of ore are left after mining as the primary form of ground support. The mine openings disrupt the established stress field and change the magnitude and direction of the stresses in the surrounding rocks, resulting in permanent stress redistribution. If the redistributed stresses caused a failure in the mine workings, the resulting void would have the potential to propagate to the surface, resulting in subsidence. Surface subsidence would impact vegetation, soil, surface water and groundwater, and slope stability. Subsidence could also impact human safety.

The type of subsidence most likely to occur at the Troy Mine is chimney subsidence. These chimney-shaped failures can be caused by several different mechanisms. At the Troy Mine, two different mechanisms are likely to cause chimney subsidence:

- Plug subsidence: Plug subsidence occurs when there are structural features near a mine opening which create a shear zone that enables the undercut rock to slide downwards under the influence of gravity. Plug subsidence would occur where faults or other large-scale geologic structures are present. This type of subsidence generally propagates upward almost instantaneously. If the mine workings are close enough to the surface, surface expression would occur soon after the initial cave-in of the mine workings.
- Progressive failure in a discontinuous rock mass: In areas where the rock mass is highly jointed and weak, like the rock around the East Fault, the rock above an underground opening can begin

to unravel. The opening propagates upward as the rock mass unravels over time. Eventually, if the workings are close enough to the surface, subsidence would occur.

Subsidence at the Troy Mine was not addressed as part of the 1978 reclamation plan. At the Troy Mine, there have been two occurrences of surface subsidence, which have been referred to colloquially as “sinkholes” (Call and Nicholas, Inc. 2005 and 2006, Tetra Tech 2006) (**Figure 2-3**). Rock mass rating (RMR) is a method used to determine the overall integrity of the rock mass and to provide guidelines for engineering design and ground support. RMR is based on several parameters which can be categorized as rock strength, jointing, and groundwater inflow. RMR can range from 0 to 100, with a rating between 80 and 100 indicating a rock mass which requires little support.

Both surface subsidence occurrences are located in the rock mass associated with the East Fault, a highly fractured area with an estimated RMR of approximately 20 (Tetra Tech 2006). An RMR of 20 puts the rock mass along the East Fault in the “very poor” class, which is the lowest of five classes. The mine rock mass not associated with the East Fault, in general, has an RMR of 50 to 90. This range spans the top three of the five classes, from “fair” to “very good.”

The existing subsidence at the Troy Mine occurred in the weak rock mass along the East Fault. Given the RMR values of this area, it would be reasonable to expect that the East Fault rock mass would be the most likely area to encounter future subsidence.

After the 1978 EIS, numerous subsidence studies on projects in the same geologic units have used the Troy Mine as an analog (Redpath (1991); Agapito (1991); Camp, Dresser and McKee, Inc. (1989); and ASARCO (1994). These reports support the conclusion that a properly designed room and pillar mine has a low likelihood of causing subsidence. A report by Tetra Tech (2006) states:

At hard rock room and pillar mines... surface subsidence is not an inevitable consequence of mining. Provided that the mine is properly designed to prevent subsidence, the potential for subsidence to occur is minimal. This view is shared by many experts in the field of subsidence, including Peng (1992), Whitaker and Reddish (1989), Agapito (1991), Golder Associates (1989), and Cullen and others (2002). Room and pillar mining is well established as a means to significantly reduce or prevent surface subsidence.

3.8.5 Environmental Consequences

Numerous reclamation alternatives were reviewed and evaluated to determine geologic impacts and to ensure reclamation success within the analysis area.

Methods for assessing geologic impacts to reclamation success generally include analyzing how each alternative addresses the effects of the following issues:

- Geochemical composition limits on plant growth due to sulphur content, metal concentrations, or other parameters in the development rock, tailings, or reclamation materials;
- Mining-induced subsidence; or
- Altered local topography.

Information used for this analysis is taken from the various studies, reports, and reviews of environmental documents on the Troy Mine and on other mine projects in the area.

The geologic materials at the Troy Mine have little or no potential for ARD but have some potential for near-neutral metal mobility (BC Research 1976, Kirk 2003). Previous studies have shown that the infiltration of water through waste rock fill found at the Troy Mine and other mine sites with similar geology in the area does not degrade groundwater or surface water. Oxidation of the mineral pyrite is the main reaction which is responsible for acid production and metals leaching at mine sites. The Troy Mine ore body is composed of non-acid producing copper sulfide minerals (digenite, bornite, and chalcocite) and has a low pyrite content (Balla 2000). The total sulfur content of the ore body is low, ranging from 0.3 percent to 1.0 percent by volume. In addition, iron and magnesium carbonates present within the ore body act to neutralize any acid that may be generated.

The potential environmental consequences from surface subsidence event include: slope instability; loss of vegetation; erosion and soil loss; changes in the groundwater regime; increased sediment loading in adjacent streams; and changes in surface water drainage.

Proposed reclamation of subsidence features was reviewed and evaluated in order to ensure reclamation success within the analysis area by alternative. The following parameters were used to assess reclamation success:

- Post-reclamation stability of steep slopes;
- Erosion control during establishment of vegetation;
- Success of revegetation;
- Mitigation of impacts to ground and surface water; and
- Mitigation of impacts to human safety.

3.8.5.1 No Action Alternative

Geochemical Composition

Development rock, ore, and tailings have a low acid-producing potential but have some residual metal content. Under the No Action Alternative, reclamation of the patios would include some regrading to achieve the final contours needed for drainage and then covering the areas with 12 inches of stockpiled lacustrine and volcanic ash-derived soil material hauled from the tailings impoundment area or borrow from the USFS borrow site. Revegetation would include seeding a mixture of herbaceous plants. Over time, trees and shrubs would be expected to volunteer from the surrounding slopes. This type of reclamation activity would minimize the risk of near-neutral metal mobility and erosion from the development rock.

Potential issues related to nitrates from blasting residues in waste rock or tailings are discussed in **Section 3.9**.

Subsidence

In hard rock mines, it is difficult to estimate how far subsidence would propagate toward the surface, but a conservative estimate is that the maximum height would be approximately 10 times the height of the excavation (Tetra Tech 2006). The two subsidence features at the Troy Mine are located where the overburden thickness is between 270 feet and 320 feet (Tetra Tech 2006). Based on these reports, the Agencies conclude that any future subsidence would be most likely to occur along the East Fault zone under similar conditions.

Genesis (now Troy Mine, Inc.) made efforts to reclaim the existing subsidence features in 2005 and 2006. In 2007, Genesis applied for Minor Revision 07-001 to Operating Permit 00093 to address one future subsidence occurrence. In this minor revision application, Genesis concluded that “the only area with any potential for a similar sinkhole event to occur is between the two reclaimed sinkholes on private land,” (letter from Genesis to DEQ dated February 14, 2007). The reclamation bond was increased to include the cost of reclaiming one additional subsidence feature. None of the parameters used to assess reclamation success were adequately addressed in Minor Revision 07-001.

The first feature was about 50 feet in diameter, 20 feet deep, about 0.1 acre in size (Tetra Tech 2006), and located on a moderate slope. Genesis (now Troy Mine, Inc.) backfilled the depression with borrow material to blend with the surrounding slopes, covered the disturbance with growth medium, and seeded in 2006 with the approved mix. During the Agencies’ inspection in September of 2010, the site appeared to be stable, showed no evidence of erosion, and had established vegetation (DEQ 2010). The Agencies concluded that the reclamation has minimized impacts to surface and groundwater and has minimized impacts to human safety.

The second subsidence feature was oblong in shape, approximately 100 by 135 feet, 20 to 30 feet deep (Tetra Tech 2006), and located on a steep slope. Genesis (now Troy Mine, Inc.) did not backfill the depression, but used an excavator to push the sides into the depression in an attempt to blend with the surrounding slopes. The headwall remained. No growth medium was applied, and the area was seeded in 2006 with the approved mix. During the September 2010 inspection, the existing slope did not appear stable, material continued to slough, erosion was apparent over most of the disturbance (including continued erosion up the slope), and the top of the slope was eroded and undercut. Vegetation had not established enough to prevent erosion; moreover, sediment had washed downslope into the drainage ditch along the road and through the culvert to the other side of the road (DEQ 2010). The Agencies concluded that Troy Mine, Inc. has not minimized impacts to surface and groundwater or to human safety and has not returned the area to comparable stability and utility. Overall, reclamation methods previously used by Troy Mine, Inc. proved insufficient for larger subsidence features and steeper slopes.

Topography

Under the No Action Alternative, reclamation activities for the final mine closure would continue under the specifications of the 1978 Reclamation Plan. Mine adits would be plugged with concrete. Under the 1978 Reclamation Plan, regrading of the mine and mill area would promote storm water drainage and revegetation efforts. Regrading in the No Action Alternative would not remove the man-made appearance of the portal patios and mill area.

Reclamation of the tailings impoundment surface would start with regrading to the final contours needed for drainage to the northeast corner of the impoundment surface. Then the area would be covered with 18 inches of salvaged lacustrine and volcanic ash-derived soil material from the soil stockpile between the tailings impoundment and Lake Creek. Because the embankment has already been reclaimed, it would not be regraded at closure. Regrading of the surface would direct runoff away from the embankment but would not return the tailings impoundment area to pre-mine conditions. Revegetation would soften the man-made appearance, but the tailings impoundment would always resemble a terrace above Lake Creek.

3.8.5.2 Proposed Action

Under the Proposed Action, reclamation activities on the Troy Mine Permit Area would follow the specifications of the revised plan (Genesis 2006) (**Table 2-1**). Development rock would be used to backfill from portals 30 feet into the adit and would be placed as tightly as possible against the roof. Rock remaining after adit plugging would be graded against the sides of the slopes to form a wedge. The portal patios would be regraded to slope away from the mine. Two concrete, non-hydraulic plugs are proposed for the Service and Conveyor adits. Under the *2006 Revised Reclamation Plan*, regrading activities proposed in the mine and mill areas as part of the No Action Alternative would be included within the Proposed Action. Additional grading of the portal patios, drainages, and borrow sites would promote better slope stability, storm water drainage, erosion resistance, and better revegetation potential.

Geochemical Composition

The development rock, ore, and tailings all have low acid producing potential but have some residual metal content. Regrading and revegetation would be similar to the No Action Alternative and would minimize the risk of near-neutral metal mobility and erosion from the development rock.

Subsidence

Mining-induced subsidence would be dealt with as in the No Action Alternative. The effects of the Proposed Action would be the same as the No Action Alternative.

Topography

The Troy Mine Revised Reclamation Plan (Genesis 2006) summarizes reclamation work completed on the impoundment to date and provides figures associated with soil stockpile locations and volumes for use at final reclamation.

Under the Proposed Action, the tailings impoundment surface as deposited during operations would remain largely unchanged (Genesis 2006, Exhibit E). Minor regrading may be needed to relocate the final decant ponds. Storm water could still run off the tailings surface into the decant ponds, which may decrease the permeability of the decant ponds over time.

The topographic effects of the Proposed Action would be similar to the No Action Alternative.

Reclamation of the tailings impoundment surface would include minimal regrading to achieve the final contours needed for drainage to the decant ponds and then covering with 18 inches of glacial outwash from the borrow sites east of the impoundment. Because the embankment has already been reclaimed, it would not be regraded at closure. Regrading of the surface would direct runoff away from the embankment. Regrading would not return the tailings impoundment area to pre-mine conditions; however, revegetation would soften the man-made appearance of the impoundment. The tailings impoundment would resemble a terrace above Lake Creek.

3.8.5.3 Agency-Mitigated Alternative

Under the Agency-Mitigated Alternative, the *2006 Revised Reclamation Plan* would be implemented and further amended to address issues identified during the public scoping and agency review processes (**Table 2-1**).

Geochemical Composition

The effects of regrading and revegetation under the Agency-Mitigated Alternative would be similar to the other alternatives as far as reducing the risk of near-neutral metal mobility and erosion from the development rock. In addition, under the Agency-Mitigated Alternative, all drainage channels would be built from imported rock rather than from mine development rock. This approach would further minimize the potential for near-neutral metal mobility.

Subsidence

As discussed under the No Action Alternative, efforts to date to reclaim the second subsidence feature have not been adequate. Based on the 2010 inspection, the Agencies would require Troy Mine, Inc. to properly reclaim the second subsidence feature to meet the parameters for reclamation success under this section of the EIS.

Minor Revision 07-001 is inadequate to address reclamation of future subsidence events, particularly those occurring on steep slopes. Under the Agency-Mitigated Alternative, the following mitigations would be required, as appropriate, to address parameters used to assess reclamation success:

- Post-reclamation stability of steep slopes;
 - Excavate the upslope end of the disturbed area to lay the slope back to a grade mild enough to minimize erosion. This would create further disturbance, but would stabilize the slope and prevent headward erosion.
 - Recontour the disturbed area by using a combination of grading and backfilling to blend into the adjacent undisturbed area. The recontoured area would be free-draining, prevent ponding, and minimize infiltration.
 - Terrace across the slope to key in the fill material.
 - Recontour or back fill additional disturbed areas related to accessing the site.
- Control erosion during establishment of vegetation;
 - Erosion control would include BMPs on the subsidence features, and any additional disturbance necessary to reclaim the feature, as approved by the Agencies.

- On steep slopes or drainageways, an erosion control mat would be keyed in on the upslope end to discourage water flow beneath the mat. The mat would provide stability and help control erosion while the vegetation has time to establish.
- Success of revegetation;
 - Use rocky growth medium with wood-based organic amendment and soil testing to determine needs for fertilizer and mulch.
 - Use an aggressive cover crop to help control erosion until perennial plants are established.
- Mitigation of impacts to ground and surface water; and
 - Install a drainage ditch above the subsidence feature to divert surface runoff.
 - The mitigations listed above would limit surface and groundwater impacts.
- Mitigation of impacts to human safety.
 - Signs and fences would be used, as necessary, until reclamation is complete.
 - The mitigations listed above would limit impacts to human safety.

Topography

The Agency-Mitigated Alternative contains alterations to the mine and mill area regrading plan to safely pass storm water or any potential mine water discharge in the future through the mill pad area to Stanley Creek (see **Appendix E**). The additional grading of the mine and mill areas under the Agency-Mitigated Alternative would achieve a higher level of erosion resistance, storm water control, and revegetation potential to promote soil stability than would the Proposed Action.

Grading of the impoundment surface would be similar to the Proposed Action. The surface would slope towards the relocated decant ponds. A berm would be built to prevent storm water and sediment from entering the decant ponds (see **Appendix C**). Effects would be similar to the Proposed Action.

Effects of the Agency-Mitigated Alternative on topography would essentially be the same as the other alternatives.

3.8.6 Resource Impact Summary

In all three reclamation alternatives, the geology and geochemical composition would have minimal impact on revegetation success. In general, the effects of geologic materials on reclamation in the three alternatives would be minor.

Under all three reclamation alternatives, another subsidence event could occur.

Similarly, all three alternatives would provide a net positive effect to local topography through increased soil stability, erosion resistance, and storm water control. Regrading would not return the mine area or the tailings impoundment area to pre-mine conditions, but revegetation would soften the man-made appearance. The portal patio slopes would resemble talus slopes, and the tailings impoundment would resemble a terrace above Lake Creek.

3.8.7 Effectiveness of Mitigation Measures

Under the Agency-Mitigated Alternative, no additional measures would be required to mitigate geochemical impacts to reclamation success. The use of rocky glacial and lacustrine and volcanic ash-derived soils as growth media would minimize root contact with mined materials. This would effectively minimize the potential effects of plant uptake of metals from the development rock and tailings.

The Agency-Mitigated Alternative would use the most appropriate technology currently available. Such technology would include engineering and reclamation practices that have been proven effective to stabilize soils, minimize erosion, and to limit infiltration into mined-materials containing metals.

3.8.8 Cumulative Effects

Cumulative indirect and direct effects are anticipated to be minimal with regard to geologic materials. There would be few anticipated geologic impacts associated with any of the alternatives when combined with potential effects from past, present, or reasonably foreseeable future actions in the Lake Creek watershed.

3.8.9 Regulatory Compliance

The No Action Alternative does not meet the requirements of the MMRA and the USFS mineral regulations because it does not address past or future subsidence. Efforts by Troy Mine, Inc. to date have not adequately mitigated impacts from subsidence.

The Proposed Action would not be consistent with MMRA and the USFS mineral regulations in that it does not provide additional mitigations for management of subsidence.

The Agency-Mitigated Alternative would be consistent with MMRA and the USFS mineral regulations because it provides appropriate mitigations for subsidence. It also minimizes potential impacts from use of development rock in channel construction by using imported rock instead of development rock.

3.9 Hydrology

3.9.1 Introduction

Hydrology is the description of the water resources of an area, including groundwater, surface water, the interaction between them, and overall water quality. This section characterizes the existing hydrology within the three sub-watersheds that surround the Troy Mine Permit Area. Hydrology could be affected by reclamation activities or long-term water quality of mine discharges. Discharges could arise from the mine adits and workings or seepage from the tailings impoundment. This section identifies potential impacts to these resources under each of the reclamation alternatives.

3.9.2 Regulatory Framework

The regulatory framework for this section includes:

- The Federal Clean Water Act.

- The Montana Water Quality Act (75-5-101, *et seq.*, MCA).
- Forest Service Manual 2532 and FSH 2509.22 R1/R4 Amendment, including Manual and policy updates (USFS 2009a).
- The Kootenai National Forest Plan - 1987.
- Executive Order 11990.

The Federal Clean Water Act provides for the restoration of the Nation's water (33 USC 1251 *et seq.*). The U.S. Environmental Protection Agency (EPA) delegated most of the implementation of the Clean Water Act (CWA) to the State of Montana. Designated beneficial uses of Montana's state waters include recreation, water supply, fisheries, aquatic life, and wildlife. The CWA requires that the State of Montana establish priority ranking for waters on the Section 303(d) List of impaired waters and to develop Total Maximum Daily Loads (TMDLs) for these waters. TMDLs are one of many tools in the CWA to help achieve the Act's main objective to "restore and maintain the chemical, physical, and biological integrity of the Nation's waters." (CWA section 101(a)). A federal judicial order and Montana Law (MCA 75-5-703(3)) both require that "all necessary TMDLs" be completed by May 5, 2012, for water bodies on the 1996 303(d) List.

Section 303(d) of the CWA requires the listing of water bodies and outlines a program for addressing water body segments with impairments that preclude them from meeting standards designated for beneficial uses. These impairments to water quality include both point and non-point sources. Under United States Department of Agriculture (USDA) Non-point Source Water Quality Policy Directive 9500-007, the USFS agreed to become a Designated Management Agency for NFSL in Montana. The USFS, as a Designated Management Agency, is responsible for conducting land management activities that maintain or enhance the water quality within NFSL (USDA 1986).

Section 313 of the CWA requires the USFS to adhere to the goals set forth in the state surface water quality laws and regulations. Section 319(k) of the CWA, in conjunction with Executive Order 12372, state that federal agencies shall accommodate state concerns regarding the consistency of agency projects with the state non-point source pollution management program. DEQ is the lead agency for development of Water Quality Plans/TMDLs for 303(d)-listed water bodies.

The Clean Water Act regulates discharge of dredged or fill material into any water of the U.S., including wetlands (33 USC 1344) and provides the regulatory framework for assessing impacts to water quality. Section 404(b)(1) guidelines prohibit discharges of dredged or fill material into waters of the United States, including wetlands, if a practicable alternative to the proposed discharge exists that would have less adverse impacts on the aquatic ecosystem (provided that the alternative does not cause other significant adverse environmental impacts) (40 CFR 230(a)).

DEQ administers the **Metal Mine Reclamation Act** (MMRA) under which the Troy Mine has applied for amendments and revisions to its Operating Permit #00093. One of the MMRA's purposes is to ensure that the usefulness, productivity, and scenic values of all lands and surface waters affected by mining and exploration receive the greatest reasonable degree of protection and that the lands are reclaimed to beneficial uses. The act and its rules define the steps to be taken in issuing an operating permit or

revising an approved operating plan for reclamation of an applicant's proposed or modified mine operation. Pursuant to Section 82-4-336(10), MCA, DEQ may not issue a permit or approve an amendment to a permit unless the reclamation plan prevents the pollution of air or water. In addition, the reclamation bond that a mine operation must submit before DEQ issues a permit or approves a permit amendment must be sufficient to ensure compliance with the Montana Water Quality Act (WQA).

The WQA provides a regulatory framework for protecting, maintaining, and improving the quality of water for beneficial uses. Pursuant to the WQA, DEQ has developed water quality classifications and standards, as well as a permit system to control discharges into state waters. Mining operations must comply with Montana's regulations and standards for surface water and groundwater.

All federal agencies are obliged to meet state water quality standards that protect the beneficial uses of lakes, rivers, streams, and wetlands.

The Forest Service Manual. The basis of the USFS's non-point source pollution control strategy stems from the USFS's non-point source policy (USDA 1986). In implementing non-point source pollution controls, the USFS will apply its non-point source strategy to all activities on NFSL that may impair water quality. USFS's non-point source strategy includes integrated project planning that considers temporal and spatial distribution of impacts, identification of priority restoration needs, implementing restoration, implementing best management practices (BMPs) on all ground disturbing activities, monitoring, and adjusting BMPs, or mitigating actions as needed to ensure that Montana Water Quality standards are met and designated beneficial uses of water are protected (DEQ and USFS 2008).

Executive Order 11990 requires that federal agencies ensure that their actions minimize the destruction, loss, or degradation of wetlands. It also assures the protection, preservation, and enhancement of the nation's wetlands to the fullest extent practicable during the planning, construction, funding, and operation of transportation facilities and projects.

3.9.3 Analysis Area

The project area lies within the KNF immediately west and north of Bull Lake and encompasses a major portion of the Stanley Creek drainage and a portion of the Lake Creek drainage. The analysis areas for this section are the sub-watersheds of the Lake Creek watershed that include the following mine facilities: Stanley Creek (mine and mill facilities and mine-related roads), Ross Creek (South Adit and mine-related roads), upper Lake Creek (tailings impoundment), and lower Lake Creek (monitoring site) (**Figure 3-2**). No mine facilities are located in the Keeler Creek sub-watershed, so it will not be discussed further.

The analysis area for cumulative effects is the Lake Creek watershed, which is the extent of potential water-related effects.

3.9.4 Affected Environment

3.9.4.1 Surface Water

The 1978 EIS for the Proposed Plan of Mining and Reclamation contains general baseline information on the entire Lake Creek watershed. This section focuses on the surface waters affected by reclamation actions identified in the analysis area, namely the mine and mill facilities, the tailings impoundment, and the waters potentially affected by seeps and springs in the mine workings area.

Ross Creek

Ross Creek is a cobble/boulder stream with naturally high peak flows due to precipitation intensity, steep topography, and rocky slopes. Natural debris flows occasionally occur above tree line or in burned areas and contribute to high sediment loads in Ross Creek during flood events. Large debris jams are common and cause relatively frequent channel adjustment and migration. However, the lowest reach of Ross Creek has intermittent streamflow and is usually dry for part of the year.

Elevated peak streamflows from timber management is not generally measurable in streams the size of Ross Creek (Grant *et al.* 2008). The Ross Creek watershed also has a high proportion of roadless areas, which have never been timber harvested and which make management-related peak flow increases highly unlikely (KNF 2010).

During the 1960s, numerous roads were built on Mt. Vernon in the lower Ross Creek watershed for exploratory drilling and development of the South Adit. Portions of National Forest land on Mt. Vernon were patented in 1978 and subsequently the timber was harvested. Evidence from historic aerial photos indicates that road development, timber harvest, and mine development work increased the frequency of slope failures on Mt. Vernon. At least five slope failures have occurred since the 1960s, with three resulting in debris torrents. The most recent event was in November of 2006 when a slope failure caused a debris torrent that delivered considerable fine sediment to Ross Creek. Overall, these events have scoured two tributary streams to bedrock and left extensive bedload deposits along the channels.

The effects of these events on the mainstem of Ross Creek appear to be fairly minor because the alluvial fans at the bases of these drainages prevented most of the larger material from reaching Ross Creek. Most of the fine sediment that reached Ross Creek probably has been transported down to the south end of Bull Lake. The lake acts as a settling basin and substantially reduces the sediment load that Ross Creek contributes to Lake Creek.

Development rock from construction of the South Adit was sidecast along an approximately 200 foot length of a tributary of Ross Creek. The sidecast material has forced the stream into the opposite bank, resulting in erosion at high flows. However, this site contributes little sediment to Ross Creek because of the large depositional area in the Ross Creek valley bottom.

Stanley Creek

For purposes of this analysis, Stanley Creek is divided into two segments: upper Stanley Creek is defined as the reach of Stanley Creek above its confluence with Fairway Creek; and lower Stanley Creek refers to the stream below the confluence. Upper Stanley Creek is a steep cobble/boulder stream that readily transports sediment downstream. It is perennial in the upper reaches and intermittent in the lower reaches. Flow is largely snowmelt-driven, and flow along the intermittent reach down to lower Stanley Creek generally occurs only for two to three months in April, May, and June. Flows in upper Stanley Creek are quite responsive to large rain or rain-on-snow events.

Natural peak flows in upper Stanley Creek have been increased by additional runoff from timber harvest, road construction, and from paving of the mill site. Higher peak flows generally result in more sediment transport. The maximum peak flows resulting from logging and mining activities probably occurred in the early 1980s when the mill site storm drainage system was connected to Stanley Creek. Since then, peak flows have dropped because the mill site drainage is no longer connected to Stanley Creek, and headwater areas have gradually reforested.

The increases in peak streamflow from more recent timber harvest (KNF 2001), planned timber harvest, and from ecosystem burning (KNF 2010) have and would remain below Forest Plan guidelines. This means that the range of peak streamflow expected is acceptable on the basis of channel conditions and would not impair beneficial uses.

Streamflow in lower Stanley Creek comes primarily from Fairway Creek, which emanates from Spar Springs. The flow from the springs is not subject to the typical high peaks associated with storms and spring runoff. As a result, lower Stanley Creek has a particularly stable channel condition. Trees remain where they fall into the stream, and bedload sediment migrates downstream slowly. The substrate is dominated by sands and small gravels rather than by coarse gravels and cobbles. Water clarity is exceptional most of the year.

The upper Stanley Creek watershed has three tributary streams. Below the west ventilation adit, the middle tributary of Stanley Creek was partially buried by coarse rock, which was sidecast during the initial mine development. The stream discharges through a culvert onto the talus slope and flows about 200 feet down to the original stream channel. The stream channel area is unvegetated for approximately another 200 feet below the toe of the sidecast material. While some erosion may be occurring along the unvegetated steep slope adjacent to the sidecast area, this site overall is probably a minor source of sediment to Stanley Creek.

Management activities that have increased sediment supply to upper Stanley Creek include road construction and timber harvest in the 1960s and 1970s, adit development in the 1970s, a tailings spill

from the pipeline below the mill site in 1981, sediment washing from the mill pad area during the 1980s, on-going erosion from NFSR 4626 above the mill site, and erosion below the two 48-inch culvert outlets located below the mill site. Most of this sediment is probably transported fairly rapidly down to lower Stanley Creek and to Lake Creek. Implementation of BMPs has reduced sediment contributions from the mill site and from NFSR 4626. Sidecasting of snow containing sand from road plowing operations continues to contribute fine sediment to lower Stanley Creek where NFSR 4626 is close to the stream.

In 1996, a slump occurred in the fill slope on NFSR 4626 between the mill site and the North Portal area resulting in a debris avalanche that buried approximately 200 feet of upper Stanley Creek with landslide debris. After reaching Stanley Creek, the slide became a debris torrent that caused major scour and sediment deposition down to the creek's confluence with Fairway Creek. Sediment deposited during this event is still evident throughout upper Stanley Creek and is a chronic source of sediment during peak flow events. It is likely that much of the sediment resulting from the 1996 slope failure is now deposited in lower Stanley Creek.

Heavy equipment was used to do channelization work in upper Stanley Creek following flood events in 1980 and in 1996. This work left an unnaturally incised channel that was vulnerable to erosion in subsequent high runoff events.

In October of 2009, a leak in a tailings pipeline spilled tailings into Thicket Creek (a tributary to Stanley Creek) about 150 feet above its confluence with lower Stanley Creek. Approximately 40 tons of tailings solids flowed out of the pipeline during the course of the spill and much of this material settled in Thicket and Stanley creeks as a layer of cohesive silt. Some of the material was suspended in the stream and carried down to Lake Creek. Cleanup operations removed most of the tailings from Thicket Creek. Difficult access and high water velocities made it impossible to remove most of the tailings that had reached Stanley Creek. Tailings are presently visible in the slower water areas downstream from the confluence with Thicket Creek.

Lake Creek

Lake Creek is a meandering, low-gradient stream with a wide floodplain. It flows through deep deposits of fine-grained soil. Trees and other woody debris frequently form jams that cause secondary channels and main channel migration. This on-going channel adjustment is the initiating process that causes adjacent bank and slope erosion. Tributary streams also contribute sediment from natural processes. The dominant substrate size on the bars is gravel and cobble. Lake Creek is perennial for its entire length.

Elevated peak flows from management activities are not generally measurable in streams the size of Lake Creek (Grant *et al.* 2008). Upper Lake Creek watershed also has a high proportion of roadless and wilderness areas that make management-related peak flow increases highly unlikely.

In upper Lake Creek, human-caused sediment sources appear to be primarily from road failures from timber harvest-related slope failures in the Camp Creek watershed and from various activities related to timber harvest and mine operations in the Stanley Creek watershed as discussed above. In 1984, a tailings spill released an unknown quantity of tailings into Lake Creek (EPA 1992). After 26 years, it is likely that most of these tailings have been flushed from Lake Creek into the Kootenai River and are no longer impacting the substrate of Lake Creek.

The tailings spill into Thicket Creek on October 1, 2009, resulted in short-term turbidity from a plume of suspended tailings flowing down to Lake Creek. "Copper and lead exceeded chronic water quality criteria for a short period (not more than two or three days) while the total suspended sediment values were high, but quickly returned to baseline conditions as tailings materials settled out and were back to baseline conditions in Lake Creek by October 3rd. There likely were no toxic effects due to the short duration at chronic levels" (Hydrometrics 2009). Concentrated deposits of material from this spill were not apparent on the stream bottom, and there appear to have been no long-term sediment effects to Lake Creek.

Some of the sediment entering Lake Creek is deposited on the channel bottom and gradually works its way downstream. There has been no systematic stream channel morphology monitoring in Lake Creek, so it is unknown whether there have been recent changes in channel conditions due to sediment deposition. The proportion of human-caused sediment to natural sediment is unknown.

Water Quality Sampling

A sampling program was implemented to determine baseline conditions for surface waters (DSL and KNF 1978, page 107) for analysis in the 1978 Draft EIS. Appendix G of the 1978 Draft EIS (Volume 2) presents the surface water quality data collected. Typical water quality data were extracted from these files and presented in the Draft EIS as Table II-8 (DSL and KNF 1978, page 111). These data indicate that baseline water quality met water quality standards applicable at that time.

The investigation was rigorous in areas of most probable impact (*i.e.*, Stanley and upper Lake creeks) and cursory for other water bodies (DSL and KNF 1978, page 110). Water quality parameters evaluated included specific conductance, nutrients, temperature, metals (iron, zinc, and copper), and turbidity. Water quality was reported in the Draft EIS as being:

...very similar in all surface waters in the drainage with only small areal or seasonal variations. Water quality is a direct result of the quality of precipitation with some addition of ions from rock/water interactions. Water quality in the Belt Series Precambrian rocks usually is excellent and quality in this drainage is exceptionally high. Biological productivity is generally low in these cold and pure waters and the systems are poorly buffered. This means that small inputs of acid or alkaline wastes can alter pH. Similarly, wastes added to these streams usually have a greater impact than in streams with higher concentrations of dissolved minerals. These streams, thus, are sensitive to changes, and can easily be impacted (DSL and KNF 1978, page 110).

Stanley and Lake creeks are on the list of impaired waters for the State of Montana (**Table 3-6**).

Table 3-6. Water Quality Impaired Streams (2008 Water Quality Integrated Report, DEQ)

Stream	Aquatic Life	Probable Cause	Probable Source
Lake	Partial support	Physical substrate	Natural, mine tailings
		Nitrate/nitrites	Natural
		Sediment, siltation	Forest roads
Stanley	Partial support	Copper	Mine tailings
		Nutrient/Eutrophication Biological Indicators	Streambank Modifications/Destabilization

Copper and antimony are constituents of concern because they have exceeded water quality standards for surface water in the mine water (**Table 3-7**). TMDLs are scheduled to be completed for all impaired water bodies in Montana by 2012. Stream conditions in Stanley and Lake creeks will be evaluated for water quality impairments. If one or both streams are impaired, TMDLs will be developed for the constituents of concern. Nutrients, including ammonia and nitrate plus nitrite, are also a concern because they are present in mine water from blasting residue. Surface water quality has been monitored at Stanley and Lake creeks since 1975 (SRK 2005). Additional water quality monitoring sites were added in 1986, as was an aquatic biological monitoring program. The program included macroinvertebrate monitoring and water quality and flow monitoring three times per year (Parametrix 2009).

Manganese and iron have also been sampled and often exceed the secondary drinking water guidelines in monitoring wells near the tailings impoundment and in the toe ponds. This is regarded as the natural condition for this aquifer because similar levels of iron and manganese were documented in monitoring wells installed in 1980, prior to construction of the tailings impoundment. The probable source is dissolution of these metals from glacial lake silts and from other sediments that comprise the aquifer. Moreover, natural springs containing high levels of iron are observed throughout the Lake Creek valley.

Nitrates are elevated in mine water due to residues from blasting compounds. During mine shutdown nitrate plus nitrite levels have ranged from 0.3 to 1.1 mg/L as nitrogen (**Table 3-7**). The mine was shut down from 1993-2004 as described in Section 1.4.1. Based on the limited interim shutdown data collected between 2000 and 2003, nitrate levels averaged 0.91 mg/L as nitrogen, less than the operational average of 4.88 mg/L (**Table 3-7**).

Table 3-7. Dissolved Water Quality Concentrations for Mine Discharge Water

	Antimony mg/L	Copper mg/L	Zinc mg/L	Ammonia (NH ₃) mg/L	Nitrate + Nitrite mg/L	TDS mg/L
WQ Standard	0.006	0.00285	0.037	3.58	Narrative	NA
During Shutdown (2000-2003) Metals measured as dissolved.						
Max	0.016	0.079	0.015	0.13	1.1	181
Min	0.007	0.044	<0.001	<0.05	0.3	102
Mean	0.011	0.059	0.013	0.087	0.91	132
n	4	7	4	4	7	8
Operation (2004-2009) Metals measured as dissolved.						
Max	0.015	0.042	0.01	2.39	13.6	199
Min	0.006	0.041	<0.01	<0.05	0.7	111
Mean	0.010	0.041	<0.01	1.64	4.88	144
n	3	3	3	9	9	9

Notes: Data from Troy Mine, Inc. Water Quality Data Base.

TDS – Total Dissolved Solids

n – sample size

Note: although shutdown did not end until 2004, the data were collected between 2000 and 2003.

Water quality standards shown are the lowest applicable standard from Montana Numeric Water Quality Standards from Circular WQB-7 (February 2008). Zinc and copper standards based on chronic aquatic life criterion at hardness = 25 mg/L. Ammonia standard based on temperature of 0° C and pH of 7.7. Nitrate-nitrite standard is a narrative standard to prevent nuisance algal growth.

Shading indicates exceedance of standard.

Dissolved metals concentrations (primarily copper and antimony) increase in groundwater that moves through the mine workings. During mine operations, copper concentrations have averaged 0.041 mg/L, and antimony concentrations have averaged 0.010 mg/L (**Table 3-7**). Interim shutdown data indicate similar metals concentrations: copper concentrations were somewhat higher, averaging 0.059 mg/L, and antimony concentrations averaged 0.011 mg/L (**Table 3-7**). During both shutdown and operations, copper in mine water has exceeded the chronic aquatic life standard. Because this copper standard is hardness-dependent and the hardness in upper Stanley Creek is generally less than 25 mg/L, the aquatic life standard is quite low at 0.003 mg/L.

Mine and Mill Site Facilities

The mill and office facilities would be reclaimed after mine closure. The mill facility platform was built of development rock and rocky glacial fill. This material fills portions of two ephemeral drainages (**Figure 3-3**). Runoff from both drainages is currently combined and routed through two long, four-foot diameter culverts beneath the fill and eventually discharges to Stanley Creek. The high velocity of water discharging from the culverts has scoured an area below the fill, causing sediment to enter Stanley Creek.

Water quality for selected parameters in Stanley Creek is summarized in **Table 3-8**. Water Monitoring Station 17A is located below the mill and office sites, and Station SC02 is located below the confluence with Fairway Creek. Site SC-17A is sampled annually and has a small sample size. Stanley Creek is listed as an impaired stream for copper concentrations and nutrients/eutrophication. Three of the four samples taken at monitoring site SC-17A between 2005 and 2009 exceeded chronic aquatic life criteria

for copper. There are several possible sources of copper in this stream segment, including natural constituents.

Table 3-8. Recent Surface Water Quality Data for Stanley Creek, 2005 – 2009.

Site		Antimony (TR) mg/L	Copper (TR) mg/L	Zinc (TR) mg/L	Ammonia (NH ₃) mg/L	Nitrate + Nitrite mg/L	TDS mg/L
WQ Standards		0.006	0.00285	0.037	3.58	Narrative	NA
SC17A	Max	<0.003	0.011	0.04	<0.05	0.13	29
	Min	<0.003	0.002	<0.01	<0.05	0.08	10
	Mean	<0.003	0.005	0.012	<0.05	0.10	19
	n	4	4	4	4	4	4
SC02	Max	<0.003	<0.001	<0.01	<0.05	0.13	44
	Min	<0.003	<0.001	<0.01	<0.05	0.07	20
	Mean	<0.003	<0.001	<0.01	<0.05	0.10	31.4
	n	15	15	15	15	15	15

Notes: Data from Troy Mine, Inc. Water Quality Data Base
 TR – Total recoverable
 TDS – Total Dissolved Solids
 n – sample size

Water quality standards shown are the lowest applicable standard from Montana Numeric Water Quality Standards from Circular WQB-7 (February 2008). Zinc and copper standards based on chronic aquatic life criterion at hardness = 25 mg/L. Ammonia standard based on temperature of 0° C and pH of 7.7. Nitrate-nitrite standard is a narrative standard to prevent nuisance algal growth. Shading indicates exceedance of standard.

Tailings Impoundment Area

The tailings impoundment would be reclaimed after mine closure, but the decant ponds would remain to treat and to dispose of mine discharge water. The tailings impoundment is located about 500 to 1,000 feet east of Lake Creek, and many studies have investigated the potential for water infiltrating through the tailings impoundment to influence water quality in Lake Creek (DSL and KNF 1978, SRK 2005, Summit Envirosolutions 1996, and Summit Envirosolutions 1999) (see also Appendices C, D, and I). Water containing tailings that is routed to the impoundment during operations plus all precipitation that falls on the impoundment surface either infiltrates through the tailings mass or is collected in the decant pond and pumped back to the mine for reuse.

In addition to operational monitoring conducted under the operating permit, the water quality and health of the aquatic ecosystem in Lake Creek adjacent to the impoundment has been monitored since 1986. Water quality data at surface water stations upstream (LC-1) and downstream (LC-2 and LC-4) of the impoundment are shown in **Table 3-9**. There is one exceedance of the chronic aquatic life criterion for copper at site LC-01 and one at LC-02. The latter sample was collected in October of 2008 and contained 0.049 mg/L copper (Parametrix 2009). Surface water samples collected both upstream and

downstream of LC-2 on the same date showed no detectable copper. It is not known if a field or laboratory error occurred, but a resample in November of 2008 showed copper below detection (Parametrix 2009, p. 3-15). No adverse impacts to the macroinvertebrate community have been observed at this site (Parametrix 2009).

Table 3-9 summarizes surface water quality in Lake Creek near the tailings impoundment for selected parameters. Monitoring stations are shown on **Figure 2-5**.

Table 3-9. Surface Water Quality Data for Lake Creek, 2005 – 2009.

Site		Antimony (TR) mg/L	Copper (TR) mg/L	Zinc (TR) mg/L	Ammonia (NH ₃) mg/L	Nitrate + Nitrite mg/L	TDS mg/L
WQ Standards		0.006	0.003	0.037	3.58	Narrative	NA
LC-1	Max	<0.003	0.006	<0.01	<0.05	0.08	46
	Min	<0.003	<0.001	<0.01	<0.05	0.04	25
	Mean	<0.003	0.001	<0.01	<0.05	0.059	36.2
	n	15	15	15	15	15	15
LC-2	Max	<0.003	0.049	<0.01	<0.05	0.09	45
	Min	<0.003	<0.001	<0.01	<0.05	0.03	32
	Mean	<0.003	<0.004	<0.01	<0.05	0.057	37.5
	n	14	14	14	14	14	14
LC-4	Max	<0.003	0.003	<0.01	<0.05	0.17	55
	Min	<0.003	<0.001	<0.01	<0.05	0.06	32
	Mean	<0.003	0.001	<0.01	<0.05	0.10	43.6
	n	15	15	15	15	15	15

Notes: Data from Troy Mine, Inc. Water Quality Data Base
 TR – Total recoverable
 TDS – Total Dissolved Solids
 n - Sample size

Water quality standards shown are the lowest applicable standard from Montana Numeric Water Quality Standards from Circular WQB-7 (February 2008). Zinc and copper standards based on chronic aquatic life criterion at hardness = 25 mg/L. Ammonia standard based on temperature of 0° C and pH of 7.7. Nitrate-nitrite standard is a narrative standard to prevent nuisance algal growth.. Shading indicates exceedance of standard.

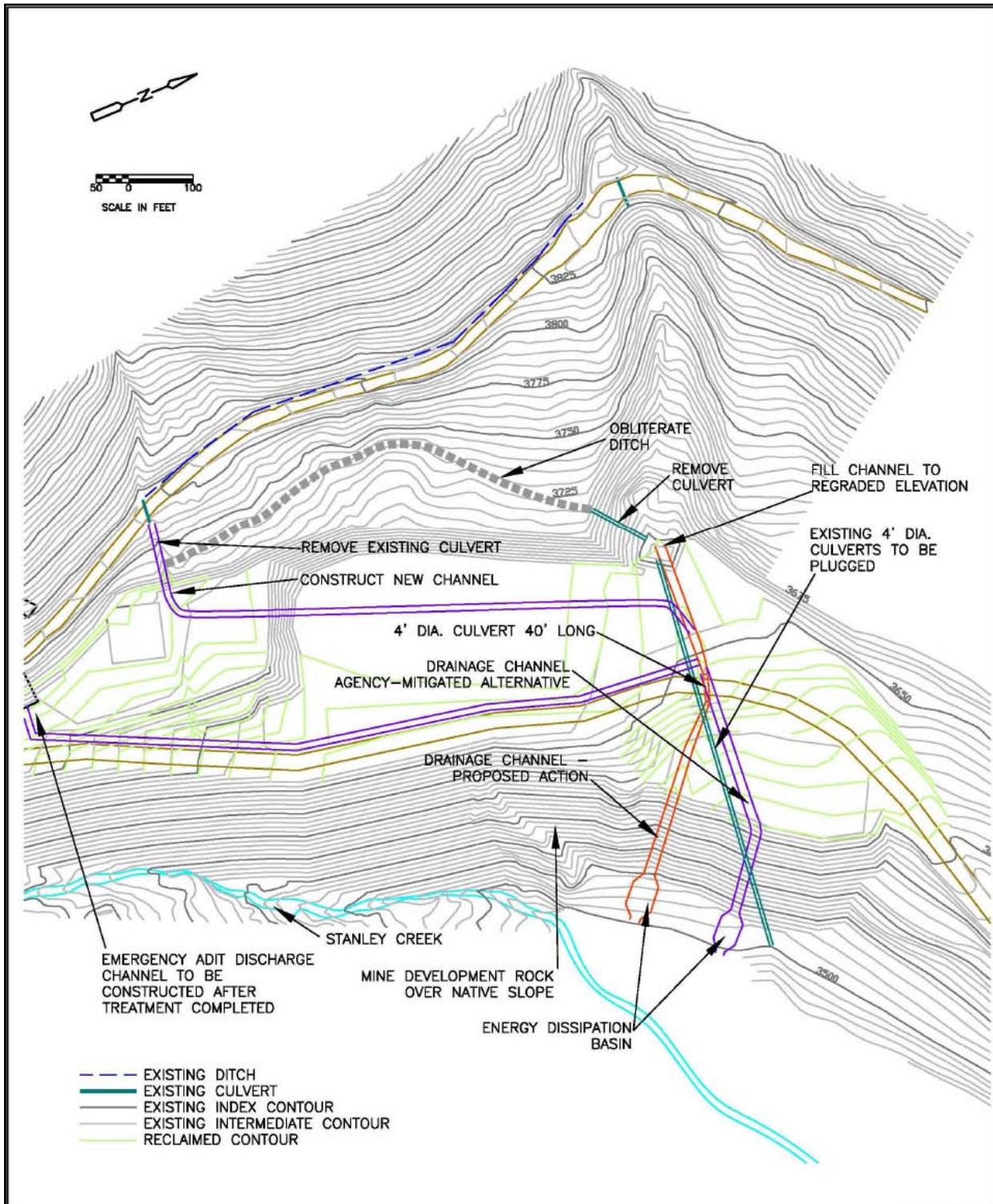


Figure 3-3. Mill Site Drainage Channel Alternatives

Mine Workings Area

The mine workings are located high in Mt. Vernon between Ross Creek on the south, Stanley Creek on the north, Bull Lake on the east, and a high ridge to the west. There is potential for water in the mine void to discharge through springs and seeps on the lower slopes of Mt. Vernon and thus affect the water quality of these surface waters.

Selection of the surface water monitoring sites was based on knowledge of the geology in the area. There are a number of seeps, springs, and small tributary streams surrounding the mine workings area (**Figure 3-4**). These surface water sources are located in tributaries to Ross and Stanley creeks, and to the Emma Gulch and Weasel Gulch drainages, both of which flow into Bull Lake. **Table 3-10** summarizes water quality at surface water sites, seeps, and at springs in the vicinity of the mine workings. Comparing the data to surface water quality standards, the total recoverable concentration of copper in a sample collected at SC-15A on April 4, 2005, exceeded the chronic aquatic life standard for copper; and the total recoverable copper concentration in a sample collected at SC-15C on August 12, 2010, was at the chronic aquatic life standard for copper. All other constituents were below water quality standards at all collection times. SC-17A is located below the mill site, and elevated copper levels at this sampling site are likely affected by water or sediment coming from the mill site itself.

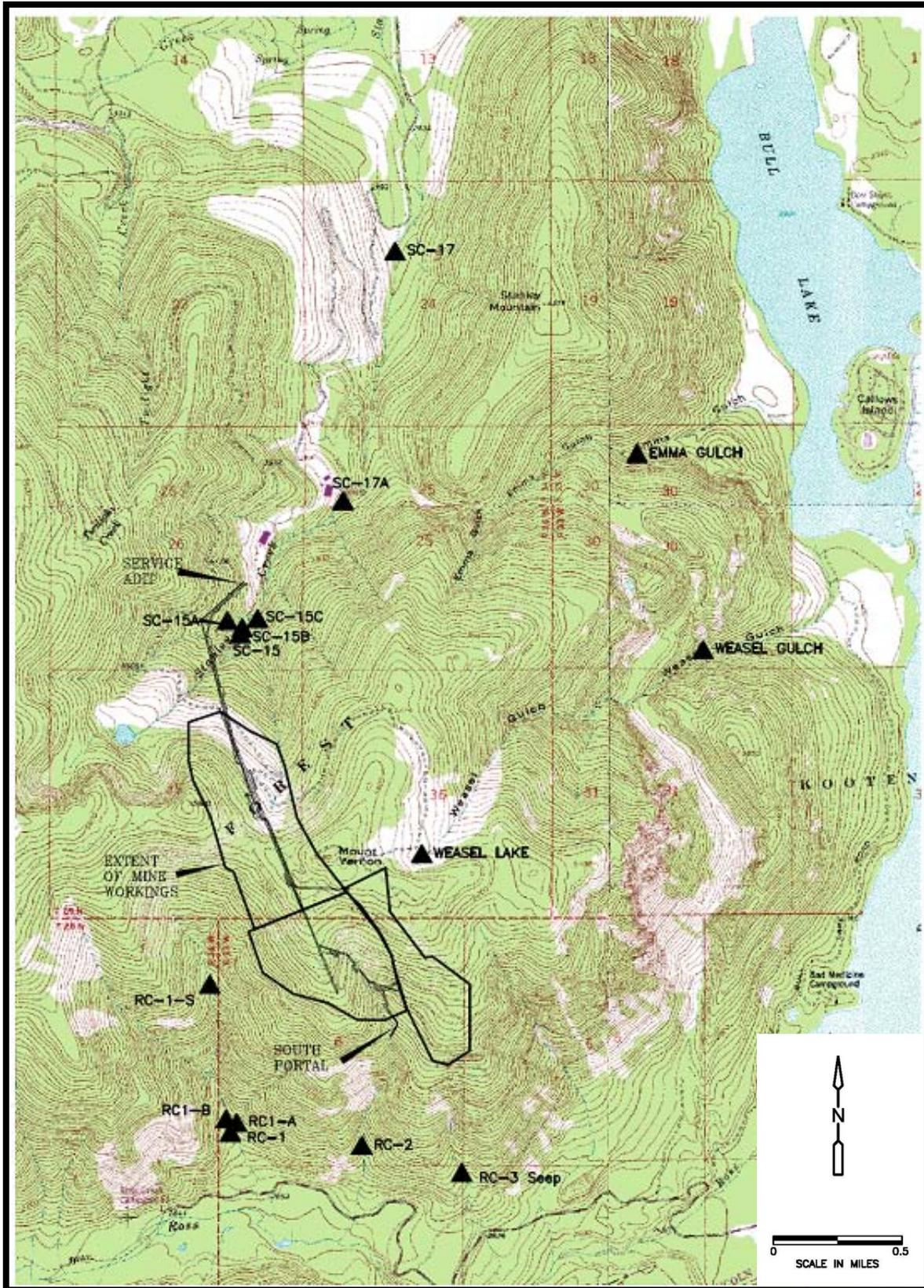


Figure 3-4. Seeps, Springs, and Surface Water Monitoring Sites in the Mine Workings Vicinity

Table 3-10. Surface Water Quality Data in Mine Workings Vicinity 2000 – 2010.

Site		Antimony mg/L	Copper mg/L	Zinc mg/L	Ammonia (NH ₃) mg/L	Nitrate + Nitrite mg/L	TDS mg/L
WQ Standard		0.006	0.00285	0.037	3.58	Narrative	NA
Weasel	10/21/05	<0.003	<0.001	<0.10	<0.05	<0.01	<10
Emma	Max	<0.003	<0.001	<0.010	0.23	0.079	62
	Min	<0.003	<0.001	<0.010	<0.05	<0.01	21
	Mean	<0.003	<0.001	<0.010	<0.013	<0.047	44
Aug. 26, 2003		<0.003	<0.001	<0.010	0.23	<0.01	62
	n	6	6	6	7	8	10
RC1	Max	<0.003	<0.001	0.003	0.69	2.74	111
	Min	<0.001	<0.001	0.003	<0.05	0.69	80
	Mean	<0.003	<0.001	0.003	<0.28	1.40	91.3
Aug. 26, 2003		--	<0.001	<0.010	0.69	1.1	--
	n	3	3	2	3	4	3
RC3	Max	--	0.001	0.003	--	--	--
	Min	--	0.001	0.003	--	--	--
	Mean	--	0.001	0.003	--	--	--
	n		1	1			
SC15A	Max	<0.003	0.004	<0.010	<0.1	0.34	34
	Min	<0.001	<0.001	0.002	<0.05	<0.05	<10
	Mean	<0.003	0.002	<0.009	<0.06	0.13	21
	n	9	9	8	8	9	8
SC15C	Max	<0.003	<0.01	<0.001	<0.1	0.88	41
	Min	<0.001	0.003	<0.001	<0.1	0.27	41
	Mean	<0.003	<0.01	<0.001	<0.1	0.58	41
	n	2	2	1	2	2	1

Notes: Data from Troy Mine, Inc. Water Quality Data Base and DEQ August 2010 Sampling
 Metals data from August 26, 2003 and site RC-3 are dissolved; other metals data are total recoverable or a combination of dissolved and total recoverable measurements.
 TDS – Total Dissolved Solids
 n - Sample size; small sample sizes are due to low or no flows at time of sampling.
 Water quality standards shown are the lowest applicable standard from Montana Numeric Water Quality Standards from Circular WQB-7 (February 2008). Zinc and copper standards based on chronic aquatic life criterion at hardness = 25 mg/L. Ammonia standard based on temperature of 0° C and pH of 7.7. Nitrate-nitrite standard is a narrative standard to prevent nuisance algal growth.
 Shading indicates exceedance of standard.

Roads and Other Facilities

Mt. Vernon has an extensive system of roads, which are in a variety of conditions. All the roads are unsurfaced except for NFSR 4626, which has been paved up to the mill site. Roads currently used for mining operations are minimally maintained, and roads that are not used are gradually revegetating. However, some of these roads adversely affect area water resources by intercepting and routing water directly to streams, thereby contributing sediment from chronic erosion of unvegetated surfaces and initiating debris events through failure of saturated road fills on steep slopes.

3.9.4.2 Groundwater

The study area lies within the Northern Rocky Mountains Intermontane Basins aquifer system. According to the USGS Ground Water Atlas of the United States, the groundwater of these basins generally occurs as follows:

Recharge to the aquifer system is by precipitation that falls directly on basin floors and by snowmelt that runs off the surrounding mountains and is transported into the basins by tributary streams. The streams lose much of their water by infiltration into the basin-fill deposits. The basin-fill aquifers discharge primarily to streams that flow parallel to the long axes of the basins; some discharge is to springs and by withdrawals from wells (USGS 1996).

Tailings Impoundment Area

The tailings impoundment lies within the Lake Creek watershed. The Lake Creek valley is filled with unconsolidated to semi-consolidated deposits of silt, clay, and sand interbedded with gravel and cobble zones. Groundwater occurs in the Lake Creek valley in permeable sand, gravel, and cobble zones. Groundwater flow is presumed to be from the valley sides toward Lake Creek and to the north (Land and Water Consulting 2004).

Table 3-11 shows the typical water quality of wells installed in the tailings impoundment area. Wells MW-1 through MW-4 are completed in the deep aquifer, but wells MW 95-4 and MW 95-5 are shallow wells completed 10 to 15 feet below ground surface. The wells are located near the toe of the tailings dam, generally west and south of the impoundment (**Figure 2-5**). The monitoring shows no exceedance of groundwater standards. However, if nutrients in shallow groundwater, as measured in MW 95-4, discharge locally to surface water (as they may at the toe ponds) nuisance algal growth could occur. No numeric exceedances for the aquatic life standard for ammonia or for the human health standard for nitrate plus nitrite are observed in the toe pond water quality data. Nonetheless, nitrate plus nitrite levels may be high enough at times to promote nuisance algal growth in the toe ponds.

Mill Site Facilities

The office and mill site platform are built over glacial till overlying quartzite bedrock. This bedrock has enough secondary porosity (fractures) to transmit groundwater to unconsolidated deposits in the adjacent stream valley. With no groundwater monitoring at the mill site, it is not known if water flowing through mill site fill could potentially dissolve metals and discharge them to Stanley Creek. Groundwater beneath the mill site ultimately discharges to Stanley Creek.

Previous studies (Balla 2000, Kirk 2003) have shown that development rock fill found at the Troy Mine and at other mine sites in the area with similar geology is not generally acid-producing and is unlikely to degrade groundwater or surface water. In general, oxidation of the mineral pyrite is the main reaction that is responsible for acid production and for metals leaching at mine sites. The Troy Mine ore body is composed of non-acid producing copper sulfide minerals (digenite, bornite, and chalcocite) and has low pyrite content (Balla 2000). Kirk (2003) demonstrated that metals could be leached at neutral pH conditions.

Table 3-11. Groundwater Quality Data for Monitoring Wells at Tailings Impoundment 2000 – 2009

Site		Antimony mg/L	Copper mg/L	Zinc mg/L	Ammonia (NH ₃) mg/L	Nitrate + Nitrite mg/L	TDS mg/L
WQ Standard		0.006	1.3	2	NA	10.0	NA
MW-1	Max	<0.005	0.002	0.011	0.015	0.32	171
	Min	<0.003	<0.001	<0.01	<0.05	0.05	142
	Mean	<0.003	<0.0011	<0.010	0.10	0.16	156
	n	7	7	7	7	7	7
MW-2	Max	<0.005	0.012	0.25	0.75	0.22	197
	Min	<0.003	<0.001	<0.01	0.082	<0.01	19
	Mean	<0.003	<0.0027	0.047	0.41	<0.075	115
	n	7	7	7	7	7	7
MW-3	Max	<0.005	0.002	0.024	0.51	0.15	178
	Min	<0.003	<0.001	<0.01	0.25	<0.01	122
	Mean	<0.003	<0.0013	<0.012	0.37	<0.05	147
	n	7	7	7	7	7	7
MW-4	Max	<0.005	<0.002	0.04	0.78	0.13	197
	Min	<0.003	<0.001	<0.01	<0.05	<0.01	30
	Mean	<0.003	<0.0012	0.019	0.31	<0.07	99
	n	7	7	7	6	6	7
MW95-4	Max	<0.005	0.038	0.028	4.2	1.19	460
	Min	<0.003	<0.001	<0.01	<0.05	<0.01	126
	Mean	<0.003	0.007	<0.012	2.12	0.19	284
	n	11	8	10	13	13	14
MW95-5	Max	<0.005	0.003	0.35	0.6	0.4	284
	Min	<0.003	<0.001	<0.01	<0.05	0.09	97
	Mean	<0.003	0.002	0.095	0.25	0.23	168
	n	4	4	4	3	3	4

Notes: Data from Troy Mine, Inc. Water Quality Data Base.
 Metals data measured as dissolved for groundwater samples.
 TDS – Total Dissolved Solids
 n – sample size
 Water quality standards are human health standards from Montana Numeric Water Quality Standards from Circular WQB-7 (February 2008). Shading indicates exceedance of standard.

The portal patios were constructed of development rock fill that may contain zones of higher pyrite concentrations. Balla (2000) found that most of the pyrite grains were not reactive because they were coated with a non-reactive oxidation rind and enclosed within the impermeable quartzite rock. The portal patios have not shown any evidence of acid generation in the past 30 years.

Mine Water Discharge

The Troy Mine underground workings are within the Stanley Creek and Ross Creek sub-watersheds. During operations, dewatering pumps in the underground mine route water to the mill and/or tailings

impoundment. After groundwater enters the mine workings, metals concentrations increase (**Table 3-7**). Although most water from the mine void is removed by pumping, some of it may re-enter the groundwater system, ultimately discharging to streams, seeps and springs, and to groundwater aquifers in the Stanley Creek and Ross Creek watersheds.

The total sulfur content of the ore body is 0.3 to 1.0 percent (Hayes 1983). In addition, the ore body contains about 4 percent iron and magnesium carbonates that act to neutralize any acid that may be generated (Balla 2000). The dissolved copper in the mine void is associated with neutral metals leaching, and given the low acid-producing potential, metals concentrations are not expected to increase above currently observed concentrations in mine-affected waters (KNF and DEQ 2001, KNF and DEQ 2009).

Groundwater in the mine void was sampled in December of 2009 and had a dissolved copper concentration of 0.114 mg/L and a dissolved zinc concentration of 0.020 mg/L (**Appendix D**). Previous mine water chemistry data are summarized in **Table 3-7**. These levels do not exceed groundwater standards, but if mine water discharges to streams, seeps, or springs, metals could potentially exceed the surface water standards for aquatic life. The mine pool rate of rise was monitored during an 18-month period of mining inactivity from September of 2002 to February of 2004 as described in the Mine Flooding Report (Genesis 2006, Appendix A). Pumping was resumed prior to mine water reaching the 4,225-foot elevation spillover point within the mine. During this time, surface water sites surrounding the mine workings were monitored, and no changes in water quality were observed at these sites (Table 3-10 and Troy Mine Water Quality Data Base).

Mine Water Management

During active operation of the mine, Troy Mine, Inc. typically uses the tailings impoundment and decant ponds to settle out suspended sediment from the tailings slurry, which is piped from the mill. Decant water is then pumped to the mill circuit via a return line. Up to 1,170 gpm of the decant pond water seeps through the unlined bottom of the ponds into the underlying aquifer. The fate and transport of contaminants in mine waters downgradient of and beneath the tailings impoundment/decant pond area have been described in the following reports:

- Interim Report of Findings: Hydrologic and Hydrogeologic Assessment, ASARCO Troy Mine, Troy Montana. 1996. By Summit Envirosolutions;
- Site Instrumentation Status Report, Troy Tailings Facility. December 1999. By Summit Envirosolutions;
- Mine Water Plume Location and Identification Phase 1 Results and Phase 2 and 3 Workplan. October 2001. Prepared for Genesis Inc./Sterling Mining Company by Hydrometrics (see Appendix H);
- Assessment of Fate and Transport of Copper in Decant Pond Disposal System – Troy Mine. Lincoln County, Montana. January 2004. Prepared for Revett Mining Company by Land and Water Consulting, Inc.;
- Troy Mine Copper Attenuation Study – Secondary Processes (see Appendix D). May 2010. Prepared for DEQ and KNF by CDM; and

- Assessment of Natural Attenuation of Metals in a Decant Pond Disposal System, Troy Mine. May 2010. Prepared for Genesis Inc. by Hydrometrics, Inc. (see Appendix I).

Empirical evidence indicates that treatment of discharged mine waters occurs due to attenuation of metals as water percolates through glacial and stream sediments underlying the tailings impoundment.

Summit Envirosolutions (1996) evaluated the potential impacts of dissolved parameters from the tailings impoundment and concluded that groundwater from beneath the impoundment flows towards Lake Creek. In 2001, Hydrometrics conducted a tracer study in which sodium chloride (salt) was added to the decant ponds (Appendix H). The transport of salt from the decant ponds into the groundwater was tracked and monitored by measuring electrical conductivity within existing wells. (Water containing salt conducts electrical current, whereas pure water does not conduct electricity.) This report concluded that the deep wells and decant ponds appeared to be hydraulically connected; that is, some decant water did flow vertically downward to be intercepted by the deep wells, but the travel time was longer than the period of the test (80 days). To determine whether decant water was also transported within shallow sands and gravels above the zone of the deeper wells, shallow monitoring wells were installed. The 2001 Hydrometrics report (Appendix H) indicated that, while deep groundwater and the decant ponds system are hydraulically connected, most of the decant pond water is transported downgradient (towards Lake Creek) via the shallow alluvial aquifer (**Figure 2-1**).

Because decant pond water primarily traveled downgradient of the ponds in the shallow groundwater system, it was expected that copper concentrations should be higher in the shallow monitoring wells. However, copper concentrations in groundwater along the flow path were either much lower than the decant pond water or below the laboratory reporting limit. These data indicate that copper was being removed from the groundwater via some undefined geochemical process.

In 2004, a study was performed that focused on the fate (ultimate state) and transport (movement) of copper beneath the decant ponds (Land and Water 2004). Geologic material beneath the decant ponds was analyzed for total copper both by electron microprobe (to identify the composition of copper minerals) and by sequential extraction (to identify which mineral phases contain the most copper). Study results indicated that copper was attenuated (removed from the groundwater) within the upper foot of soil primarily through the precipitation of secondary copper minerals (carbonates, silicates, and oxides) and through the secondary adsorption of copper onto organic matter. Precipitation is the formation of a solid (mineral) from dissolved constituents in groundwater; and adsorption is a process where dissolved metal adheres to the surface of organic particles.

The Land and Water (2004) report did not evaluate the longevity of the attenuation processes and only evaluated the fate and transport of copper. Thus, the agencies required Revett (Troy Mine, Inc.) to expand the evaluation to include other metals (antimony, arsenic, cadmium, lead, mercury, and uranium) and to evaluate the duration of the natural attenuation mechanisms. This evaluation was to include the effects of changing redox (oxygenated vs. anaerobic environment) or pH (corrosive vs. neutral) conditions on the attenuation processes.

The final Hydrometrics (2010) report addressed the issues of other metals and the duration of natural attenuation mechanisms (Appendix I). Antimony, uranium, and cadmium were detected at low levels in well MW-01-15 adjacent to the decant ponds. Within 150 feet (downgradient) of the decant ponds, concentrations of metals were below the analytical reporting limit. These results indicated that natural attenuation effectively removes metals from groundwater within a relatively short flow path. Of particular note is the fact that mine-related water has been disposed of within the decant pond system for over 30 years. During this time, metals of concern have not been detected at levels that exceed applicable standards, either in groundwater at the edge of the tailings impoundment or in Lake Creek itself.

The agencies evaluated whether there are other secondary attenuation processes that would prevent migration of metals beyond the decant ponds. These secondary attenuation processes would occur when oxygen-rich mine water from the decant ponds mixes with groundwater. When the oxygen-poor groundwater contains iron, the dissolved iron precipitates from solution as iron hydroxide (a solid mineral). When the iron hydroxide precipitates, it would facilitate removal of other metals from water by co-precipitation. Specifically, the 2010 CDM study evaluated the following: whether dissolved iron in groundwater would precipitate as iron hydroxide; whether dissolved iron that precipitates would help remove copper and other metals (co-precipitation) from mine waters (**Appendix D**); and the quantity of other metals that would be removed with the iron. The evaluation consisted of: 1) computer geochemical modeling using the input parameters from mine waters and the groundwater under the tailings impoundment; and 2) bench-scale jar testing using varying proportions of mine waters and groundwater.

Study results showed that if the effectiveness of the primary metals attenuation mechanisms beneath the decant ponds decreases over time, there would be secondary attenuation mechanisms capable of removing at least 73 to 98 percent of the copper and 11 to 59 percent of the antimony from the groundwater. The range of the concentrations remaining in solution after bench scale testing was 0.002 to 0.012 mg/L copper and 0.002 to 0.046 mg/L antimony in groundwater (**Appendix D**).

In summary, water quality data and several studies on the fate and transport of metals of concern in the vicinity of the decant ponds and tailings impoundment show that natural attenuation mechanisms have been effective at removing metals from the Troy Mine decant pond water for the last 30 years.

3.9.5 Environmental Consequences

Potential impacts to hydrology resources from mine closure and from reclamation activities include effects on water quantity, water quality, and on stream channel morphology. Water quality concerns include nutrients, metals, and sediments. These issues are evaluated for each of the three alternatives. The issue of treatment of mine discharge water at the tailings impoundment is discussed under the tailings impoundment section of the Proposed Action.

3.9.5.1 No Action Alternative

Mine Water Discharge

Under the No Action Alternative, mine closure and reclamation would be conducted according to the Reclamation Plan analyzed in the 1978 Draft EIS. The mine workings would be allowed to fill to the elevation where water would naturally flow out the Service and Conveyor adits and down the slope to Stanley Creek. According to the 1978 Reclamation Plan, the water would be discharged “under applicable State and Federal permits.” However, this discharge would not be permissible without treatment under MPDES regulations for reasons explained below. The water quality standards for surface water have become more stringent since the mine was originally permitted.

Water Quantity

Studies and data collected from the Troy Mine production years help describe the hydrologic cycle at the mine site and the expected long-term equilibrium water level when mining ends. Inflows to the underground workings consist of rainfall and snowmelt that infiltrate the area above the mine and then percolate into the underground workings. The rate at which the underground void space would be occupied by groundwater and whether the groundwater would rise to the point of spill-over have been studied by Klohn Crippen (2000), Genesis (2006), and by CDM in 2010 (Appendix B).

However, data collected during mining operations that could be used for prediction of hydrologic equilibrium at the Troy Mine are somewhat limited. Hydrologic equilibrium refers to a balance between mine inflows and outflows that results in a relatively constant water elevation in the mine workings. For the Troy Mine, this balance would be attained after closure when the water elevation reaches the height of the high points in the Service and Conveyor adits (4,225 feet) and flows down the adits, thus controlling the water elevation in the mine. In the 1978 Draft EIS, the mining company predicted that the maximum discharge from the mine would be 2,500 gpm (5.57 cfs). There was no estimate of minimum discharge (DSL and KNF 1978, page 305). Klohn Crippen (2000) states that peak inflow into the mine can approach 4,000 gpm (8.9 cfs) during spring snowmelt events. The mine pool rate of rise was monitored during an 18-month period of mining inactivity from September of 2002 to February of 2004 as reported in the Mine Flooding Report (Genesis 2006, Appendix A). In September of 2003 the mine water level reached 4,209 ft. before pumping resumed; therefore, outflow at the predicted 4,225 feet elevation from the mine was not observed.

A study on the mine water balance predicted that water would begin to flow from the mine at the 4,225 feet elevation approximately 21 months after pumping ceases (**Appendix B**). This water would exit the mine through the Service and Conveyor adits. However, the exact period before overflow is dependent on precipitation conditions preceding and after the termination of pumping. Mine water discharge rates would vary seasonally and are predicted to range from 300 to 3,100 gpm (0.67 to 6.9 cfs). The water balance estimates that flows would vary seasonally as shown in **Table 3-12**. June would be the month with the greatest discharge with an average monthly flow estimated at 4.9 cfs and peak discharge of 6.9 cfs. In drier years, it is expected that water, other than adit seepage water, would not discharge from the main mine workings in August and September (**Appendix C**).

Table 3-12. Estimated Monthly Mine Water Discharges (cubic feet per second)

Month	1999	2000	2001	2002	2003	2004	2005	2006	2007	2008	Ave.
Oct	0.84	1.57	0.67	3.29	0.67	1.98	0.69	1.02	1.10	1.88	1.37
Nov	1.31	2.04	0.73	3.76	0.73	2.45	1.16	1.49	1.57	2.35	1.76
Dec	1.00	1.74	0.67	3.46	0.67	2.15	0.86	1.19	1.27	2.04	1.50
Jan	1.76	2.49	1.18	4.21	1.18	2.90	1.61	1.94	2.02	2.80	2.21
Feb	1.52	2.25	0.95	3.97	0.95	2.66	1.37	1.70	1.78	2.56	1.97
Mar	1.39	2.13	0.82	3.84	0.82	2.54	1.25	1.58	1.66	2.43	1.84
Apr	2.25	2.98	1.68	4.70	1.68	3.39	2.10	2.43	2.51	3.29	2.70
May	3.59	4.32	3.01	6.04	3.01	4.73	3.44	3.77	3.85	4.63	4.04
Jun	4.44	5.18	3.87	6.90	3.87	5.59	4.30	4.63	4.71	5.48	4.90
Jul	2.47	3.20	1.89	4.92	1.89	3.61	2.32	2.65	2.73	3.51	2.92
Aug	1.19	1.92	0.67	3.64	0.67	2.33	1.04	1.37	1.45	2.23	1.65
Sep	0.67	1.03	0.67	2.74	0.67	1.44	0.67	0.67	0.67	1.33	1.06

Water discharging from the Service and Conveyor adits would flow both overland and subsurface in the coarse development rock and glacial fill towards Stanley Creek. The slope distance between the adits and Stanley Creek is approximately 250 feet. The ratio of surface to subsurface flow between the portals and the toe of the portal patio fill would vary seasonally. At higher adit discharge rates, a greater proportion of water would remain as surface flow all the way to Stanley Creek. Most of the subsurface water would likely emerge at the toe of the portal patio fill and then flow into Stanley Creek.

The discharge of mine water directly to Stanley Creek would result in higher flows in upper Stanley Creek year-round. The highest flows would occur in late spring to early summer. Continually augmented flows in Stanley Creek would probably change the length and duration of perennial reaches. Because upper Stanley Creek typically has baseflows in the 1 to 3 cfs range (DSL and KNF1978, p. 305), the inflow of up to 6.9 cfs of additional water would result in a flow regime measurably different than those measured before mine development or during operation. This effect would diminish in the downstream direction and result in smaller flow alterations in lower Stanley Creek and much smaller effects in Lake Creek.

Water Quality

The discharge of relatively large quantities of water to upper Stanley Creek would alter the water quality of the stream because the mine water would contain elevated levels of nitrates and metals. Copper and antimony are expected to exceed water quality standards for an extended period of time, but nutrients would probably decrease to acceptable levels within several years of closure. At closure, copper and antimony in mine water infiltrating the coarse development rock that forms the mill patio would not be

sufficiently attenuated to meet water quality standards before reaching Stanley Creek. Once reaching upper Stanley Creek, the concentrations of copper and antimony would be diluted to some degree by the stream. Because the No Action Alternative does not include water treatment, copper and possibly antimony would potentially exceed water quality standards for upper Stanley Creek both in the short- and long-term. The metal concentrations would vary seasonally. Any mixing zone allowed would be insufficient to attain water quality standards under low flow conditions because of the high volume of mine water compared to the volume of receiving water.

At closure, the amount of nitrates in mine water infiltrating the coarse development rock that forms the mill pad below the Service and Conveyor adits would not be attenuated before reaching Stanley Creek. The Agencies concluded that nitrates may initially violate narrative water quality standards for upper Stanley Creek. However, the interim shutdown data demonstrated that nitrates would decline in mine water within several years; and, therefore, the Agencies concluded that nitrates would not violate water quality standards over the long-term.

Sediment and Stream Morphology

Sediment would be generated by the discharge of mine water on the mill patio. This sediment would have impacts on aquatic habitat in Stanley and Lake creeks, especially in the portions of those streams with lower gradients where the sediment would tend to deposit, potentially affecting channel morphology as well.

Mine Area Surface Water, Seeps, and Springs

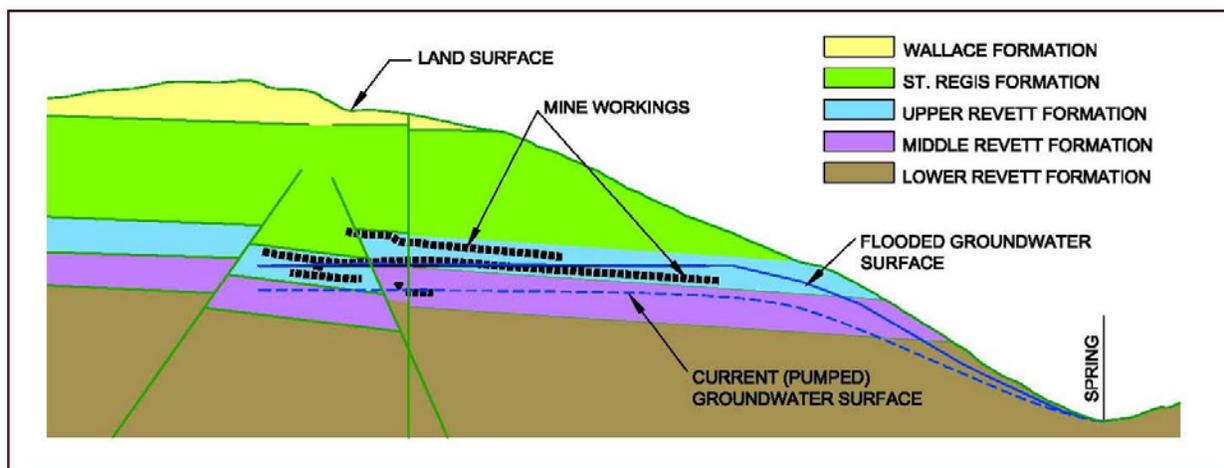
After mine closure, groundwater would rise in the mine to the predicted overflow elevations (4,225 feet) in the Service and Conveyor adits, as described in the previous section. A potential consequence of this rise is that water, contaminated with nutrients or metals, could move through bedrock formations and discharge at area seeps, springs, and streams in the headwaters of drainages surrounding the mine workings, namely, Stanley Creek, Weasel Gulch, and Emma Gulch drainages, and the northern tributaries of Ross Creek. Monitoring site locations for springs, seeps, and other surface water in these drainages are shown on **Figure 3-4**.

Water Quantity

One potential consequence of the increased hydraulic head from the rising level of water in the mine workings is that it could force mine water through fractures and other pathways in the vicinity of the mine, thus increasing flow to seeps, springs, or streams in the vicinity of the mine. To evaluate this potential, an investigation of the seeps, springs, and surface water was undertaken from both a hydrogeological and a geochemical perspective (Appendix F). The hydrogeologic evaluation superimposed a three-dimensional map of the mine workings on the map of surface water monitoring sites in the vicinity of the mine workings to show the three-dimensional relationship between projected water levels in the flooded mine to sites of known surface water flow. Cross-sections were cut through this mine model to show the expected groundwater conditions in the operational (dewatered) and post-

closure (flooded) mine conditions. **Figure 3-5** is a typical section showing the expected change in groundwater surfaces in relation to surface water.

The monitoring sites in Stanley Creek are 250 feet below the elevation of the operational (pumped) water level in the mine, and the monitoring sites in the Ross Creek drainage are at least 700 feet below the operational water level. The projected post-closure rise of water level would be relatively small compared to the hydraulic head difference between the operational (pumped) mine water level and most surface water measurement sites (**Figure 3-5**). By using the principles of groundwater flow, it is expected that this head difference would decrease in an outward direction from the mine to no more than a few tens of feet in the vicinity of the monitoring sites. This few tens of feet head difference would limit the potential for seeps and springs to migrate horizontally and vertically from their current locations. This head difference would also limit the potential increase in seep and spring flow rate to a small percentage of current flow.



Source: Genesis Inc., 2010.

Figure 3-5. Typical Section of Expected Groundwater Surfaces

Two tributaries of Stanley Creek have perennial flow above the elevation of the mine workings. These streams could potentially be augmented by groundwater as the mine workings flood. Other springs and seeps may become active in the 175 foot vertical interval between the current pumping level of 4,050 feet and the final pool elevation of 4,225 feet. Whether these springs would appear depends largely on whether the faults that intersect the workings and ground surface can transmit sufficient water to result in surface seeps. Known surface faults in the perimeter around the mine workings tend to be vertically oriented. It is likely that these fractures would already have associated springs prior to flooding, and mine flooding would slightly increase their flow and possibly cause their points of discharge to move upslope a few feet. This is because vertical fractures are currently likely to be discharging to springs at a lower elevation, and it is only the elevation of the discharge that would change. Horizontal joints, fractures, and faults that are currently above the flooded level would exhibit no discharge until they

become saturated by future mine flooding. This geological structure suggests limited potential for development of new springs in the 175 foot interval between current pumping level and final pool elevation.

An average of 2.3 cfs of water is displaced from the mine workings to areas (*e.g.*, the decant ponds) more distant from the mine (Appendix D). Changes in surface water flows and locations are expected to be minimal after mine closure because discharges are not expected to vary measurably at the surface water monitoring sites and because the potential for new, higher elevation springs to develop would be limited. Surface water flows after mine closure would likely remain less than pre-mining flows in the vicinity of the workings.

Water Quality

Recent water quality data for surface water in the vicinity of the mine are summarized in **Table 3-8** and **Table 3-10**. Currently, surface water generally meets human health standards and chronic aquatic life criteria. The exception is in upper Stanley Creek at SC-17A where mill site operations are likely a contributing factor to elevated copper levels in water samples. Such operations at the mill site would include past snow handling practices. Snow that was plowed from the mill and office yards was dumped over the face of the mill pad. Sediment from the mill area was deposited in the dirty snow where it could wash into Stanley Creek. During the ten years of surface water monitoring in the vicinity of the mine, effects of mine water on surface water in the immediate area are not clearly evident. It should be noted that, during the interim shutdown period from 1993 to 2004, mine water elevations varied. The hydraulic head increased within the mine void during periods when the pumps were shut off. In August of 1999 the water elevation was at 4,189 feet, and in August of 2003 the water level was at 4,209 feet. On August 26, 2003, some surface water sites in the vicinity of the mine workings were sampled (**Table 3-10**). Antimony and copper concentrations were below detection limits at these sites, and nitrates were within the range of observations made at other times when the mine pool was lower. Monitoring continued at some of these sites on an annual basis and no detections of metals were found. This suggests that mine water has not measurably affected these surface water sites.

A geochemical evaluation of surface water quality data compared with mine water quality data was undertaken for common ions, selected dissolved metals, and for nitrogen compounds (**Appendix F**). The analysis of common ions showed that the mine-related waters had higher total dissolved solids and a distinct calcium-magnesium bicarbonate composition, indicative of long-term contact with dolomitic aquifer materials. The surface waters in the vicinity of the mine are not calcium-magnesium bicarbonate waters and are low in dissolved solids, suggesting that the primary source of these waters is precipitation, runoff, and/or freshly recharged, near-surface groundwater. Typically, precipitation, runoff, and near-surface groundwater have not had enough residence time (contact) with dolomitic aquifer materials to become calcium-magnesium bicarbonate waters. The metals comparison shows that dissolved copper concentrations were nearly two orders of magnitude lower in these surface water locations than in the mine-related waters. These data suggest that the surface water in the vicinity of the mine is derived primarily from precipitation or freshly recharged near-surface aquifers.

After the mine is flooded, mine water quality would be expected to improve over time. Following closure of the mine, rebound of the water table would reduce oxidation in the workings by orders of magnitude, because the dissolved concentration of oxygen in the water is 10,000 times lower than in air. Construction of portal plugs and backfilling of the adits would further reduce available oxygen to water in the workings by reducing the rates of groundwater recharge with aerated surface water. However, flooding of the mine to the spill-over elevation (where the Service and Conveyor adits intersect the ore body) would not result in complete flooding of the underground workings. About half of the workings would still remain above the water table. Oxidation rates are projected to decrease primarily within the flooded portion of the mine void. Long-term metals concentrations in drainage from the mine are expected to be similar to concentrations observed near the end of interim shutdown in 2004 with potential decreases over an unknown period of time. A decrease in ammonia and nitrate plus nitrite concentrations is expected post-closure because this was observed during the temporary shutdown and in unused, flooded portions of the mine where blasting has ceased.

Because discharges are not expected to vary measurably at the surface water sites, and because no sediment is likely to be transmitted to the seeps and springs by groundwater flow, sediment and stream morphology impacts from mine flooding are not expected in mine area surface waters.

Mill Site and Portal Patios

As approved in the 1978 EIS, the Reclamation Plan states that the mill site patio would be left at its current elevation and that the cut and fill slopes, which are partially revegetated, would be left in the current configuration. However, it does not address how reclamation would treat runoff from the two ephemeral channels that currently cross the mill site in culverts. It is assumed that the culverts would remain in place and that the smaller drainage to the south would continue to drain to the entrance of these culverts. The 1978 Reclamation Plan also states that the mine patios would be regraded to drain and that the faces of the portal patios would be left at their current angle-of-repose slopes.

Sediment

Water flowing through the two long culverts at the mill site is causing erosion at their discharge point at the base of the patio fill. At some point in the future, it is expected that the culverts would plug or fail internally and discharge water across the fill and down its face to Stanley Creek. It is also likely that the ditch that diverts water from the smaller drainage across the regraded mill patio would fail and discharge water across the regraded patio and down its face to Stanley Creek. Fine-grained material currently on the face of the fill near the mine portals would eventually erode into Stanley Creek. All these sources would contribute sediment to Stanley Creek and impact aquatic habitat and stream morphology.

No mine water flows out of the North or South adits. Water seen near the portal outlets of the North and South adits during spring runoff is due to surface runoff in the vicinity of the adits. The west ventilation adit lies in the path of an ephemeral stream that originates farther upslope. No provision for restoration of this channel was provided in the 1978 Reclamation Plan. The 1978 EIS is unclear whether placement of soil on the faces of the portal patios was planned. If soil were placed on the steep slopes of

development rock below the adits, it would erode. Erosion of soil below the North Adit would contribute sediment to Stanley Creek. Below the South Adit, erosion of soil would contribute sediment to a Ross Creek tributary. However, delivery of sediment to the main stem of Ross Creek might not occur because the flows would cross a large alluvial fan, which would slow water flow and cause sediment to deposit prior to reaching the stream.

A mine subsidence area is located northeast of the South Adit. The headwall of this subsidence area is unstable and is a potential source of sediment to Ross Creek. This source of sediment is not addressed in the 1978 Reclamation Plan because it resulted from mining-related subsidence that occurred after mine development.

Channel Morphology

Sediment resulting from erosion at the mine site and North Adit area would be rapidly transported to lower Stanley Creek, where the low gradient and lack of flushing flows would result in a relatively long residence time. The sediment would accumulate in slower reaches such as pools, gradually reducing pool depth.

Roads and Other Facilities

Under the Reclamation Plan analyzed in the 1978 EIS, disposition of the mining-related roads was left up to the discretion of the USFS at time of closure. Consequently, the No Action Alternative with respect to roads is the same as the Agency-Mitigated Alternative (see Agency-Mitigated Alternative effects discussion for roads and **Table 2-1**). The tailings pipelines and the power line would be removed. Removal of miscellaneous facilities, including the water makeup pump station, reclaim pump station, and the maintenance sump, was not addressed.

Surface Water Quantity

Proposed road treatment (**Section 3.15**) would increase the infiltration of precipitation, reduce runoff, and route less water to stream channels. Road runoff can increase the volume of water delivered to stream channels, elevate the peak streamflow rate, and cause accelerated erosion in stream channels.

Surface Water Quality

Under the No Action Alternative, NFSR 4626 would retain a paved surface and would limit sediment delivery to Stanley Creek until such time as the pavement fails in the future. Treatment of other roads would result in minor short-term sediment delivery during the first year following treatment; but by the second year, revegetation would minimize sediment delivery. Over the long-term, there would be less sediment delivery from surface erosion and stream culvert failures to Ross and Stanley creeks from these roads. The risk of mass failures and the accompanying sediment delivery would also be reduced.

Disturbed ground associated with the removal of the power line and the tailings pipelines would be revegetated. Where these facilities are close to streams, short-term sediment delivery would be possible until vegetation is re-established.

Stream Channel Morphology

Short-term sediment delivery from reclamation activities associated with roads and other facilities would not be expected to have a measurable effect on stream channel morphology. Stabilization of roads would lessen the long-term risk of mass failures and would provide better protection for stream channel conditions in Stanley and Ross creeks.

Tailings Impoundment

According to the reclamation plan analyzed in the 1978 Draft EIS, the tailings impoundment would be reclaimed by regrading the surface to promote runoff and by excavating a channel from the low point of the final impoundment surface to an appropriate natural drainage. Eighteen inches of stockpiled soil would be spread over the surface, and vegetation would be re-established. This would eliminate the decant ponds and prevent accumulation of water on the surface of the impoundment. The toe ponds at the tailings impoundment were permitted in July 1983 but no reclamation plan was specified. The Agencies have assumed that the toe ponds would remain after mine closure under the No Action Alternative but that the tailings pipelines and other facilities would be removed.

Groundwater Quantity

Draft EIS estimated that up to 1,170 gpm of seepage could discharge from the impoundment to the underlying aquifers during operation of the mine. After reclamation under the No Action Alternative, no water would be routed to the impoundment. Revegetation would increase evapotranspiration and reduce infiltration of precipitation that falls on the tailings impoundment surface. No groundwater recharge from mine waters would occur. Reclamation of the tailings impoundment would approximately return the flux of groundwater through the area to pre-mining levels. The water table beneath the tailings impoundment would be lower compared with operational conditions.

Groundwater Quality/Nitrates/ Metals/Sediment

Nitrate is produced from the incomplete combustion of blasting agents used during underground mine development and is transported from the mine void either dissolved in mine water or as residue on rock sent to the mill. It is then transported to the impoundment within the tailings slurry. After cessation of mining, addition of nitrate to the tailings impoundment would cease. Residual nitrate would slowly be rinsed out of the tailings by precipitation and diluted in the groundwater. Concentrations of nitrate in the underlying aquifer would decline. Currently, nitrate concentrations in the tailings decant pond water range between 10 mg/L and 30 mg/L, and concentrations in monitoring wells located close to the decant ponds are similar. Monitoring wells and toe ponds downgradient of the tailings impoundment generally have nitrate concentrations of less than 1 mg/L (**Table 3-11**). Nitrate concentrations are expected to decline rapidly after mining ends, as was observed during the interim mine shut-down between 1993 and 2004, because nitrate-rich mine water will no longer be discharged in the tailings impoundment.

Ambient groundwater beneath and downgradient of the tailings impoundment contains elevated concentrations of dissolved iron and manganese, which often exceed the guidelines for public water supplies (**Table 3-11**). In comparison, the mine's decant pond water generally contains much lower

concentrations of dissolved iron, but similar or greater concentrations of dissolved manganese. Consequently, it is expected that closure of the mine and cessation of discharge of water to the decant ponds under the No Action Alternative would slow down the operational diluting effect of the mine water on dissolved iron concentrations, potentially resulting in slightly higher iron concentrations in groundwater beneath the impoundment (similar to baseline conditions) and a possible slight reduction in manganese concentrations.

Concentrations of dissolved metals other than iron and manganese in groundwater beneath and downgradient of the tailings impoundment are generally at low to non-detectable concentrations. Copper and antimony concentrations are slightly elevated in monitoring wells completed near the decant ponds but are near or below detection limits in monitoring wells downgradient of the impoundment (**Table 3-11**). This reduction in metals concentrations is likely related to both dilution and attenuation of metals along the groundwater flow path. As noted in the Draft 1978 EIS on page 313:

“The tailings pond water quality would be modified, however, by a number of processes including oxidation in the pond, percolation through tailings and percolation through the underlying silts and clays. These fine-grained materials beneath the pond would cause some sorption and ion exchange of metals. Metals removal by earth materials has been examined in a number of waste systems and generally fine-grained materials have significant capacity to remove metals”.

Reclamation at closure of the tailings impoundment under the No Action Alternative would be expected to further reduce concentrations of these metals in groundwater beneath the impoundment because mine water would no longer be added to the impoundment.

Surface Water Quantity

Lake Creek flows from south to north along the western perimeter of the tailings impoundment and groundwater beneath the tailings impoundment flows generally westward toward Lake Creek. The 1978 Draft EIS estimated that up to 1,170 gpm of seepage from the tailings impoundment enters the underlying groundwater system and enters Lake Creek. A water balance developed by ASARCO in 1989 recalculated the rate of seepage from the impoundment into groundwater and estimated an average flow of 850 gpm. Construction of toe ponds between the tailings embankment and Lake Creek during 1983 intercepted some of this flow, thus reducing the flux of groundwater into Lake Creek. Closure of the Troy Mine under the No Action Alternative would end discharge of mine water to the impoundment and could slightly reduce the quantity of surface water in Lake Creek as a consequence of reduced groundwater flow into the creek. However, this reduction would be offset by increased flow from Stanley Creek into Lake Creek where water from the underground mine would be discharged after closure of the operation.

Surface Water Quality/Nitrate/Metals/Sediment

Concentrations of nitrate in Lake Creek adjacent to the tailings impoundment site ranged from 0.03 mg/L up to 0.5 mg/L as nitrogen during the baseline period (1977-1981) and prior to deposition of tailings in the impoundment. **Table 3-9** shows water quality for Lake Creek at three stations in the

vicinity of the impoundment. Nitrate concentrations in Lake Creek have remained within the range of baseline conditions and indicate that there is little, if any, effect on nutrient concentrations in the creek from tailings impoundment seepage. Consequently, no changes in nutrient concentrations in surface water are expected to result from reclamation of the impoundment under the No Action Alternative.

Metals from the tailings impoundment could reach Lake Creek either via transport of dissolved metals through groundwater or via overland flow into the creek. Runoff from the impoundment surface currently reports to the decant ponds area on the eastern edge of the impoundment, which is an internal basin from which no runoff is possible. Runoff from the tailings embankment generally enters the toe ponds along the western margin of the tailings impoundment. Some of this water is pumped back into the impoundment and helps prevent water from overflowing the toe ponds and reaching Lake Creek. Water quality data collected from Lake Creek at monitoring locations in the vicinity of the tailings impoundment show no exceedances of the chronic aquatic life standard at the site downstream of the impoundment (LC-4) although occasional exceedances of this standard are noted at upstream stations (**Table 3-9**). This suggests that there is no consistent source of copper loading, such as groundwater discharge from the tailings impoundment area, to Lake Creek. Antimony has not been detected at any of the monitoring sites in Lake Creek.

Under the No Action Alternative, impacts to Lake Creek from metals derived from the tailings impoundment are not anticipated. Flow of groundwater from beneath the impoundment into Lake Creek would be reduced because mine water would not be discharged to the impoundment. The No Action Alternative proposes regrading the impoundment surface to allow runoff to enter “an appropriate natural drainage.” Thus, there is some increased potential for metals in storm water runoff from the impoundment surface to reach the creek until the reclaimed surface is revegetated.

Reclamation of the tailings impoundment under the No Action Alternative would result in temporary increases in sediment eroded from disturbed ground reaching Lake Creek. No BMPs for limiting sediment were listed in the 1978 Reclamation Plan. Sources would include redisturbed soil stockpiles, haul roads, and the surface of the tailings impoundment. Transport of sediment would return to background levels once revegetation of disturbed areas is complete.

Stream Channel Morphology

No effects to the morphology of the Lake Creek stream channel are anticipated to result from reclamation of the tailings impoundment under the No Action Alternative.

3.9.5.2 Proposed Action

Mine Water Discharge

In the Proposed Action, the decant ponds would be used post-closure to dispose of mine waters discharging from the Service and Conveyor adits until the quality of this water improves enough to be discharged directly to Stanley Creek. Such a change in future water management would require issuance of, and compliance with, an MPDES permit. Under the Proposed Plan, mine water would be captured at the Service and Conveyor adit portals and then transported through the existing tailings pipelines to the

tailings impoundment for disposal. Concrete adit plugs would be constructed to funnel mine water into the pipeline (Genesis 2006, pp. 7-6 to 7-7). The quantity of water discharged from the adit would be the same as discussed under the No Action Alternative.

Water Quantity

The continued disposal of mine water via the pipelines to the tailings facility would continue to reduce flows into upper Stanley Creek, which may have occurred as a result of mine development.

Water Quality/Nitrates/Metals/Sediment

Under the Proposed Action, seepage is expected around the adit plug and could increase over time due to lack of maintenance of the pipeline intake structure. This seepage water contains metals and poses a risk of contamination to surface water. Using the existing tailings transport lines could also cause impacts to Stanley and Lake creeks if pipelines leak or break as they have in the past. This concern is real because of the age of the tailings lines (30-plus years) and because they are above ground. Pipeline leaks could also occur as a result of vandalism. Because mine water would not be discharged to Stanley Creek, implementation of the Proposed Plan would not have the water quality, sediment, and channel morphology impacts on Stanley Creek described for the No Action Alternative. The Proposed Action includes the use of the buried reclaim water line as a backup to the existing tailings pipelines. The reclaim water line has less wear than tailings pipelines because it was used to transport reclaim water, not tailings. However, buried steel pipelines are subject to corrosion. A buried line would pose a somewhat lower risk of erosion than an above ground pipeline. The existing pipelines contain no automated controls to shut the systems down in case of a leak.

Failures in the above ground pipelines could occur, discharging metals to Stanley or Lake creeks and cause erosion. These impacts could result in exceedances of water quality standards. Troy Mine, Inc., has to complete a Supplemental Environmental Project as part of a settlement for a tailings line spill in 2009. As part of the settlement, the mining company would install some controls on the tailings lines to minimize potential spills for the rest of mine life.

Mine Area Surface Water, Seeps, and Springs

Both the Proposed Action and the No Action Alternative have the same potential environmental consequences for mine area seeps and springs because the mine would flood to the same elevation. (Refer to the discussion under the environmental consequences of the No Action Alternative.) The Proposed Action would continue monitoring of surface water for heavy metals, but no further actions are proposed to protect water resources in the future.

Mill Site and Portal Patios

The mill pad and office pad areas would not be recontoured back to the pre-mine natural topography, but would be outsloped to drain precipitation (Figures 4-2 and 4-3, Genesis 2006). The fill slopes along the outside perimeter of the mill pad area, which generally range from 30 to 60 feet in vertical depth, would be left at the current angle-of-repose (approximately 1.3H:1V). The regraded area would be

covered with rocky glacial growth media located within the mill and office site pad areas. Additional borrow material, if needed, would come from the existing USFS borrow site to the north of the mill/office site area. This glacial material contains coarse fragments similar to the soils that existed in the area before mining began.

The two drainages that currently are routed through the long twin culverts would be routed across the mill pad and down the face of the fill slope in separate locations (Genesis 2006, Figure 4-3). The new channels would be armored with coarse rock to prevent scour during the proposed design flow resulting from a 100-year, 24-hour design flow event. Rock energy dissipation basins would be constructed where the channels reach the base of the fill slope. The existing culverts would be sealed with concrete at their upper ends. **Figure 3-3** shows the existing drainage system and the planned system after reclamation under both the Proposed Action and the Agency-Mitigated Alternative.

According to the Revised Reclamation Plan, adits would be closed against entry by placing backfill into the adits 30 feet and tight to the back (roof) (Genesis 2006). The mine patios at the North and South adits would be regraded to create an out-sloped surface. Twelve inches of glacial material would be placed over the regraded surface and revegetated with a forest mix. The angle-of-repose rock slopes below the adit patios would not be regraded, and no growth medium would be placed on them. The plan does not address the stream channel at the West Adit.

Water Quality/Sediment/Other Contaminants

The Proposed Action would eliminate the risk of future failure of the long twin culverts by decommissioning the culverts. However, because the reconstructed stream channels would cross the mill pad on fill material, all or part of the streamflow is likely to go subsurface and not follow the constructed channels, emerging from the fill slope or the toe of the fill slope at unknown locations. Erosion and resulting sedimentation is likely to occur from the point where the water emerges from the fill to where it enters Stanley Creek.

Water that does remain in the channels could cause erosion where the drainage is routed down the steep face of the mill site fill slope. The Proposed Action would base the channel design on the peak flow resulting from a 100-year 24-hour flow event. This flow is less than the 100-year recurrence interval peak flow that is recommended for design of new structures under the Forest Plan. Furthermore, no provision was made to route the larger stream from the toe of the fill slope to Stanley Creek, which is approximately 200 feet away. Considerable erosion could be expected as a new channel would be eroded.

Revegetation of the disturbed ground would prevent sedimentation to Stanley Creek from most of the regraded office and mill site areas. The angle-of-repose fill slopes along the outside perimeter of the mill pad area might continue to be a source of sediment and contaminants for a period of time, particularly where the slopes are in close proximity to Stanley Creek. Portions of these slopes are currently unvegetated and contain fine grained material and spilled concentrate from past snow plowing and road grading operations. Eventually natural revegetation would stabilize these slopes and lessen the risk of sedimentation.

The USFS borrow site would be regraded at 2:1 slopes and revegetated. It is unlikely to be a sediment source because the topography allows for sediment to be easily trapped on site.

If demolished buildings are buried on site as proposed, water leaching through these buried materials at the site would eventually discharge to Stanley Creek and could potentially contaminate surface water.

Under the Proposed Action, the North and South portal patios would be revegetated except for the angle-of-repose slopes, which do not currently contribute sediment to area streams. However, during reclamation and before vegetation is re-established, the patios pose a short-term risk of sediment delivery to nearby drainages. If the regraded areas are successfully revegetated with forest cover, they would not be a source of long-term sediment delivery to area streams. The intermittent stream channel at the West Adit patio could be a longer-term sediment source to Stanley Creek.

Roads and Other Facilities

The Proposed Action would leave the existing roads in place per USFS requirements. Roads would be left in their existing condition, and maintenance responsibility would be turned over to the USFS. The segment of NFSR 4626 that accesses the mill site would be left in its current paved condition.

The tailings pipelines would be retained to convey water from the mine site to the decant ponds. Once the mine water is of sufficient quality for direct discharge to Stanley Creek, the tailings pipelines, portions of which are buried less than 3 feet, would be removed and the disturbed ground reclaimed (Genesis 2006, page 4-14). The power line would be removed once power is no longer needed at the mill site. The disturbed ground associated with removal of any of these facilities would then be revegetated.

All other facilities (makeup well pump station, water reclaim pump station, and maintenance sump) would be removed. The maintenance sump would be blended to existing topography. Disturbed ground would be revegetated.

Surface Water Quantity

Roads would continue to exacerbate peak flows by concentrating storm water runoff and delivering it to stream channels. Elevated peak flows increase the risk of stream channel erosion.

Surface Water Quality

NFSR 4626 to the mill site would present a low risk of sediment delivery because it would remain paved. The USFS would have to maintain the road surface into the future to prevent deterioration.

As a result of leaving all the mining-related roads in their current condition, there would continue to be sediment delivery at stream crossings at current levels. There would continue to be a moderately high risk of steep road fill failures during storm events in both the Stanley and Ross creek watersheds.

Disturbed ground associated with removing the power line and the tailings pipelines would be revegetated. Where facilities are close to streams, short-term sediment delivery is possible until vegetation is re-established.

There is a potential for sediment delivery after reclamation of the maintenance sump because it is within 200 feet of Lake Creek, but sediment erosion at this site would be reduced by revegetation. The Proposed Action, does not address removal of tailings material that may be within the sump, so there may be a risk of water quality contamination here. It is not clear if the Proposed Action would re-establish the original surface contours when the maintenance sump site is reclaimed.

Stream Channel Morphology

The Proposed Action does not reduce the existing risk of road-related mass failures on Mt. Vernon. Based on past failure history, this risk appears to be moderately high. These failures result in severely scoured stream channels and substantial in-channel sediment deposition.

Tailings Impoundment

Under the Proposed Action, the tailings impoundment would be reclaimed by covering the surface with 18 inches of rocky, glacial materials derived from borrow sources located east of the impoundment and then revegetating this surface. No major changes to the final topography of the impoundment are proposed. Any surface contouring would be localized. Storm water from the impoundment surface would continue to drain toward the decant pond area, where it would either infiltrate to groundwater or it would evaporate. Water from the underground mine workings would continue to be discharged to the decant ponds via the tailings pipelines from the mine site. The toe pond pumpback system would continue to operate until water quality meets applicable criteria.

Groundwater Quantity

Under the Proposed Action, all mine water draining from the underground workings via the Service Adit would continue to be discharged to the decant ponds at a rate predicted to range from 300 gpm up to 3,100 gpm (Appendix C). This is similar to the rate of discharge of water into the tailings impoundment during operation of the mine. The quantity of groundwater flowing beneath the tailings impoundment would remain similar to current operational conditions and would be greater than the pre-mining flux of groundwater.

Groundwater Quality/Nitrate

The discharge of nitrate-containing mine water to the decant ponds would result in continued input of nitrate into groundwater beneath the impoundment for several years after closure of the mine. Based upon data collected during the interim shut-down of the mine between 1993 and 2004, nitrate concentrations in the mine water are predicted to decline rapidly after blasting ceases (**Table 3-7**); consequently, this continued addition of water to the tailings impoundment would not be predicted to result in long-term loading of nitrate to the groundwater in this area. Nitrate levels in groundwater near the decant ponds would decline to a few parts per million within a few years and would reach

background levels within a decade or so. Nitrate concentrations in downgradient groundwater would remain below the groundwater quality standard of 10 mg/L.

Groundwater Water Quality/ Metals

Mine water is expected to discharge from the Service and Conveyor adits after mine closure. The No Action Alternative would allow this water to discharge directly to Stanley Creek. As discussed in **Section 3.9.4.1**, Affected Environment, Water Quality Sampling, the mine discharge is expected to have concentrations of copper and antimony that will exceed water quality standards for an unknown period of time (**Table 3-7**). Upper Stanley Creek, which already exceeds the aquatic water quality standard for copper during some sampling events at some monitoring locations (**Table 3-8**), would be further impacted if untreated mine water discharge enters it. To avoid further impacts to Stanley Creek, the Proposed Action would route mine water discharge through pipelines to the decant ponds at the tailings impoundment. Mine water would be treated through natural attenuation mechanisms as it infiltrates, allowing metals concentrations to attenuate within the soils (**Appendices C, D, and G**).

Groundwater beneath the tailings moves in a westerly direction and eventually discharges to Lake Creek (Summit EnviroSolutions 1996). Mechanisms for attenuating metals (removing them from groundwater) below the impoundment include dilution, precipitation, adsorption, and co-precipitation. The effectiveness of these mechanisms in treating mine-related water has been substantiated through monitoring of water at the tailings impoundment for the past 30 years as well as studies directed at understanding the geochemical processes that occur in the underlying soils and groundwater system.

The 1978 Draft EIS for Troy Mine analyzed the dilution potential of Lake Creek on discharge of mine process water (DSL and KNF 1978). In the study, the discharge rate of process water into the aquifer was assumed to be 1,170 gpm and a conservative base flow of Lake Creek of 50 cfs (22,440 gpm) was used, which resulted in a 20:1 dilution ratio (*i.e.*, every gallon of tailings seepage water is diluted with 20 gallons of Lake Creek water). The quality of the process discharge water was taken from the maximum of two analyses of the water resulting from mill flotation/separation tests performed in 1976. These copper and antimony concentrations are much higher than those found in the discharge water expected from the closed mine. With this dilution ratio, the concentration of copper was less than the standard at that time (0.02 mg/L) but higher than the present chronic aquatic life standard (0.003 mg/L). Antimony was not considered a concern at the time of this analysis; however, this dilution ratio would allow compliance with the current standard for antimony in Lake Creek.

Data from monitoring of shallow wells near the tailings impoundment show that copper concentrations are much lower (often below laboratory detection limits) in groundwater than concentrations in the process water discharged to the decant ponds (Appendix H). This confirms that dilution and geochemical attenuation of metals are occurring below the impoundment. The primary geochemical attenuation processes, which are precipitation and adsorption of metals, were investigated by Land and Water (2004). Study results indicated that copper was attenuated within the upper foot of soil primarily through the precipitation of copper minerals (carbonates, silicates, and oxides) and through the adsorption of copper onto organic matter. Precipitation is the formation of a solid (mineral) from

dissolved constituents in groundwater, and adsorption is the dissolved metal adhering to the surface of particles. Hydrometrics (2010) conducted further studies to determine attenuation mechanisms for metals other than copper and including antimony to estimate the duration of the attenuation mechanisms (Appendix I). Metals concentrations were below the analytical reporting limit within 150 feet downgradient of the decant ponds. These results indicated that natural attenuation effectively removes metals from groundwater within a relatively short flow path. During 30 years of mine operation, copper and antimony have not been detected at levels that exceed applicable standards in groundwater at the edge of the tailings impoundment.

In regard to the duration of the primary attenuation processes, Hydrometrics states “The mineral precipitation and co-precipitation mechanisms are expected to last indefinitely or in perpetuity as long as geochemical conditions remain similar to current conditions. The geochemical conditions include soil composition and the pH and oxygen content of the discharge water and groundwater system. The adsorption mechanisms are conservatively estimated to last a minimum of 600 years” (Appendix I).

The 2004 Land and Water report focused on the current (primary) copper removal mechanisms within the decant pond sediments, while the CDM study (**Appendix D**) was designed to evaluate potential secondary removal mechanisms of copper and other metals that would occur in the event that the initial mechanisms become less effective. These additional, secondary processes would occur downgradient of the decant ponds in response to mixing the relatively oxygen-rich decant pond water with oxygen-poor and iron-rich natural groundwater. Theoretically, the mixing of the two waters would result in precipitation of iron minerals within the groundwater and concurrent removal of other metals such as copper and antimony. This process is known as co-precipitation of metals. To evaluate whether this mechanism was likely to occur, two processes had to be demonstrated: 1) that the mixing of the waters would result in the precipitation of iron, and 2) that other metals would be removed concurrently with the iron. The two processes were evaluated using geochemical computer modeling and laboratory testing, respectively. The computer modeling showed that between 98 and 100 percent of the iron would precipitate in response to mixing of the waters, while the laboratory tests showed that precipitation of the iron resulted in the removal of 73-98 percent of the copper and 11-59 percent of the antimony.

Taken together, the primary removal mechanisms (precipitation and adsorption) and the secondary co-precipitation processes that occur downgradient of the tailings impoundment ensure that copper and antimony would be removed from discharged mine water before groundwater reached Lake Creek. Numerous studies have been conducted to document that the possibility is remote for copper and other metals from mine water to reach Lake Creek at levels above the current regulatory limits. While the water from the decant ponds does move in the shallow groundwater toward Lake Creek, the effect of dilution alone would result in meeting human health criteria. Similarly, aquatic criteria are likely to be met due to the natural attenuation mechanisms that occur beneath the decant pond and in the groundwater system. Over 30 years of monitoring data have shown that copper and antimony do not migrate more than 150 feet downgradient of the decant pond at levels that exceed groundwater standards. Most of the copper and all measurable antimony are removed by primary attenuation processes occurring within the first foot of sediments below the decant pond. Additional secondary

attenuation mechanisms would result in further removal of copper. This becomes particularly important in the event that the primary attenuation mechanisms become less effective in the future. The precipitation attenuation mechanism is predicted to last indefinitely. The adsorption mechanism is predicted to last more than 600 years.

Proper functioning of the mine water disposal system could potentially be impacted if storm water transports fine sediment into the decant ponds at a rate that plugs the ponds with sediment and debris. This would prevent the infiltration of mine water through the decant ponds and limit the attenuation process beneath the tailings in the glaciofluvial materials.

Surface Water Quantity

Under the Proposed Action, mine water would continue to be discharged to the tailings impoundment decant ponds at a rate similar to current operational conditions. This water infiltrates through the tailings and into the aquifer, moves downgradient through the aquifer, and enters Lake Creek via groundwater flow paths. Mine water discharge and storm water runoff would be disposed of within the tailings impoundment area. There would be no overland flow from the tailings impoundment and no overall change to surface flow in Lake Creek.

Surface Water Quality/Nitrates

Nitrate concentrations in Lake Creek near the tailings impoundment are described in **Section 3.9.4**. There is no evidence of nitrate loading to Lake Creek as a result of operation of the tailings impoundment (see **Table 3-9**); consequently, no effects to nitrate levels in Lake Creek are predicted to result from reclamation of the tailings impoundment under the Proposed Action. Nitrate concentrations in mine water would decline after cessation of mining.

Surface Water Quality/Metals

As described for the No Action Alternative, operational water quality data from Lake Creek do not indicate that metals derived from the tailings impoundment reach Lake Creek (**Table 3-9**). Under the Proposed Action, continued discharge of mine water to the decant ponds would result in long-term addition of metals to the aquifer immediately beneath the tailings impoundment. As described in the groundwater quality section above, analysis of the Proposed Action indicates that attenuation of these metals is predicted to continue. Consequently, impacts to surface water from metals in water associated with the tailings impoundment are not anticipated.

Surface Water Quality/Sediment

As described above in the surface water quantity section, there would be no surface water runoff from the tailings impoundment area. The Proposed Action would use the borrow areas east of the impoundment for reclamation materials rather than the soil stockpiles located to the west between the impoundment and Lake Creek. This approach would reduce potential, short-term sediment impacts associated with erosion of disturbed soil. Maintenance of the decant ponds as a sump, rather than regrading the impoundment surface to drain into a natural drainage outside of the impoundment,

would also reduce the potential for sediment to reach Lake Creek compared with the No Action Alternative.

3.9.5.3 Agency-Mitigated Alternative

The Agency-Mitigated Alternative addresses those issues unresolved by the Proposed Action with respect to the methods of mine water capture, transport, and long-term treatment. This alternative requires that no demolition debris can be buried on NFSL.

Mine Water Discharge

Water Quantity

Similar to the Proposed Action, the continued disposal of mine water via the pipelines to the tailings facility would reduce the flow of groundwater that would naturally recharge Ross Creek and, especially, Stanley Creek. The effect would be continued reduction of flows in upper Stanley Creek which may have occurred as a result of mine development. The mine water intake design for the Service and Conveyor adit portals would be installed inside the adits to minimize freezing issues. The adits would be only partially backfilled but would still be accessible by small equipment through doors to allow maintenance. Both adits would have capture systems because the mine pool would overflow into the adits at the 4,225 foot elevation. Although cross-cuts connect the Conveyor Adit to the Service Adit, the cross cuts would not be maintained in the future, potentially forcing discharge out the Conveyor Adit. The rock surfaces that are below the pooled water in the adits immediately behind the dams as well as the rock around the concrete dams would be grouted to prevent seepage.

Water Quality/Nitrates/Metals/Sediments

The mine water intake structures proposed for the Service and Conveyor adits would minimize seepage of water and mitigate any potential for contamination of Stanley Creek. The Agency-Mitigated Alternative also proposes burying a new pipeline that would transport mine water to the tailings impoundment instead of using the existing tailings pipelines. The existing, buried reclaim water pipeline would be used as a backup line for overflow or if the new buried pipeline needs repair. Installing sensors, valves, and telemetry is designed to monitor the pipeline for leakage and to divert water to the backup line when needed (Appendix G). In addition, the new pipeline would be double-lined at creek crossings to minimize the potential of discharge directly to streams. Implementation of a leak detection system, installation of a new buried pipeline, reuse of the buried backup, and double-lining stream crossings all reduce the risk of affecting local groundwater systems and Stanley and Lake creeks. Although localized contamination of soil could still occur if a pipeline leaks, the risks of contamination of surface water by mine water are low and the impacts would be short-term.

A failure of the new buried pipeline would be partially contained by the fill material surrounding the pipeline, which would reduce the rate of release of water to the environment. The greatest risk would be at stream crossings, where an above ground line could rupture and release pipeline contents directly to surface water. Troy Mine, Inc. would be required to double-line or bury all pipelines at stream crossings to minimize the risk of surface water contamination. Delivery of sediment to streams would

also be reduced under this alternative because there would be no direct discharge of mine water to Stanley Creek as in the No Action Alternative. Finally, sediment delivery from an above ground pipeline break, which could occur under the Proposed Action, would also be eliminated.

Mine Area Surface Water, Seeps, and Springs

The No Action Alternative, Proposed Action, and Agency-Mitigated Alternative all have the same potential environmental consequences for mine area seeps and springs because the mine would flood to the same elevation. Refer to the discussion under the environmental consequences of the No Action Alternative.

Mill Site and Portal Patios

Mine Water Quantity and Quality

This plan is similar to the Proposed Action but with some alterations (**Table 2-1**). The Agency-Mitigated Alternative proposes additional design elements for both drainages across the mill patio (Appendix E). In the Agency-Mitigated Alternative, a larger channel would be built across the patio and down the fill slope with rock sized as needed to stabilize and protect the fill and native ground from eroding during the 100-year peak flow event. The channel would be lined with an impermeable liner to prevent the streamflow from going subsurface. The point where the larger channel reaches the toe of the fill slope would be aligned with the original drainage and would reduce erosion between the toe of the fill and Stanley Creek. The existing twin culverts would be plugged with concrete at the both inlet and outlet ends. A rock energy dissipation basin in the channel at the base of the fill slope would be built to prevent scour as in the Proposed Action and a four-foot diameter culvert would be installed beneath the access road for the large drainage. The smaller drainage located above the mill building would be routed along the uphill side of the access road to the larger drainage channel (**Appendix E**). It would also be lined with an impermeable liner and designed to withstand a 100-year flow event. The smaller drainage would be combined with the larger drainage, thus eliminating the need to build two armored channels down the fill slope as in the Proposed Action.

At mine closure, a new buried water pipeline would carry mine water from the Service and Conveyor adits to the decant ponds at the tailings impoundment for disposal and treatment. Should the mine water eventually attain surface water standards, another small channel would be constructed from the Service and Conveyor adits to route mine water directly to Stanley Creek. This channel would be sized to convey the expected maximum discharge from the adits (6.9 cfs).

Fine material on the south end of the mill site fill face below the portals would be regraded to a more stable slope, reseeded, and then covered with an appropriate erosion control mat to prevent erosion until vegetation is established.

Mine patios at the North and South adits would be reclaimed as described in the Proposed Action. However, under the Agency-Mitigated Alternative, a stream channel would be constructed at the West Adit patio, thus reducing sediment delivery to Stanley Creek.

All building demolition material would be removed from NFSL in contrast to burying material on-site as planned in the Proposed Action. This change would eliminate any potential risks to water quality from this material.

Roads and Other Facilities

The existing paved surface on NFSR 4626 from MP 2.39 (junction with NFSR 7148) to 8.36 (junction with NFSR 4626D) would be pulverized in place and converted to 4 inches of gravel surfacing. This would increase sediment delivery to surface water as compared to a paved surface. BMPs such as drain dips would be implemented to reduce potential sediment delivery. Three hundred feet of pavement would be left on either side of bridge crossings to minimize sediment delivery to surface water. BMPs would be implemented on NFSR 4626 from MP 8.36 to 11.56 (junction with NFSR 4629), NFSR 4629, and NFSR 4628 from MP 0.0 to 6.7. These roads would be left in a drivable condition that minimizes adverse impacts on the watershed without the need for regular maintenance (see **Table 2-1**). NFSR 4630A would also be treated to minimize adverse impacts on the watershed without the need for regular maintenance. However, because there is no short-term need for this road, it would not necessarily be left in a drivable condition. **Table 2-1** describes the treatments for each road, and **Figure 3-10** in the Transportation Section shows the location of the roads to be treated.

NFSRs 4624, 4624B, 4626C, 4626D, 4626F, 4626G, 4628C, and 9003 would all be actively decommissioned and treated according to **Table 2-1** and are shown in **Figure 3-10**. Most of these roads were identified as having the potential to cause sediment delivery from road surface erosion and from road fill failures. The exceptions are NFSR 4626C (access to the percolation ponds at the mill site) and NFSR 9003 (access to the water make-up wells). These roads would be decommissioned as actions connected to reclamation of mine facilities. The purpose of the active decommissioning and maintenance treatments would be to decrease road surface erosion, to decrease the risk of fill failures or washouts, to decrease routing of water by the roads, and to enhance infiltration and native revegetation.

The remaining NFSRs would not be physically treated. These roads do not pose a risk to the watershed because of topography, soil type, and/or distance from stream channels. The roads that have no future need would be removed as NFSR by being passively decommissioned (**Figure 3-10**). Most of these roads are revegetated.

Hydrologic effects of those roads on private, patented ground on Mt. Vernon are currently unknown. Some of these roads may be routing water and/or posing a risk of sediment delivery to Stanley or Ross creeks. Under the No Action Alternative and the Proposed Action, no reclamation of private roads is proposed. Under the Agency-Mitigated Alternative, all private roads on Mt. Vernon that would not be needed for a post-mine land use would be treated on the basis of an agency field review to decrease road surface erosion and to decrease the risk of failures or washouts.

The two existing above-ground tailings pipelines would be removed when no longer needed, and the disturbed ground would be scarified and revegetated.

For long-term operation of water management facilities at the mine site, Troy Mine, Inc. would be required either to maintain the existing overhead power line or to replace it with an underground power line that would be installed when the new mine water pipeline is constructed.

The other facilities (makeup well pump station and water reclaim pump station) would be removed. The disturbed ground at the sites would be ripped, recontoured, and revegetated.

The maintenance sump area next to Lake Creek would be recontoured to re-establish premine contours. Any tailings in the sump posing a risk to water quality would be removed and placed in the tailings impoundment prior to reclamation.

Surface Water Quantity

Roads can increase peak flows by routing runoff more directly to stream channels. The proposed road treatments would decrease the effect of road runoff on peak flows.

Surface Water Quality

Replacing the paved surface of NFSR 4626 with gravel would increase the risk of sediment delivery from the road surface as compared to the existing paved condition. Retention of the 300 ft of pavement at the bridge crossings and implementation of BMPs on NFSL would limit the sediment contribution to surface water.

Treatment of NFSRs 4624, 4624B, 4626, 4626D, 4626F, 4626G, 4628, 4628C, and 4629 would result in minor, short-term sediment delivery during the first year following treatment. By the second year, however, revegetation would minimize sediment delivery. Over the long-term, there would be less sediment delivery from surface erosion and stream culvert failures to Ross and Stanley creeks from these roads than under the existing condition or the Proposed Action. The risk of mass failures and the accompanying sediment delivery would also be reduced.

Disturbed ground associated with removal of the power line and removal of the above ground-tailings pipelines would be revegetated. Where the facilities are close to streams, short-term sediment delivery would be possible until vegetation is re-established.

There is the potential of sediment delivery after reclamation of the maintenance sump because it is within 200 feet of Lake Creek. However, sediment at this site would be reduced by design features including control on timing of work, installing sediment traps, establishing a temporary ground cover, and planting site-appropriate shrubs and trees.

Stream Channel Morphology

Short-term sediment delivery from reclamation activities associated with road treatment and other facilities would not be expected to have a measurable effect on stream channel morphology. Stabilizing roads would reduce the long-term risk of mass failures and would protect stream channel conditions in

Stanley and Ross creeks. Reclaiming the maintenance sump would restore the premine floodplain adjacent to Lake Creek.

Tailings Impoundment

Reclamation of the tailings impoundment under the Agency-Mitigated Alternative would differ from the Proposed Action in two ways: 1) soil from the stockpiles located between the impoundment and Lake Creek would be used to cover the tailings impoundment surface; and 2) a revegetated berm would be established between the reclaimed tailings impoundment surface and the decant ponds to prevent sediment from washing into the decant ponds. This effort would reduce long-term maintenance requirements associated with clean-out of the decant ponds to maintain their function as percolation ponds.

Groundwater Quantity

Potential groundwater quantity impacts that would result from implementing the Agency-Mitigated Alternative would be similar to those discussed for the Proposed Action.

Groundwater Quality/Nitrates/Metals

Potential groundwater quality impacts associated with nitrate and metals that might result from implementing the Agency-Mitigated Alternative would be similar to but less than those found under the Proposed Action. Additional measures that would further decrease likely impacts include installing a revegetated berm around the decant ponds to keep storm water and sediment out of the ponds. This berm would keep debris and sediment from plugging the ponds, would maintain infiltration capacity in the decant ponds, and would maintain geochemical conditions needed to attenuate copper.

Surface Water Quantity

Potential surface water quantity impacts resulting from the implementation of the Agency-Mitigated Alternative would be the same as those discussed for the Proposed Action.

Surface Water Quality/Nitrates/Metals

Implementation of the Agency-Mitigated Alternative would result in similar potential surface water quality impacts associated with nitrate and metals as those discussed for the Proposed Action.

Surface Water Quality/Sediment

As compared to the Proposed Action, the Agency-Mitigated Alternative slightly increases the short-term risk of sediment delivery to Lake Creek during reclamation activities because soil stockpiles located near Lake Creek and the toe ponds would be used. The vegetated lower portion of the stockpiles would be retained to filter sediment, and the disturbed area would be revegetated, thus minimizing long-term risk to surface water. See more sediment limiting BMPs in the discussion under western toads in **Section 3.18.5.10**.

Stream Channel Morphology

No effects to the Lake Creek stream channel morphology are anticipated from reclamation of the tailings impoundment under the Agency-Mitigated Alternative.

3.9.5.4 Cumulative Effects

Water Quantity

Under the No Action Alternative, discharging mine water directly to Stanley Creek would increase base flows in this stream, but the relative effect would diminish in the downstream direction. Flows in Lake Creek below the tailings impoundment should not be affected compared to current flows. There could be a small increased flow in seeps, springs, and tributary streams in the vicinity of the mine workings compared to current conditions with the mine operating. However, there would be little change in flow compared to the undocumented premine conditions. Planned vegetation management in the Stanley Creek watershed is predicted to increase cumulative peak flows in upper Stanley Creek by nine percent above flows expected with undisturbed conditions (KNF 2010). These cumulative actions would further increase streamflows in upper Stanley Creek. Peak flows in Lake Creek are and will remain unaffected by vegetation removal on federal and private lands for the foreseeable future. The current 7% equivalent clearcut area is well below a level that could increase peak flows (KNF 2010).

Under the Proposed Action and Agency-Mitigated Alternative, existing reductions to streamflow in Stanley Creek due to interception of groundwater by flooding mine workings would continue. On-going vegetation management in the Stanley Creek watershed elevates peak flows in upper Stanley Creek (USFS 2010). Therefore, reductions in streamflow due to interception of groundwater by the mine workings may be partially offset by peak flow increases due to vegetation management or wildfire. Water discharged from the mine would be returned to the watershed at the tailings impoundment and would result in no net loss to Lake Creek below the tailings impoundment.

Water Quality

There have been occasional low-level exceedances of copper standards in upper Stanley Creek (SC-15). The source(s) of these exceedances may be due to any number of factors, including sediment generated from surface water erosion of naturally copper-bearing soil, groundwater seeping from the mine void, erosion of copper-bearing soil from the portal patios, or groundwater containing naturally-elevated copper concentrations from mineralization in the area. The occasional low-level naturally-occurring copper exceedances in upper Stanley Creek would be expected to continue through post-closure for all alternatives. There have historically been numerous detections of copper in Fairway Creek despite the Fairway site being upgradient of the mine. The most likely reason for these detections is that copper occurs naturally in the region and is present in soils and sediment. Occasional exceedances in any stream in the area should not be ruled out for this reason.

No abandoned or inactive mines within the analysis area have contributed water quality impacts (Hargrave *et al.* 1999).

Minor sediment effects from non-mine-related sources, such as timber harvest roads and private land development, would continue to occur in Stanley and Lake creeks during and post-reclamation under all alternatives. This sediment would be in addition to the reclamation-related sediment. In Stanley Creek, it is expected that other sources would be immeasurable compared to the reclamation work. In Lake Creek, non-mine sediment sources are somewhat more substantial, but would still be substantially less than the sediment generated by the reclamation. There is virtually no potential sediment delivery from other land management sources in Ross Creek because of the undeveloped nature of the watershed.

The currently planned Sparring Bulls timber sale could result in minor short-term sediment delivery from road use. No sediment delivery is expected from harvest units (KNF 2010). Currently planned road BMPs, storage, and decommissioning projects would increase short-term sediment but reduce long-term sediment delivery to Lake Creek (KNF 2010). Most of this work would occur in the Camp Creek watershed which enters Lake Creek just above the tailings impoundment. These projects are expected to begin in 2011 and are likely to be completed well before mine reclamation occurs. As a result, potential sediment impacts from the planned road projects and the reclamation project are not expected to be additive.

No Action

Under the No Action Alternative, metals and nutrients would increase in Stanley and Lake creeks due to the direct discharge of mine water to the stream. This increase in nutrients would be expected to be a short-term effect based on the decrease in nutrient levels observed during temporary shutdown of the mine. On the other hand, the increase in metals would be expected to be a long-term effect. The increase could exceed aquatic life criteria and result in adverse impacts to macroinvertebrates and amphibians in upper Stanley Creek. Based on previous monitoring, it appears unlikely that seeps, springs, and small tributaries in the vicinity of the mine workings would exceed water quality standards as a result of contamination by mine water. The possible exception would be upper Stanley Creek where seeps may express mine water and erosion at the mill site and at the North Portal could contribute copper to the stream.

Sediment generated at the portal patios, mill patio, and at the tailings impoundment would be delivered to streams and result in short- and long-term turbidity and sediment deposition. Under the No Action Alternative, roads would be treated to minimize sediment contributions to area streams, thus reducing the current contribution rate from roads. Sediment levels would remain elevated in Stanley Creek because of potential erosion both at the mill site and at the North Portal and would probably increase in Lake Creek due to erosion at the tailings impoundment. Sediment levels in Ross Creek would decline over time due to the road treatments.

Proposed Action

Under the Proposed Action there would be no direct discharge of mine water to Stanley Creek from the mine portal. Seeps around the plug to the Service and Conveyor adits could occur and result in water quality impacts. These seeps do not presently exist and would be localized in the vicinity of the mine portal. They would be distinct from those existing and potential future seeps located elsewhere in the

vicinity of the mine workings. Based on previous monitoring, it appears unlikely that seeps, springs, and small tributaries in the vicinity of the mine workings would exceed water quality standards as a result of contamination by mine water. A possible exception to this conclusion could occur at upper Stanley Creek where seeps may express mine water and erosion at the mill site and at the North Portal could contribute copper to the stream (see **Table 3-10**).

There would be an on-going risk of accidental release of mine water to Stanley and Lake creeks from a pipeline failure under the Proposed Action. Such a failure could result in water quality standard exceedances in Stanley or Lake creeks until water flow through the pipeline could be shut off. However, these events would be episodic and would only result in relatively short-term releases of mine water and sediment from erosion to surface water.

The Proposed Action would bury demolition material at the mill site that could adversely affect water quality.

There would be a short-term sediment impact to surface waters from reclamation activities at the mill site that would not be completely mitigated by implementation of BMPs. Fine sediment would be flushed from the newly constructed channels. There would be long-term sediment delivery from scour between the toe of the mill site fill and Stanley Creek where the larger drainage is proposed to be routed. Long-term sediment impacts would also potentially occur from erosion of the face of the mill site fill where it is crossed by drainages. There would be an on-going risk of sediment delivery from the road system, including the risk of mass failures, because roads would not be reclaimed under the Proposed Action.

Long-term sediment levels would remain elevated in Stanley Creek because of erosion at the mill site and North Portal and because of the erosion coming from the existing road system. Ross Creek would remain at risk to short-term impacts from sediment delivery from road failures. Tributaries to Stanley and Ross creeks would continue to be degraded by peak flows and by sediment delivery from roads. Under the Proposed Action, there would be a low risk of sediment delivery to Lake Creek from the reclaimed tailings impoundment, but chronic sediment delivery to Lake Creek from the mine site would probably persist for several decades.

Agency-Mitigated Alternative

There would be no direct discharge of mine water to Stanley Creek from the mine portal. Seeps around the dam in the Service and Conveyor adits would be unlikely. Based on previous monitoring, it would be unlikely that seeps, springs, and small tributaries in the vicinity of the mine workings would exceed water quality standards as a result of contamination by mine water with the possible exception of upper Stanley Creek where seeps may express mine water and erosion at the mill site and at the North Portal could contribute copper to the stream (**Table 3-10**).

There would be a lower on-going risk of accidental release of metals-contaminated water to Stanley and Lake creeks from the new buried pipeline as compared with the Proposed Action.

In contrast to the Proposed Action, no demolition materials would be buried at the mill site, so there would be no risk to water quality from this material.

There would be short-term sediment impacts from reclamation activities that could not be completely mitigated by implementing BMPs. Fine sediment would be flushed from the new channel locations. This sediment contribution is expected to rapidly decline after 2 to 3 years. Long-term sediment delivery would be reduced as compared to current conditions and would also be less under this alternative than the No Action Alternative or Proposed Action. Combining the two drainages, as proposed by the Agency-Mitigated Alternative, would reduce long-term sediment impacts from erosion of the face of the mill site fill. Erosion from the mill site fill would be reduced by revegetation. Routing the channel to the pre-existing channel location would also reduce the amount of potential erosion. Erosion above the west ventilation adit would be reduced by constructing a stream channel. Although sediment from NFSR 4626 would be slightly increased by converting the paved surface to a gravel surface, chronic and episodic sediment from the remainder of the road system on Mt. Vernon would be reduced.

Short-term sediment inputs from reclamation activities would decline within 1-2 years. Long-term sediment levels in Stanley Creek would decline as compared to current conditions and would be lower than either the No Action Alternative or the Proposed Action. Sediment levels in Ross Creek would decline over time because of road treatments on Mt. Vernon. Tributary streams to Stanley and Ross creeks would be at less risk from road failures than under the existing conditions or under the Proposed Action. Sediment levels in Lake Creek would be expected to decline to levels lower than the existing condition because the mine-related sediment would be reduced by the reclamation activities, and other road-related sediment would be reduced by the BMP, storage and decommissioning work already planned in other areas on NFSL in Lake Creek watershed.

Stream Channel Morphology

All three alternatives would have a short-term increase in sediment delivery due to reclamation activities. Under the No Action Alternative and under the Proposed Action, sediment delivery from the mine and mill site area would be expected to persist. Sediment would be deposited in lower Stanley and Lake creeks. Under the Agency-Mitigated Alternative, sediment delivery from upper Stanley Creek would be less and more short-term than under the No Action Alternative or the Proposed Action.

Under all alternatives, effects on Lake Creek channel morphology are expected to be undetectable due to the sediment transport capacity of Lake Creek. Therefore, there would be no cumulative effects on channel morphology.

Under the Proposed Action, roads would not be reclaimed, so road failures would be more likely to occur. Road failures could scour steeper headwater reaches and deposit sediments in lower-gradient valley reaches in the northern tributaries of Ross Creek as well. Under the No Action and Agency-Mitigated alternatives, roads would be reclaimed, reducing this potential impact.

Beneficial Uses of Surface and Groundwater

Under the No Action Alternative, copper would exceed chronic aquatic life standards in Stanley Creek and occasionally in upper Lake Creek. Due to direct mine water discharge, aquatic life and habitats would potentially be adversely affected by sediment and metals in these streams. No adverse effects are expected on groundwater quality. Domestic wells in the vicinity of the tailings impoundment would not be affected.

Under the Proposed Action, copper would exceed chronic aquatic life standards in Stanley or upper Lake creeks for brief periods if a mine water pipeline failure occurred. Sediment from the mill site and roads would add to the already elevated sediment load that currently exists in Stanley Creek and would adversely impact beneficial uses for an extended period of time. Sediment delivery to Stanley and Lake creeks from sources in upper Stanley Creek would occur over the long-term. Cumulative deposition of sediment from erosion would impair fish habitat in lower Stanley Creek. Turbidity, which also adversely affects fish, would occasionally be elevated in Stanley and Lake Creek as a result of sediment from the mine reclamation area. Fisheries habitat in Ross Creek could be adversely impacted by sediment delivery from road failures. No adverse effects are expected on groundwater quality. Domestic wells in the vicinity of the tailings impoundment would not be affected.

Under the Agency-Mitigated Alternative, the new buried pipeline and leak detection system would minimize the risk of accidental discharge of mine water to Stanley or Lake creeks. Short-term sediment delivery from mill site reclamation activities would occur but would be minimized with mitigation. Road stabilization work would decrease long-term sediment delivery. Over time, sediment delivery to Stanley and Lake creeks would decline as compared to the existing conditions and would be lower than under the Proposed Action. Aquatic life and fisheries would be protected under the Agency-Mitigated Alternative. No adverse effects are expected on groundwater quality. Domestic wells in the vicinity of the tailings impoundment would not be affected.

3.9.5.5 Resource Impact Summary

Direct mine water discharge into upper Stanley Creek under the No Action Alternative would impact water quality in Stanley Creek and upper Lake Creek. In comparison to the No Action Alternative, mine water disposal under either the Proposed Action or the Agency-Mitigated Alternative would reduce potential water quality impacts to Stanley Creek and to upper Lake Creek. Under both the Proposed Action and the Agency-Mitigated Alternative, the mine discharge would be routed to the decant ponds for treatment. At the decant ponds, the water would infiltrate and be treated by natural attenuation mechanisms along the groundwater flow path to reduce concentrations of metals of concern to levels that would meet water quality standards. Surface water quality impacts would be further reduced under the Agency-Mitigated Alternative by installing a new buried mine water pipeline and by installing a leak detection and backup system for mine water transport.

Stanley and Lake creeks have been listed on the TMDL 303d list as impaired streams. Probable causes of impairment of Stanley Creek are copper and nutrients. Probable causes of impairment of Lake Creek are nutrients, sediment, and physical substrate habitat alterations. Because nitrate concentrations would

decrease after blasting ceases, closure and reclamation of the mine would reduce nutrient loading to surface water under all alternatives. After mine closure, there would be reduced risk of spills of mine tailings into surface water under all alternatives. The No Action Alternative would result in increased copper loading from mine water discharge to Stanley Creek and would not accomplish the goals of the TMDL program. Both the Proposed Action and the Agency-Mitigated Alternative would reduce the potential for loading of copper to Stanley Creek. Reclamation of mine roads on NFSL under the No Action and Agency-Mitigated alternatives would reduce sedimentation and siltation in Lake Creek over the long-term.

3.9.5.6 Effectiveness of Mitigation Measures

Management of erosion across all reclaimed areas, including decommissioning roads, improvements to revegetation and the implementation of Agency BMPs, is a standard and proven practice that effectively minimizes sediment delivery to surface water. Management of mine water by requiring an appropriately sized and engineered buried pipeline, an engineered leak detection system, and an automated backup system is a standard practice for minimizing the impacts of pipeline failure to surface water. The Agencies' engineered drainage channel design uses standard design methods to effectively minimize erosion and sediment delivery to surface water. Treatment of mine water by attenuation in the glaciofluvial sediments beneath the decant ponds was predicted in the 1978 EIS and has been proven through 30 years of effective operation. Both the exclusion of storm water through use of a berm and the periodic removal of sediment and debris from the decant ponds would effectively maintain their function as percolation ponds and would ensure that mine water continues to infiltrate.

3.9.5.7 Regulatory Compliance

The No Action Alternative would not comply with the Federal Clean Water Act, Montana Water Quality Act, USFS policy, or with the Kootenai National Forest Plan because untreated mine water would be discharged to surface water that would, in turn, exceed water quality standards. Moreover, moderate to high sediment delivery is likely from the mill site, mine portals, and from the tailings impoundment even following the proposed reclamation.

The Proposed Action and Agency-Mitigated Alternative would comply with the Federal Clean Water Act and the Montana Water Quality Act because mine water discharged to the decant pond would be treated by natural attenuation in the soils and aquifer beneath the tailings impoundment. The effectiveness of these mechanisms has been documented to remove metals over the 30-year period of mine operation. Studies conducted for this EIS have demonstrated the long-term viability of treatment by natural attenuation mechanisms to meet water quality standards. **Table 3-11** demonstrates that antimony and copper concentrations downgradient of the tailings impoundment have consistently met groundwater quality standards. The antimony and copper water quality standards have been met at the Lake Creek monitoring station downstream of the impoundment. This indicates that groundwater discharging to surface water in the vicinity of the impoundment does not compromise water quality in Lake Creek (**Table 3-9**).

The Proposed Action would not fully comply with the Federal Clean Water Act because of the potential for sediment impacts to surface waters. Sediment would originate from stream erosion across the mill site. The Proposed Action would also not be fully compliant with USFS manual and policy direction with respect to roads because unneeded roads that pose a resource risk would not be treated, and restoration work on needed roads would not be implemented. Any additional sediment from these sources would add to the already elevated sediment load that currently exists in Stanley Creek and would adversely impact beneficial uses for an extended period of time. Some of this sediment would also be expected to reach Lake Creek, which is listed as impaired for sediment. There is also a greater risk of short-term water quality violations under the Proposed Action because of the higher risk of accidental discharge of mine water from the tailings pipeline to Stanley or Lake creeks.

The Agency-Mitigated Alternative would comply with the Federal Clean Water Act, Montana Water Quality Act, USFS policy, and with the KNF Forest Plan because it would reduce sediment loading both by implementing reclamation actions and by treating mining road-related sediment sources. Thus, sediment levels in Stanley and Lake creeks would be expected to decline over time.

All alternatives would comply with the Clean Water Act with respect to discharging dredged or fill materials into water or wetlands and with Executive Order 11990, which directs agencies to minimize impacts to wetlands. No activities are proposed under any alternative that would discharge fill materials into water bodies or that would impact wetlands.

3.10 Land Use

3.10.1 Introduction

Land use involves either the natural conditions or the human-modified activities that take place in a specific area. Management plans and land use regulations can impact and determine the types of uses that are allowed in an area and often are established to protect sensitive features or areas. This section of the EIS characterizes land use within the Troy Mine Permit Area and surrounding Lake Creek watershed, and it also identifies potential land use changes under each reclamation alternative.

Mining has occurred within the Permit Area for nearly 30 years. After reclamation, the public lands within the Permit Area would be open lands available for recreation, similar to that of surrounding public lands. However, Troy Mine, Inc. or any subsequent owner may continue to restrict public access to private lands within the Permit Area. This section will concentrate on reasonably foreseeable land use changes that could occur on public lands within the Permit Area after mine reclamation is complete.

3.10.2 Regulatory Framework

The 1987 KNF Forest Plan establishes the land management framework for activities on NFSL and serves as the guiding management document until the 2008 Planning Rule is implemented. The 1987 Plan's goal is to promote a balance of multiple uses on KNF lands, including timber management, resource extraction, recreation, and maintenance of natural values. The Plan provides a management framework to harmonize scenic values with operations and to protect fish and wildlife habitats. As such, USFS must

review Troy Mine, Inc.'s reclamation plan to ensure that future uses of public lands within the Permit Area are consistent with management area requirements after cessation of mining.

Additional regulatory framework for this section includes both the Lincoln County Subdivision Regulations and the Lincoln County Floodplain Regulations, which apply specifically to private lands. Lincoln County does not have countywide zoning.

The Montana Subdivision and Platting Act (76-3-101 *et seq.*, MCA) requires local jurisdictions to adopt and enforce local subdivision regulations. Lincoln County has had subdivision regulations in place since 1973, and current regulations were adopted in 2004. There are no known plans for subdividing private lands within the Permit Area following reclamation. If Troy Mine, Inc. or any subsequent owner proposes a subdivision in the future, any plans would be reviewed by local authorities before approval.

Lincoln County has floodplain regulations in place to comply with the Montana Floodplain and Floodway Management Act (76-5-101 *et seq.*, MCA) and to ensure compliance with the requirements of the National Flood Insurance Program. Regulated floodplains exist in the northern portion of the Permit Area.

The MMRA requires that all lands disturbed by mining be reclaimed to meet the post-mine land use.

3.10.3 Analysis Area

The analysis area for this section is the Lake Creek watershed, but it focuses on the vicinity of the Troy Mine Permit Area.

3.10.4 Affected Environment

3.10.4.1 Overall Land Ownership

Almost 79 percent of the area comprising the entire 131,000-acre Lake Creek watershed is managed by the USFS as part of the KNF (**Figure 3-6 and Table 3-13**). Most of the remaining 21 percent is privately owned. The State of Montana holds 2,648 acres within the Lake Creek watershed with the closest state parcel located approximately one half mile west of the tailings impoundment area (**Table 3-13**).

3.10.4.2 Kootenai National Forest Lands

Of the nearly 103,000 acres of NFSL within the Lake Creek watershed, there are 18 unique USFS Management Areas (MAs), as well as seven old growth forest sub-classifications. **Table 3-14** provides a breakdown of these lands and associated MAs, which are also detailed on **Figure 3-7**. **Figure 1-2** shows land ownership surrounding the Troy Mine Permit Area.

Table 3-13. Land Ownership within Lake Creek Watershed

Owner	Acres	Percent
USFS	102,910	78.72%
State of Montana	2,648	2.03%
Stimson Lumber	8,427	6.45%
Plum Creek Timber	449	0.34%
Other Private Parcels	15,088	11.54%
Water	1,199	0.92%
Total	130,721	

Source: KNF 2003

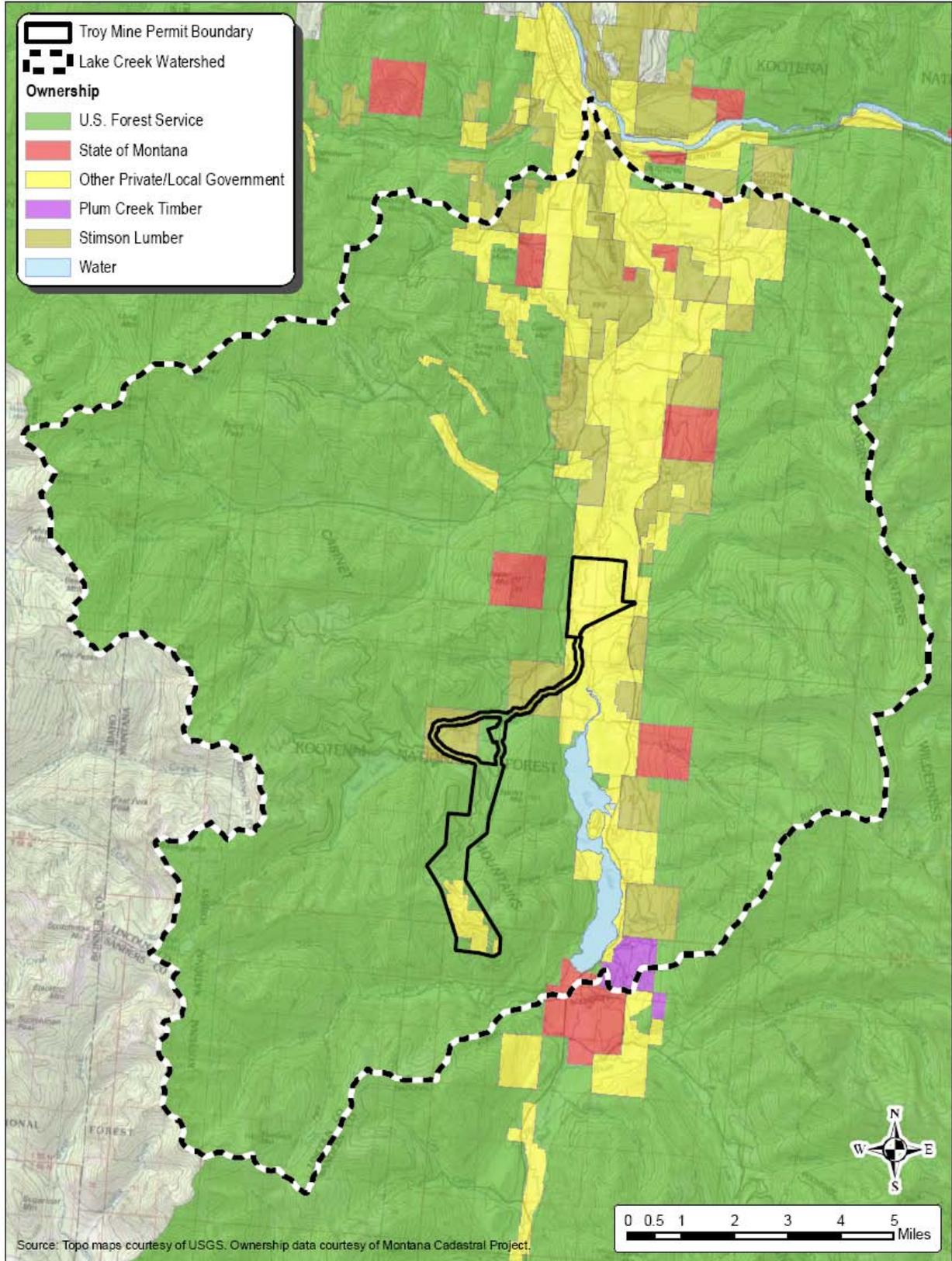


Figure 3-6. Land Ownership within Analysis Area for Land Use

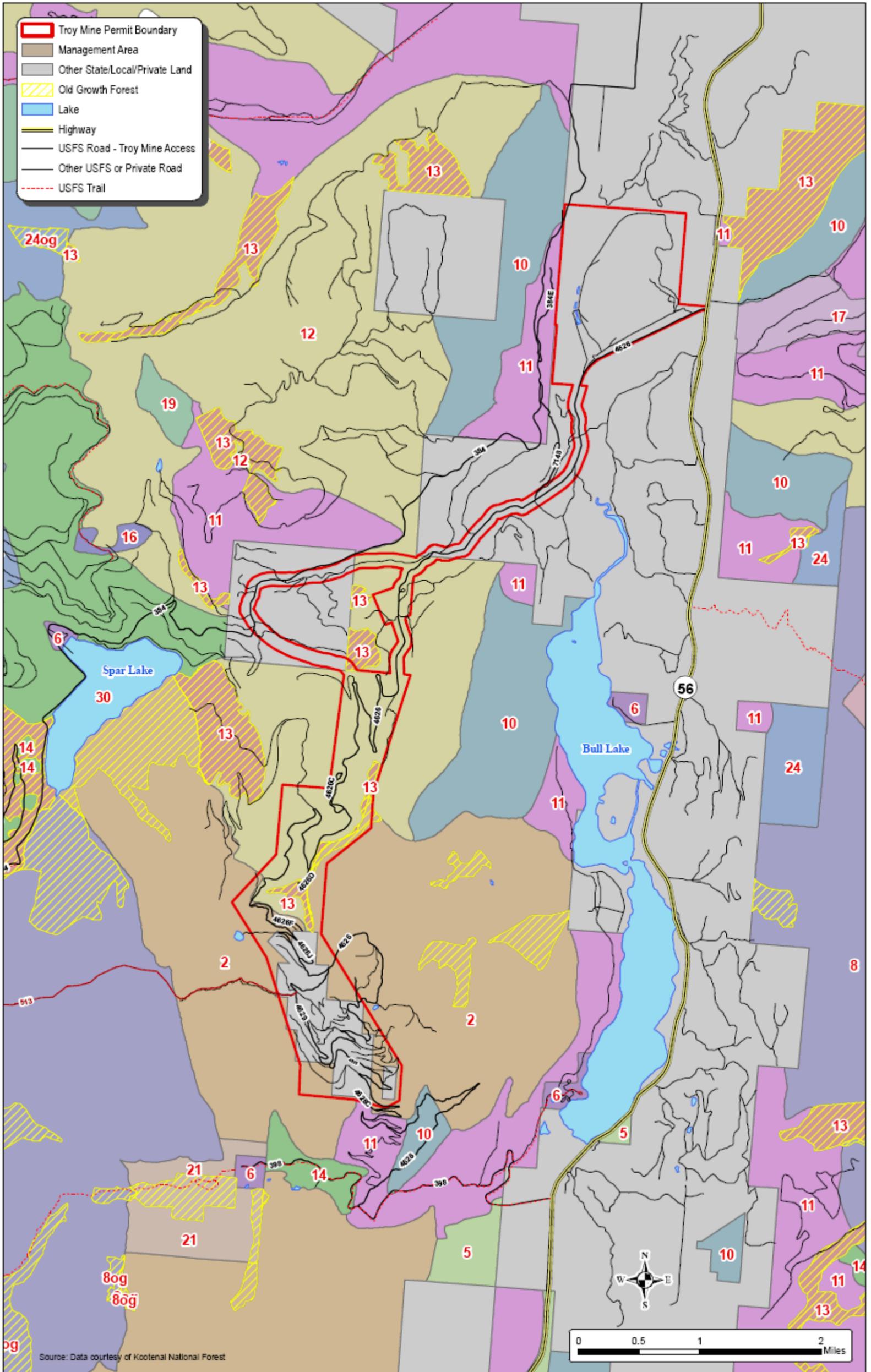


Figure 3-7. NFSL Management Areas

Table 3-14. KNF Management Areas within Lake Creek Watershed

MA	Description	Acres	Percent
pvt	Private land	27,804	21.27%
2	Large and small areas offering roadless recreation opportunities in a semi-primitive setting. Motorized vehicle use must be compatible with the roadless management goal. Timber harvest is not permitted.	14,939	11.43%
2og	Large and small areas offering roadless recreation opportunities in a semi-primitive setting. Motorized vehicle use must be compatible with the roadless management goal. Timber harvest is not permitted. Contains old growth forest.	1,334	1.02%
3	Small natural appearing areas offering opportunities for road-based recreation in a semi-primitive setting. Timber harvest must be compatible with the recreation management goal.	261	0.20%
5	Natural appearing areas containing highly sensitive viewsheds. Timber harvest must be compatible with the visual management goal.	27	0.02%
6	Small areas containing campgrounds, picnic areas, ski areas, etc; providing developed recreation opportunities.	160	0.12%
7	Cabinet Mountains Wilderness.	15,086	11.54%
7og	Cabinet Mountains Wilderness. Contains old growth forest.	115	0.09%
8	Areas being recommended for additions to the National Wilderness System.	20,889	15.98%
8og	Areas being recommended for additions to the National Wilderness System. Contains old growth forest.	2,495	1.91%
10	Areas generally below 4,500-foot elevation on favorable solar exposures which are important for big game winter range. They are generally difficult to manage for timber because of low productivity or difficult environmental problems.	2,849	2.18%
11	Same as Management Area 10 except that productive forest lands are involved which can provide both wildlife and timber benefits.	7,892	6.04%
12	Productive forest lands containing moist or wet habitat types at elevations above 4,500 feet. Managed to provide forage, cover, and security for big game by using compatible timber and road management prescriptions.	17,241	13.19%

MA	Description	Acres	Percent
13	Small areas generally below 5,500-foot elevation providing special habitat needs for old growth timber dependent species. Timber harvest is not permitted.	3,771	2.88%
14	Productive forest lands identified as being essential for the recovery of the grizzly bear. Managed to provide forage, cover, and security by using compatible timber and road management prescriptions.	8,370	6.40%
16	Productive forest lands that will be managed for high timber yields while protecting watershed, soil, fisheries, and providing a high level of protection to visual resources.	60	0.05%
17	Productive forest lands located within sensitive viewsheds. Timber harvest and visual resource management must be coordinated to provide a natural appearing landscape.	646	0.49%
18	Small productive forest areas that contain habitat types those are difficult to regenerate. Timber harvest must be compatible with regeneration goals.	752	0.57%
18og	Small productive forest areas that contain habitat types which are difficult to regenerate. Timber harvest must be compatible with regeneration goals. Contains old growth forest.	47	0.04%
19	Small productive forest areas that are on very steep slopes or in areas difficult and costly to develop roads. Timber harvest must be compatible with soil and watershed protection goals.	2,273	1.74%
19og	Small productive forest areas that are on very steep slopes or in areas difficult and costly to develop roads. Timber harvest must be compatible with soil and watershed protection goals. Contains old growth forest.	73	0.06%
21	Small areas containing both productive and non-productive forest land that are unique or special in some way, including Research Natural Areas. Managed to protect and retain these characteristics for public and scientific purposes.	400	0.31%
21og	Small areas containing both productive and non-productive forest land that are unique or special in some way, including Research Natural Areas. Managed to protect and retain these characteristics for public and scientific purposes. Contains old growth forest.	166	0.13%

MA	Description	Acres	Percent
24	Small areas of non-productive forest lands. Managed to protect soil, watershed, fisheries, and vegetation.	2,466	1.89%
24og	Small areas of non-productive forest lands. Managed to protect soil, watershed, fisheries, and vegetation. Contains old growth forest.	217	0.17%
30	Reservoirs and large lakes.	387	0.30%

Source: KNF 1999

3.10.4.3 Troy Mine Permit Area

The Troy Mine Permit Area is permitted for 2,782 acres. Approximately 57 percent of this area is private and patented land, and the remaining 43 percent is USFS managed acreage. The majority of the USFS acreage within the Permit Area is classified either as MA 2 or as MA 12. **Table 3-15** describes these lands and associated MAs.

Table 3-15. USFS Management Areas (MA) within Troy Mine Permit Area

MA	Description	Acres	Percent
pvt	Private land	1,500	57%
2	Large and small areas offering roadless recreation opportunities in a semi-primitive setting. Motorized vehicle use must be compatible with the roadless management goal. Timber harvest is not permitted.	313	12%
2og	Large and small areas offering roadless recreation opportunities in a semi-primitive setting. Motorized vehicle use must be compatible with the roadless management goal. Timber harvest is not permitted. Contains old growth forest.	31	1%
11	Same as Management Area 10 (described in Table 3-14) except that productive forest lands are involved which can provide both wildlife and timber benefits.	3	0.1%
12	Productive forest lands containing moist or wet habitat types at elevations above 4,500 feet. Managed to provide forage, cover, and security for big game by using compatible timber and road management prescriptions.	731	28%
13	Small areas generally below 5,500-foot elevation providing special habitat needs for old growth timber-dependent species. Timber harvest is not permitted.	57	2%

Source: KNF 1999

3.10.4.4 Private Lands

Private land comprises nearly 24,000 acres within the Lake Creek watershed (**Table 3-14**). Approximately 8,400 acres are owned by Stimson Lumber. Approximately 1,500 acres of private lands are located within the current Permit Area. Most of these lands are owned either by Revett Minerals or by Stimson Lumber (KNF 2003). Any development of private lands in the analysis area may be subject to Lincoln County Subdivision Regulations or to Lincoln County Floodplain Regulations, depending upon the nature of the proposed development.

Lincoln County Subdivision Regulations apply to all land divisions that create parcels smaller than 160 acres. A “Major” subdivision contains six or more lots, and a “Minor” subdivision is defined as one that contains five or fewer lots. A Subdivision Exemption may apply to family transfer situations: when a division of land occurs for the purpose of a single gift or sale to each member of a landowner’s immediate family; for situations where a landowner splits off a piece of land for agricultural use only; or for relocating a common boundary between adjoining parcels (no new or additional parcels are created).

Lincoln County Floodplain Regulations apply to all lands within the jurisdiction of Lincoln County as shown on the official Federal Emergency Management Agency (FEMA) floodplain maps and also apply to all amendments or revisions to those maps. These regulations guide how developments in floodplains may be designed.

3.10.5 Environmental Consequences

The three reclamation alternatives were evaluated to determine their potential impacts on the existing and potential land uses within the analysis area. The methods for assessing potential land use impacts generally include analyzing each alternative’s potential, according to its location or associated activities and how the alternative will:

- Impact adjacent land uses directly through increased noise, loss of public access, potential water quality violations;
- Foster (indirectly) increased development or other changes in areas adjacent to the site;
- Conflict with applicable local or regional land use management plans or local zoning ordinances; or
- Meet post-mine land use objectives.

In general, all three alternatives are expected to provide an overall positive effect to land use by reclaiming previously disturbed mining lands to a condition that benefits recreation, a primary goal of the KNF Forest Plan for the area. None of the alternatives include provisions on future development or subdivision of private land, and there is a lack of zoning regulation throughout Lincoln County. These topics will not be discussed further. However, potential impacts of each of the alternatives on public lands and private uses are discussed in further detail below.

3.10.5.1 No Action Alternative

Under the No Action Alternative, reclamation activities would continue under the specifications of the 1978 Reclamation Plan at the time of final mine closure. Existing mine infrastructure would be demolished and removed, adits would be sealed with development rock fill, adit water would be routed out of the Service Adit across the portal patio to Stanley Creek, and disturbed areas would be regraded and revegetated (see **Sections 3.8** and **3.16** for a further discussion on regrading and revegetation plans).

Per KNF approval, roads no longer deemed necessary for recreation or management access would be removed, and remaining roads (namely NFSR 4626) would be returned to KNF management control (see **Section 3.15** for a further discussion on roads). In general, the Permit Area should be reclaimed to a relatively natural, vegetated state that would return these lands to use by big game populations. Also reopening portions of the KNF (*e.g.*, Spar Lake and Mount Vernon) to recreation that once had only limited or no access potential during mining operations would be consistent with the KNF Forest Plan.

While there would be short-term (2-year) noise and activity-related disturbance to surrounding lands from reclamation activities (*e.g.*, heavy machinery during regrading and demolition operations), disturbance levels are not anticipated to be greater in terms of level or duration than during operation of the mine. As such, reclamation activities should be considered only a minor, short-term negative impact that would be minimal when compared to 30 years of operational noise levels and long-term post-reclamation periods.

Overall, under the No Action Alternative, the return of recreational potential of public lands, a prime objective of the KNF Forest Plan for the area, would restore pre-mine land uses. Reclamation would also return private and patented lands to post-mine land uses of timber production, wildlife habitat, and recreation.

3.10.5.2 Proposed Action

Under the Proposed Action, the *2006 Revised Reclamation Plan* would be implemented. Future reclamation activities within the Permit Area would follow the specifications of the updated plan. Similar to the No Action Alternative, the proposed reclamation activities under the Proposed Action would allow pre-operational recreational access to and use of public land, a primary goal of the KNF Forest Plan. Under the Proposed Action, reclamation activities would be similar to the No Action Alternative, creating similar short-term disturbances associated with reclamation activities. Any short-term negative impacts to recreation associated with reclamation activities would be minimal in comparison to operational impacts and the long-term benefit of returning some pre-operational recreation access to public lands. Reclamation would return private and patented lands to post-mine land uses of timber production, wildlife habitat, and recreation.

3.10.5.3 Agency-Mitigated Alternative

Under the Agency-Mitigated Alternative, the *2006 Revised Reclamation Plan* would be implemented and expanded upon to address issues identified during the public scoping and agency review processes. Similar to the Proposed Action, the proposed reclamation activities under the Agency-Mitigated

Alternative would return some pre-operational recreational access and use of public land, a primary goal of the KNF Forest Plan. Reclamation activities would have a greater chance of success than under either the No Action Alternative or the Proposed Action. Any short-term negative impacts to recreation associated with reclamation activities would be minimal in comparison to operational impacts and in comparison to the long-term benefit of returning some pre-operational recreational access to public lands. Reclamation would return private and patented lands to post-mine land uses of timber production, wildlife habitat, and recreation.

3.10.5.4 Resource Impact Summary

The No Action Alternative, Proposed Action, and Agency-Mitigated Alternative would all provide some return to pre-operational land uses within the Permit Area. By closing the mine and reclaiming the land, a large local disturbance would be removed, and the land would be reclaimed to a more natural vegetated state. The potential for big game populations to use the area and for recreational use of public lands within the Troy Mine Permit Area would increase. Reclamation would provide access to surrounding recreational features, such as Spar Lake and Mount Vernon, and should provide some level of pre-operational recreational use of the area, a prime land-use objective of the KNF Forest Plan. This return of recreational potential would provide a long-term net positive effect on local and regional land use on public, private, and patented lands.

3.10.5.5 Effectiveness of Mitigation Measures

No mitigation measures have been identified regarding limits to be imposed on the return of pre-operational levels of access, recreation, and big game use for the No Action Alternative, the Proposed Action, or the Agency-Mitigated Alternative.

3.10.5.6 Cumulative Effects

Cumulative effects on local land use as a result of implementation of the No Action Alternative, the Proposed Action, or the Agency-Mitigated Alternative would include incremental improvement to reclamation of vegetation and lands available for recreational purposes. No other past, present, or reasonably, foreseeable future actions would change the cumulative effects.

3.10.5.7 Regulatory Compliance

All three alternatives would be in compliance with the KNF Forest Plan because all alternatives would restore disturbed lands and return public, private, and patented lands to a balance of uses including timber management, resource extraction, recreation, and maintenance of natural values.

All three alternatives would also comply with the MMRA by restoring disturbed lands and allowing return of pre-operational land uses.

3.11 Recreation

3.11.1 Introduction

This section characterizes existing recreational resources that include developed sites, trails, and wilderness or non-roaded areas in proximity to the Troy Mine Permit Area, and it identifies potential impacts to these recreational resources under each of the reclamation alternatives.

3.11.2 Regulatory Framework

The 1987 KNF Forest Plan establishes the management framework for activities on NFSL lands and serves as the guiding management document until the 2008 Planning Rule is implemented. The 1987 Plan's goal is to promote a balance of multiple uses on KNF lands, including timber management, resource extraction, recreation, and maintenance of natural values. Promoting recreational opportunities is a primary goal of the plan within the portion of the KNF that includes the Permit Area.

On November 2, 2005, the USFS announced final travel management regulations (*36 CFR Parts 212, 251, 261, and 295 Travel Management; Designated Routes and Areas for Motor Vehicle Use; Final Rule*) that require each National Forest to designate and map roads, trails, and areas that are open to motor vehicle use.

The USFS completed a Motor Vehicle Use Map Project, Decision Notice, and Finding of No Significant Impact for the Three Rivers Ranger District in 2009, which officially designates routes open to motor vehicle use. A motor vehicle use map for the entire Ranger District, established in support of this effort, became effective on January 1, 2010.

3.11.3 Analysis Area

The analysis area for this section includes all lands within the Lake Creek watershed and focuses on the vicinity of the Troy Mine Permit Area.

3.11.4 Affected Environment

The Lake Creek watershed provides a wide variety of summer and winter recreational opportunities, which are defined in the USFS's Recreation Opportunity Spectrum (USFS 1986). Classifications include Primitive, Semiprimitive-Motorized, Semiprimitive Non-motorized, Roaded Natural, Rural, and Urban. All but the Urban classification are located within the Lake Creek watershed. Activities vary from backpacking within a roadless area to camping at a developed recreational site.

A large portion of the Scotchman Peaks Inventoried Roadless Area (IRA) (portions are also a proposed Wilderness Area) is located in the west-southwestern corner of the watershed. The Scotchman Peaks area is a popular regional recreational resource known for its scenic beauty. Popular activities include backpacking, fishing, hunting, and snowmobiling. Other popular areas for access and recreation include the Ross Creek drainage and the Spar Lake area, including little Spar Lake, Spar Peak, Hiatt Creek, and Spruce Lakes (KNF 2001).

The Willard-Lake Estelle IRA located along the west-northwestern edge of the Lake Creek watershed has six mountain lakes that provide camping and fishing opportunities, as well as good habitat for big-game animals (KNF 2001). The Cabinet Mountain Wilderness Area and the Cabinet Face West IRA dominate the eastern portion of the watershed and provide primarily primitive or wilderness experiences. Because Bull Lake is also a popular area for boating and water-based recreation, it receives heavy use from boaters, swimmers, campers, and anglers during the summer months.

3.11.4.1 Developed Recreation

Four developed recreation areas are located within the analysis area (**Figure 3-8**). These include Spar Lake Campground off NFSR 384 (Lake Creek Road), Dorr Skeels Campground off MT 56, Bad Medicine Campground off Ross Creek Cedars Road, and Ross Creek Picnic Area off NFSR 398 (Ross Creek Road) (KNF 2001).

- Spar Lake Campground is a small 12-unit campground and camphost site, adjacent to Spar Lake. A small boat ramp is located on site, and the campground is within a few miles of Spar Peak Trail (#324) and Little Spar Lake Trail (#143). Spar Lake Campground became a fee site in 2010.
- The Ross Creek Picnic Area, designated an official Scenic Area in 1960, is a day-use area providing access to about 100 acres of giant western redcedars. A 0.9-mile self-guided nature trail is located on site.
- Bad Medicine Campground is a 17-unit seasonal campground located on Bull Lake. A boat ramp is located on-site, and the campground is within about three miles of the Ross Creek Scenic Area.
- Dorr Skeels Campground is a seven-unit campground open year-round. The site provides a motorized boat ramp, swimming area, and picnicking, and is within about seven miles of the Ross Creek Scenic Area. Dorr Skeels Campground became a fee site in 2010.

3.11.4.2 Dispersed Recreation

KNF recently developed a motor vehicle use map (MVUM) (effective January 1, 2010) in support of the Travel Management Rule (36 CFR 212). The Three Rivers Ranger District (District) is responsible for implementing motorized plans developed for the analysis area. Based on information from the *Motor Vehicle Use Map Project, Decision Notice and Finding of No Significant Impact* (KNF 2009a), several key decisions have been made on motorized vehicle use designations in this area. Namely, approximately 500 miles of USFS roads within the District's jurisdiction are open to motor vehicle use. Moreover, the District allows 300 feet of cross country motor vehicle use off designated USFS roads for the purpose of dispersed camping as displayed in the MVUM, including NFSR 384 in and around the Permit Area. The District now also prohibits motorized use of all National Forest System trails and prohibits cross-country motor vehicle use on 42,000 acres of District land located in Idaho (excluding over-snow vehicles).

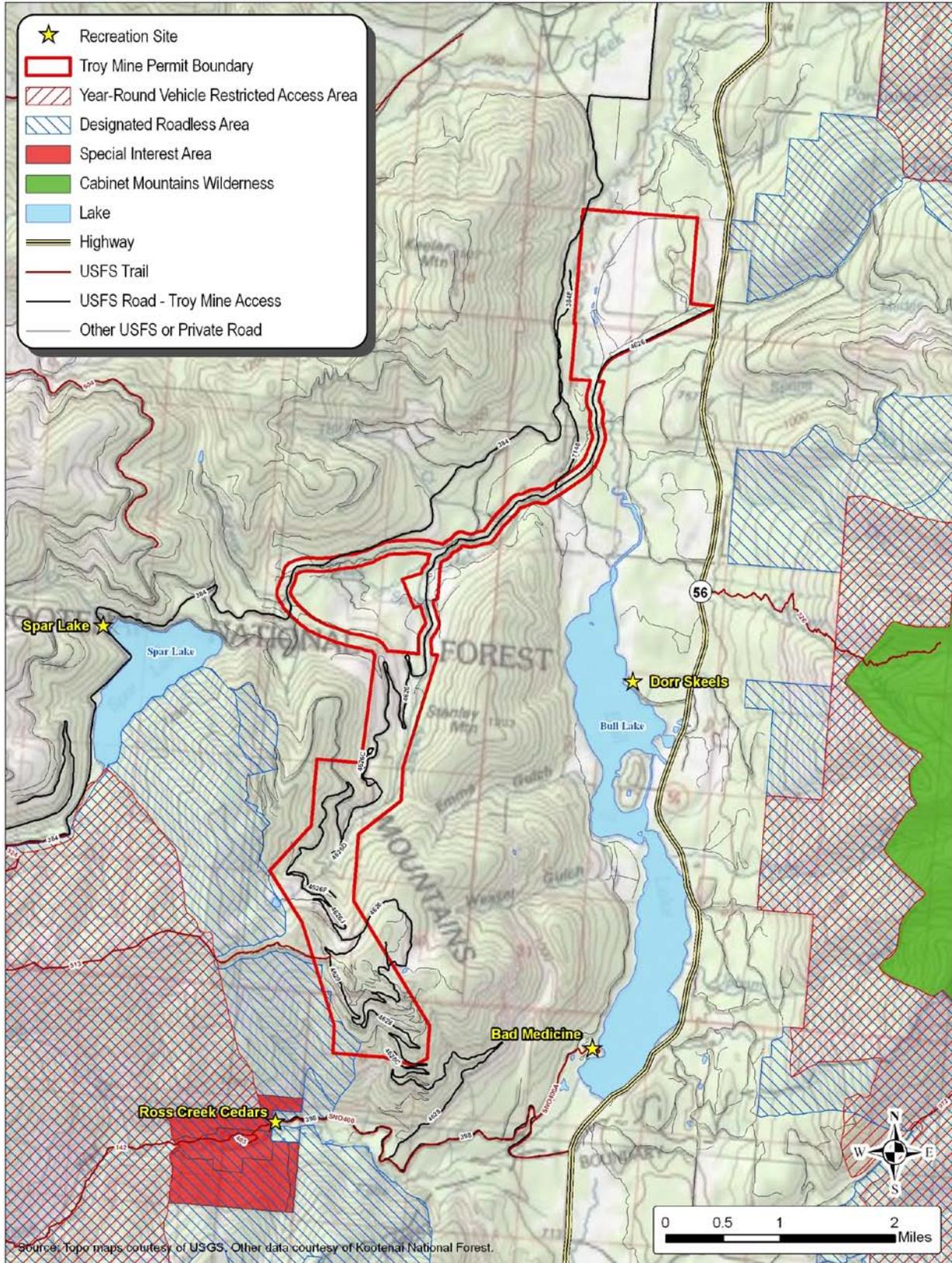


Figure 3-8. Recreation

Several National Forest System trails are located throughout the Lake Creek watershed, including Little Spar Lake Trail, Spar Peak Trail, Ross Creek Trail, South Fork Ross Creek Trail, and Spar Ridge Trail. Spruce Lakes is a fairly popular area among locals for hunting, horseback riding, and hiking. Keeler Creek Road NFSR 473 is used as a groomed snowmobile route from December to April. Other areas available for snowmobile use include the Spruce Lake area and areas around Spar Lake within the Hiatt Creek drainage (KNF 2001).

3.11.4.3 Special Uses

Two outfitters are permitted to operate in the watershed. One outfitter provides hunting and fishing services, including spring bear, fall archery, fall bear, fall general season, and mountain lion hunts. The other outfitter provides horseback rides, primarily in the Spruce Lakes area. The outfitters average about 220 service days per year in this area (KNF 2001).

3.11.4.4 Wilderness Areas/Inventoried Roadless Areas

The Cabinet Mountains Wilderness Area is the only official Wilderness Area in the KNF. Designated under the Wilderness Act of 1964, this 94,360-acre Wilderness Area includes the upper elevations of the east range of the Cabinet Mountains. Lake Creek watershed skirts the western edge of the Wilderness Area, and access is considered moderate to difficult due to steep and rugged topography.

In addition to the official Cabinet Mountains Wilderness Area, the 1987 Forest Plan identified a number of IRAs by name, number, and acreages. There are three IRAs within the analysis area including Scotchman Peaks #662, Willard-Lake Estelle #173, and Cabinet Face West #670. All planned management activities within these IRAs have maintained wilderness characteristics since the Forest Plan was signed in 1987, and all Forest Plan IRAs have since been validated through landscape assessments by using the Roadless Area Inventory Protocol developed in 1996 (KNF 2001).

Scotchman Peaks IRA #662

A large portion of the Scotchman Peaks IRA, confirmed at 54,433 acres on October 1, 1999, is located in the western portion of Lake Creek watershed, and skirts the boundary of the southwestern section of the Permit Area. The main drainages of this IRA include Ross, Spar, and Blue creeks. Large sections of this IRA are within MA 8, meaning it is designated as a proposed wilderness area in the 1987 Forest Plan.

The Scotchman Peaks area is popular for recreation including backpacking, fishing, hunting, berry picking, and snowmobiling. The area is scenic and rugged. Popular areas for access and recreation include the Ross Creek drainage and the Spar Lake area, which includes Little Spar Lake, Spar Peak, Hiatt Creek, and Spruce Lakes (KNF 2001).

Willard-Lake Estelle IRA #173

The western and northwestern corner of the Lake Creek watershed contains the 33,349-acre Willard-Lake Estelle IRA (validated September 30, 1999). Six mountain lakes are located in this area, providing a range of backcountry camping and fishing opportunities, as well as big-game hunting opportunities (KNF 2001).

Cabinet Face West IRA #670

The eastern-most portion of the Lake Creek watershed contains a portion of the Cabinet Face West IRA and includes most of the lands between the Cabinet Mountain Wilderness and MT 56. The validated acreage is 13,690 (October 1, 1999). This area has three hiking trails that access the IRA, but no developed recreational sites. The Cabinet Face West IRA is generally remote; although, its proximity to MT 56 (Bull Lake Highway) does influence the remote character of this area to some degree. Also, the Cabinet Face West IRA buffers the Cabinet Mountain Wilderness further to the east, providing a larger overall roadless area than what is officially designated as Wilderness. In addition, sections of this IRA are within MA 8, and it is designated as a proposed wilderness area in the 1987 Forest Plan (USFS 1987).

3.11.5 Environmental Consequences

The methods for assessing potential recreational resource impacts generally include analyzing each reclamation alternative according to how its location or associated activities will:

- Impact the recreational potential of area public lands with regard to disturbance, noise, and conflicting activities; or
- Modify access to recreational areas on public lands.

Potential impacts of each alternatives are discussed in further detail below.

3.11.5.1 No Action Alternative

Under the No Action Alternative, reclamation activities would follow the specifications of the 1978 Reclamation Plan at the time of final mine closure. NFSR 4626 would be maintained by KNF to provide recreational access to the Spar Lake and Mt. Vernon areas (see **Section 3.15** for a further discussion on roads). All other roads would be removed and reclaimed, pending approval of KNF. In general, the Troy Mine Permit Area would be revegetated to promote use by big game populations and the mill site area would be reopened to public non-motorized access.

There would be short-term (2-year) noise and activity-related disturbances to public lands in the vicinity of the Troy Mine Permit Area from reclamation activities (*e.g.*, heavy machinery during regrading and demolition operations). However, disturbance levels would be no greater in intensity or duration than during actual mine operation. They would be considered a minor, short-term negative impact when compared to 30 years of operational noise levels. Finally, over the long-term following reclamation, such disturbances would be largely be removed from the area.

Overall, under the No Action Alternative, reclamation would return pre-operational recreational access to public lands.

3.11.5.2 Proposed Action

Under the Proposed Action, the *2006 Revised Reclamation Plan* would be implemented and on-going. Future reclamation activities within the Permit Area would follow specifications of the updated plan. Similar to the No Action Alternative, reclamation activities should return pre-operational recreational access and use to public land in the vicinity of the Troy Mine Permit Area, a primary goal of the KNF

Forest Plan. Under the Proposed Action, reclamation activities would create short-term (2-year) disturbances. Any short-term negative impacts to recreation associated with reclamation activities would be minimal in comparison to operational impacts. There would be a long-term benefit of returning pre-operational access to public lands.

3.11.5.3 Agency-Mitigated Alternative

Under the Agency-Mitigated Alternative, the *2006 Revised Reclamation Plan* would be implemented and expanded to address those issues identified during the public scoping and agency review processes. Similar to the other alternatives, reclamation activities proposed under the Agency-Mitigated Alternative would return pre-operational recreational access and use of public land in the vicinity of the Troy Mine Permit Area, a primary goal of the KNF Forest Plan. Reclamation would have a greater chance of success than under either the No Action Alternative or the Proposed Action. Any short-term negative impacts to recreation associated with reclamation activities would be minimal in comparison both to operational impacts and to the long-term benefit of returning pre-operational recreational access to public lands.

3.11.5.4 Resource Impact Summary

The No Action Alternative, Proposed Action, and Agency-Mitigated Alternative should all return some pre-operational recreational use to the Troy Mine Permit Area. By closing the mine and reclaiming the land, a large local disturbance would be removed, and the land would be revegetated, thereby increasing the potential for big game hunting and recreational use of public lands. Return of recreational use is a prime land use objective of the KNF Forest Plan.

Overall, under all alternatives, reclamation of previously disturbed land would improve non-motorized recreational use and access for recreational use of the NFSL in the vicinity of the mine. However, landowners would still control access to private lands.

3.11.5.5 Effectiveness of Mitigation Measures

No mitigation measures have been identified regarding limits on the return of pre-operational levels of access and recreational use by the No Action Alternative, Proposed Action, or Agency-Mitigated Alternative.

3.11.5.6 Cumulative Effects

Implementation of the No Action Alternative, the Proposed Action, or the Agency-Mitigated Alternative would return public lands to pre-operational recreational uses locally within the Troy Mine Permit Area. No other past, present, or reasonably foreseeable future actions would affect recreational resources within the analysis area. Therefore, there would be no cumulative effect.

3.12 Socioeconomics

3.12.1 Introduction

This section describes the socioeconomic characteristics of the human environment and economic activity in Lincoln County, including demographics, employment, and income. It also identifies potential impacts to these resources and communities for each of the proposed reclamation alternatives.

3.12.2 Regulatory Framework

The federal regulatory framework for this section includes:

- Executive Order 12898, Federal Actions to Address Environmental Justice in Minority and Low Income Populations; and
- Executive Order 13045, Protection of Children from Environmental Health and Safety Risks.

Both of these executive orders ensure that federal actions identify and address any potential for disproportionately high or adverse effects to these populations. Although, no specific state regulations exist for this section, DEQ discloses socioeconomic effects to the human environment in its environmental documents.

3.12.3 Analysis Area

The analysis area for this section is Lincoln County, Montana.

3.12.4 Affected Environment

KNF occupies approximately 76 percent of the land base in Lincoln County where it plays a dominant economic role. The two largest private landowners in Lincoln County are Burlington Northern and Plum Creek Timber. Major population centers in Lincoln County include Eureka, Libby, and Troy.

3.12.4.1 Lincoln County Demographics, Income, and Employment

According to the U.S. Census data, Lincoln County experienced an approximate 8 percent increase in total population between 1990 and 2000 but is estimated to have had a 0.6 percent decrease between 2000 and 2009. This compares to an approximately 13 percent increase for the State of Montana between 1990 and 2000 and an estimated 8.1 percent increase between 2000 and 2009.

The civilian labor force grew over 20 percent in Montana between 1990 and 2000, but by less than 2 percent in Lincoln County over this same time frame. Lincoln County also experienced a slight decline in its labor force of nearly 1.5 percent between 2000 and 2009. Lincoln County's unemployment rate remained at 13.8 percent in 2000 as compared to a statewide average of 6.3 percent. This is higher than the statewide average, though somewhat lower than the county's 1990 unemployment rate of 16.1 percent. Based on more recent data from the Bureau of Labor Statistics, Lincoln County's unemployment rate averaged approximately 11.7 percent from June of 2009 to June of 2010.

Lincoln County's median household income levels have been consistently lower than the state average and have not kept pace with the statewide growth. Lincoln County's median household income

averaged \$26,754 in 2000 as compared to the statewide average of \$33,024, and averaged \$33,383 in 2008 as compared to a statewide average of \$43,948 that same year. **Table 3-16** provides a demographic and economic breakdown for both the State of Montana and Lincoln County based on available 1990, 2000, and 2009 U.S. Census and Bureau of Labor Statistics data.

Table 3-16. Selected Demographics, Income, and Employment

Characteristic	Montana			Lincoln County		
	1990	2000	2009	1990	2000	2009
Population	799,065	902,195	974,989	17,481	18,835	18,717
Civilian labor force	376,940	454,687	498,907	7,749	7,907	7,792
Percent Unemployment Rate	6.9%	6.3%	6.2%	16.1%	13.8%	11.7%*
Median household income **	\$22,988	\$33,024	\$43,948	\$20,898	\$26,754	\$33,383
Percent of persons below poverty level **	16.1%	14.6%	14.1%	14.1%	19.2%	20.1%

*Not seasonally adjusted

** Based on 2008 data

Sources: KNF 2004b; Census QuickFacts 2010, U.S. Bureau of Labor Statistics 2010

3.12.4.2 Troy Mine Employment/Expenditures

According to Revett Silver Company (parent company of Troy Mine, Inc.) information dated January 2010, Troy Mine had a payroll of approximately \$10.7 million in 2009. Average employee wages totaled approximately \$58,790 per year based on 182 total employees. Labor breakdown includes mine, mill, and general and administrative labor. This is well above Montana’s average wage of \$33,759; Lincoln County’s average wage of \$30,341; and Sanders County’s average wage of \$26,065 for that same year (Department of Labor and Industry, 2010a, 2010b, 2010c).

Revett’s 2009 Troy Mine expenditures topped \$29.1 million, approximately 80 percent of which was spent in Montana. Approximately 37 percent of expenditures were labor related, while 56 percent were supply related, and 5 percent were earmarked for mining and property taxes. Of the \$16.4 million in supplies purchased in 2009, about 60 percent were purchased in Montana (Erickson 2010).

3.12.4.3 Environmental Justice

Although poverty levels decreased in the State of Montana as a whole between 1990-2009, the percentage of Lincoln County’s population below the poverty line increased during this same time period. Namely, Lincoln County had just over 14 percent of its population below the poverty line in 1990, 19.2 percent in 2000, and 20.1 percent in 2009. This compares to 16.1 percent of Montana’s population below the poverty line in 1990 and to 14.1 percent in both 2000 and 2009.

While on average, both state and Lincoln County populations are aging, age classes vary somewhat. In 1990, Lincoln County had a slightly higher percentage of its population under 18 years of age as compared to Montana, a nearly identical percentage in 2000, but had a slightly lower percentage of its population under 18 estimated in 2009. In 2009, the State of Montana is estimated to have 22.5 percent of its population under 18, and Lincoln County is estimated to have only 19.9 percent under 18.

Compared to the national average, the State of Montana has a smaller minority population as a percentage of its total population. Moreover, Lincoln County has a smaller minority population as a percentage of its total population as compared to the State of Montana. The 2000 Census and estimates for 2009 showed that over 96 percent of Lincoln County is considered White as compared to just over 90 percent in Montana as a whole. **Table 3-17** provides a detailed breakdown of age and minority populations for Montana and Lincoln County.

Table 3-17. Montana and Lincoln County Age Classifications and Minority Populations

Characteristic	State of Montana			Lincoln County		
	1990*	2000*	2009	1990*	2000*	2009
Total population	799,065	902,195	974,989	17,481	18,837	18,717
Percentage below poverty line	16.1%	14.1%	14.1%	14.0%	19.2%	20.1%
Females	50.5%	50.2%	50.0%	49.8%	49.3%	49.4%
Age < 5	7.4%	6.1%	6.4%	7.2%	5.0%	5.0%
Age <18	27.8%	25.5%	22.5%	30.0%	25.4%	19.9%
Age 65+	13.3%	13.4%	14.6%	12.3%	15.2%	19.7%
White	92.7%	90.6%	90.3%	97.8%	96.1%	96.2%
Black	0.3%	0.3%	0.7%	0.1%	0.1%	0.2%
American Indian	6.0%	6.2%	6.4%	1.6%	1.2%	1.3%
Two or more races	n/a	1.70%	1.8%	n/a	1.9%	1.9%
Hispanic	1.50%	2.00%	3.1%	1.1%	1.4%	2.2%

* 1990 numbers are from 1989 and 2000 numbers are from 1999

** n/a=not available

Source: KNF 2000b; Census QuickFacts 2010

3.12.5 Environmental Consequences

In this section, project alternatives are evaluated to determine their potential impacts on the socioeconomic conditions of the analysis area.

Methods used to assess how the alternative would potentially impact socioeconomic resources generally include analyzing each alternative's potential, due to its location or associated activities, to:

- Change local and regional population levels or demographics;
- Change local and regional economies, labor forces, or incomes;
- Adversely impact minority or low income populations; or
- Adversely impact children.

In general, all three alternatives have an overall small, short-term effect on local and regional socioeconomic resources through reclamation-related job opportunities and associated economic stimulus. While the mine closure and the associated loss of jobs would result in negative impacts to socioeconomic resources in Lincoln County, this job loss would occur regardless of which alternative is selected and, therefore, is outside the scope of this analysis. Economic effects of mine closure will not be discussed further. None of the proposed reclamation alternatives would have any effect on population levels or on demographics; nor would they have any adverse impacts to minorities, low income populations, or to children. Therefore, these topics also will not be discussed further. Specific potential impacts of each of the alternatives are discussed below.

3.12.5.1 No Action Alternative

Under the No Action Alternative, reclamation activities would continue under the specifications of the 1978 Reclamation Plan at the time of final mine closure. Reclamation-related jobs, expenditures, and the related economic stimulus from these activities, which would likely be drawn at least partially from local or regional sources, would result in small short-term economic boosts to local and regional economies and populations.

No other socioeconomic resources are expected to be affected by this alternative, and no long-term (*e.g.*, post-reclamation) economic effects are anticipated.

3.12.5.2 Proposed Action

Under the Proposed Action, the 2006 Revised Reclamation Plan would be implemented, and reclamation activities on the Permit Area would follow the specifications of that updated plan. Similar to the No Action Alternative, a short-term, positive impact to local and regional economies would be expected from the Proposed Action. A long-term positive impact would occur under the Proposed Action due to on-going, long-term, post-reclamation water management and monitoring, but the level of economic growth due to this extension would be minimal in comparison to the levels during reclamation. The effects of the Proposed Action would be comparable to those of the No Action Alternative.

3.12.5.3 Agency-Mitigated Alternative

Under the Agency-Mitigated Alternative, the *2006 Revised Reclamation Plan* would be implemented and further expanded to address issues identified during the public scoping and agency review processes. The Agency-Mitigated Alternative would provide a small, short-term, positive effect to local and regional economies. The increased water management and monitoring activities proposed would provide a minimal economic benefit as compared to the other alternatives.

3.12.5.4 Resource Impact Summary

Overall, all three alternatives would provide a small net positive effect over the short-term to local and regional socioeconomic resources in the form of economic gains related to reclamation activities. However, the alternatives are different in the amount and duration of the long-term effect of water management and monitoring activities. The difference in scope of reclamation is not likely to result in differences in positive economic effects. Potential economic effects due to water management and monitoring activities would be lower than those of the reclamation activities and would be considered minimal. Thus, the positive socioeconomic effects of each alternative can largely be considered equal.

3.12.5.5 Effectiveness of Mitigation Measures

No mitigation measures would be required for socioeconomic resources due to the lack of anticipated negative impacts from any of the proposed alternatives.

3.12.5.6 Cumulative Effects

Cumulative and additive effects of reclamation activities at the Troy Mine with other past, present, and future actions in the analysis area are anticipated to be minimal as far as socioeconomic resources are concerned because of the minimal long-term effects associated with the three alternatives.

3.12.5.7 Regulatory Compliance

All three alternatives would be in compliance with Executive Order 12898 on environmental justice and Executive Order 13045 on the protection of children because no alternative would have any adverse impacts to minorities, low income populations, or to children.

3.13 Reclamation Materials

3.13.1 Introduction

This section characterizes the materials available for use as growth medium in reclaiming the Troy Mine area and identifies potential effects of using these resources under each of the alternatives. It also gives a brief overview of soil resources in the project area.

3.13.2 Regulatory Framework

Forest Service Guidelines

The Forest Service Manual (FSM) guidelines on soil management (FSM 2550) require that NFSL be managed to maintain or improve soil quality (USFS 2009a). The objective with reclamation of disturbed

sites is to restore soil function so that the disturbed areas can absorb and retain water, sustain appropriate native vegetation, and return to forest cover. Regional guidelines also suggest that organic matter retention should follow recommendations contained in Graham (1994) if specific local guidelines are not available.

Kootenai Forest Plan

The Forest Plan incorporates practices, as outlined in the Soil and Water Conservation Practices (SWCP) Handbook (FSH 2509.22), into all land uses and project plans as the principal mechanism for controlling non-point pollution sources, meeting soil and water quality goals, and protecting beneficial uses (USFS 1987). Although the Soil and Water Conservation Practices Handbook does not specifically address hard rock mining reclamation, it directs Forests to develop site-specific SWCPs based on project level evaluation. Examples of project-specific SWCPs or BMPs that could be implemented to protect soil productivity during reclamation include erosion control practices to limit sedimentation to surface water (*e.g.*, recontouring slopes to a stable angle so that vegetation could be re-established).

State Guidelines

The MMRA requires that lands disturbed by mining must be reclaimed such that the disturbed lands can meet the desired land use after mining. The desired future land use on NFSL within the permit area includes timber production, watershed protection, wildlife habitat enhancement, and recreation. The desired future land use at the tailings impoundment on private lands is timber production and wildlife habitat. The MMRA requires the Agencies to evaluate reclamation plans and to determine whether the plan achieves those land use goals. The MMRA also requires that reclaimed lands must be returned to a comparable state of stability and utility as the adjacent lands.

3.13.3 Analysis Area

The analysis area includes all disturbed Troy Mine lands that need to be reclaimed. These include roads used for drilling and other operations, utility and pipeline corridors, mill site, adits and portals, development rock areas, subsidence areas, the tailings impoundment, and the proposed borrow sites (**Figure 2-1** and **Figure 2-2**) (see also Genesis 2006, Table 2-1). Proposed reclamation resources include three types of growth media: rocky glacial materials in the mill pad area and the KNF borrow site; lacustrine and volcanic ash-derived soil materials salvaged from the tailings impoundment site and stockpiled between the tailings impoundment and Lake Creek; and glacial outwash borrow materials from east of the tailings impoundment. Reclamation activities that may result in off-site effects such as sediment delivery to surface waters are discussed in **Section 3.9**.

3.13.4 Affected Environment

The affected environment includes lands associated with the Troy Mine Permit Area that have been disturbed by over 30 years of mining. Development of the mine and related facilities have resulted in unavoidable impairment of land productivity on the sites that were physically disturbed by mining operations.

The reclamation materials in the project area are derived from a combination of glaciation, glaciofluvial deposits, and residual material weathered from the bedrock. Glacial till deposits in the area vary and can contain considerable fines (sands and silts), have subrounded to angular rock fragments, and can be dense enough to restrict root growth. Extensive water-influenced unconsolidated deposits of alluvium, lacustrine (glacial lake) materials, and glacial outwash are found in the valley bottoms. The entire area has a volcanic ash layer over the top of these materials. The soil stockpiled near the tailings impoundment contains lacustrine and volcanic ash-derived soil materials. Soils with this volcanic ash component have greater water retention potential and may result in greater revegetation success.

At the mine site, most reclamation materials would consist of rocky glacial growth medium stored in the mill pad. This material was removed from cut slopes in the mill area and placed in the mill pad for use after mining. The material has been covered with pavement for approximately 30 years. This rocky material includes soil, subsoil, and rocky geologic materials. Soil biological activity would be minimal because the material has been stockpiled and covered for 30 years. The water-holding capacity of the mill pad material would exceed that of the development rock, which was largely used to build the portal patios in the mine area. The organic matter content of material in this area would be minimal, and fertility of the mill pad material would be low.

The USFS borrow site could also be used to help reclaim the mine site disturbances. The borrow source contains rocky glacial materials similar to the mill pad material. Soil biological activity would be minimal, and the materials would include some noxious weed seeds, including rush skeletonweed, which is a state priority for control. The water-holding capacity of the USFS borrow material would exceed that of the development rock, which was largely used to build the portal patios in the mine area. The organic matter content of the borrow would be minimal, and fertility of the borrow material would also be low.

The soil stockpiles at the tailings impoundment contain mostly fine-grained lacustrine materials mixed with weathered volcanic ash that were stockpiled from the tailings impoundment footprint. They have been stockpiled for 30 years and would have minimal biological activity below the upper layer of soil that has been revegetated. The soil stockpiles have been covered with many species of noxious weeds for many years. Over the last few years, Genesis (now Troy Mine, Inc.) has been controlling noxious weeds on the piles by spraying, but the soil would still contain some noxious weed seeds. The water-holding capacity of the stockpiled materials is low but exceeds that of any other growth medium proposed to be used under any of the alternatives. The organic matter content in the stockpiled material would be minimal, and its fertility would also be minimal.

The glacial outwash borrow sites east of the impoundment footprint contain rocky materials that have been used to construct dikes which were used to separate cells in the impoundment, operational roads, and in reclamation test plots. This glacial outwash material would have little biological activity, and the borrow sites have been covered with noxious weeds for many years. Over the last few years, Genesis (now Troy Mine, Inc.) has been controlling noxious weeds by spraying, but the glacial outwash would still contain noxious weed seeds when used for reclamation. Moreover, the water-holding capacity of the borrow materials is low and varies with the rock content. The organic matter content would be minimal, and fertility of the material would also be low.

During mine operations the tailings have been seeded with barley and irrigated to control blowing dust. Many species of plants have also volunteered in the tailings over the 30-year operational period. Some of these plants have displayed yellowing due to a lack of nutrients as well as potential minor metal phytotoxicity.

Genesis (now Troy Mine, Inc.) reclaimed the 42-acre embankment of the tailings impoundment from 1995 to 1998 with an average of 18 inches of lacustrine and volcanic ash-derived soil materials salvaged from the area before the impoundment was built (DSL and KNF 1978, page 68). The starter dam is constructed of local sands and gravels and is 30 feet high. It has a 1.5H:1.0V slope on the upstream (interior) side and a 2.5H:1.0V slope on the downstream (outer) side. Above the starter dam, the embankment is constructed in 10-foot lifts of compacted tailings sands. This portion of the embankment has an overall downstream slope of 3.0H:1.0V, from the embankment crest to the crest of the starter dam (Knight Piesold, 2007). An upstream construction method was used to build the embankment, which means that the disturbance footprint from the embankment will always remain the same. Soil cover on some small areas of the embankment slopes has eroded enough to expose embankment tailings. However, the overall reclamation could be considered successful.

The embankment was planted with the seed mix described in the 1978 Reclamation Plan, which is dominated by introduced grasses. The embankment slopes are currently dominated by a mixture of introduced grasses (*e.g.*, hard fescue) and conifers. Monitoring in 1985 documented from 25 to 85 percent cover on the embankment slopes. Dominant species were timothy, smooth brome, and alsike clover (Genesis 2006, Appendix B, page 1). Since 1985, however, vegetation cover has deteriorated so that the slopes are currently dominated by hard fescue and spotted knapweed. The plants growing on the embankment do not display the yellowing evident in plants growing on raw tailings, an indication that the lacustrine and volcanic ash-derived soil cover materials are providing more nutrients than the tailings and are minimizing the amount of roots that are entering the raw tailings.

3.13.5 Environmental Consequences

Discussed below are potential impacts and benefits from using the various reclamation materials in the disturbance areas under each of the alternatives. The objective of reclamation is to restore soil function, which includes the ability to support a productive biological community, adequate hydrologic function, and nutrient cycling. All alternatives focus on reclamation activities, and there would be minimal “new” soil disturbance (*e.g.*, from road building, use of borrow sources, etc.).

3.13.5.1 No Action Alternative

Mine and Mill Site

To reclaim the mill and mine areas, stockpiled lacustrine and volcanic ash-derived soil materials from the tailings impoundment would be used to cover disturbed areas and to provide a growth medium for revegetation efforts. Approximately 43,560 cy of materials would be needed to reclaim the 27 acres of disturbed area with an average depth of 12 inches of growth medium.

These reclamation materials would be fine-grained and would have the highest water-holding capacity and cation exchange capacity of available reclamation materials. The No Action Alternative would use chemical fertilizer to enhance soil fertility instead of organic matter amendment. Organic matter amendments can increase water infiltration, soil biologic activity, water-holding capacity, or decrease potential soil compaction.. Nitrogen-fixing shrubs, such as alder, would be planted to enhance long-term soil quality.

The reclamation materials approved in the 1978 EIS are fine-grained materials susceptible to compaction (Genesis 2000) and subsequent surface erosion. Erosion risk would increase with compaction and with increasing slopes, particularly those greater than eight percent. The use of mulch as proposed could reduce erosion effects in some areas but would not reduce compaction. No methods to reduce compaction are included in the No Action Alternative. Erosion of reclamation materials would reduce soil quality by reducing soil productivity and stability in reclaimed areas.

As the angle-of-repose portal patios were formed, larger rocks naturally sorted out and rolled to the bottom of the slope, leaving the smaller rock fragments and any fines near the top. The lower slopes of the portal patios would largely not revegetate because they are too rocky and contain little material for plants to invade. They would resemble talus slopes over the long-term. The upper slopes would support some vegetation, including shrubs, trees, and spotted knapweed. These angle-of-repose slopes would not receive additional reclamation treatment under the No Action Alternative.

Overall, the No Action Alternative would apply reclamation materials that improve soil function enough to support vegetation. However, there may still remain issues with erosion of fine-grained soils that would not be stable on slopes over eight percent in the mine and mill area.

Impoundment Area

Reclamation of the tailings impoundment area would use lacustrine and volcanic ash-derived soil materials which are stockpiled between Lake Creek and the toe ponds. Approximately 766,600 cy of soil would be needed to cover approximately 324 acres of tailings impoundment disturbed area with 18 inches of soil (Genesis 2006, Table 4.1). The lacustrine and volcanic ash-derived soil materials were salvaged and stockpiled when the impoundment was originally built. Ninety percent of the stockpiled soil would be sufficient to provide the 18 inches of soil required under the No Action Alternative. These lacustrine and volcanic ash-derived soil materials are described in Section 3.13.4.

Reclamation materials would be placed on the impoundment by using rubber-tired vehicles. This method would compact these materials, and the No Action Alternative does not propose ripping to reduce this compaction. The materials have a low fertility, which would be addressed by applying chemical fertilizers. Although the materials have high erosion potential, the tailings impoundment surface is relatively flat with slopes between one and two percent, so water erosion would be minimal. Wind erosion would still remain an issue, but the No Action Alternative includes irrigation for one year to control blowing dust and to limit loss of growth material.

The No Action Alternative would not include an organic matter amendment to enhance water-holding capacity, infiltration, and soil productivity, or to decrease compaction. While the material would have

adequate productivity to support revegetation, the level of compaction and lack of organic matter would compromise soil function. The 18 inches of soil cover would minimize metal phytotoxicity effects from the tailings.

The lacustrine and volcanic ash-derived soil materials originally supported a productive forest before the impoundment area was disturbed. Tree cover would eventually return even with the presence of noxious weeds and other invasive weed plants, but long-term tree health and vigor would be reduced as compared to trees growing on undisturbed soil.

3.13.5.2 Proposed Action

Mine and Mill Site

The mine and mill site areas would be reclaimed by using rocky glacial material found within the mill and office/shop pads, the upper percolation pond embankment, old warehouse pad slope, or within the USFS borrow site in Section 24 (Genesis 2006, Table 4-1). Up to 12 inches of borrow material (32,400 cy for the mill and mine sites) would be placed on these areas. Regrading under the Proposed Action would include placement of development rock back into the adits, out-sloping the mill and office sites at six to seven percent, and regrading to control surface drainage (see Genesis 2006, Figures 4-2 and 4-3). Other work proposed under the Proposed Action would include burying demolition debris on site.

The rocky glacial growth media has a high coarse-fragment content (DSL and KNF 1978, page 90). It would improve infiltration and reduce compaction and erosion as compared to the lacustrine and volcanic ash-derived soil material proposed under the No Action Alternative. The Proposed Action would not include ripping of the portal patios or mill pad prior to placing growth media or ripping of compacted growth media prior to seeding. As a result, compaction could impair long-term productivity.

As in the No Action Alternative, the angle-of-repose portal patio slopes would not receive additional reclamation treatment and would remain as talus slopes. The adits would be backfilled with coarse rock and covered with an average of 12 inches of rocky glacial material as a growth medium.

The mill and office pads would be out-sloped to six to seven percent and capped with an average of 12 inches of rocky glacial material. The rocky glacial growth media is described in **Section 3.13.4** and would have decreased soil quality, a low water-holding capacity, and reduced productivity as compared to the fine-grained material used under the No Action Alternative.

The natural revegetation observed over the last 30 years on disturbed rocky glacial slopes in the vicinity of the mine indicates that soil function is adequate to support the gradual re-establishment of native forest vegetation. Therefore, using similar materials on reclaimed areas should produce similar results as long as the material is not excessively compacted in the process of placement. Reclamation of the mine and mill areas by using rocky glacial materials would have a lower erosion risk, and the soils would be more likely to stay in place as compared to the No Action Alternative, which would use fine-grained materials. The Proposed Action does not include an organic matter amendment to enhance soil productivity; therefore, soil function would be reduced, similar to the No Action Alternative. Overall, the rocky glacial material would provide better reclamation of the mine and mill areas than the fine-grained

material imported from the tailings impoundment area because of the lower erosion risk. However, under the Proposed Action, soil function would return more gradually than under the No Action Alternative.

No roads would be removed as part of the Proposed Action. The existing road beds would remain compacted and weed-infested, which would reduce long-term soil function on the 2.7 miles of road that would be treated under the No Action and Agency-Mitigated alternatives.

Impoundment Area

The Proposed Action would leave the stockpiled lacustrine and volcanic ash-derived soil materials in place. Glacial outwash borrow gravels would be used for the growth media from the borrow site east of the tailings impoundment. The glacial outwash gravels have no organic matter and a large and varying rock fragment content. Fertility is also low in this rocky glacial material.

The Proposed Action does not include the addition of an organic amendment for the glacial outwash gravels. Chemical fertilizers would be used to enhance the fertility of the growth medium. This treatment would provide a short-term boost, but no long-term fertility. As in the No Action Alternative, no ripping is proposed to reduce compaction of the replaced growth medium. As no ground disturbance would occur at the lacustrine and volcanic soil stockpiles, sediment delivery to Lake Creek and the toe ponds would be minimized.

Genesis (now Troy Mine, Inc.) has conducted reclamation test plots on the tailings impoundment in Cell 2. To test reclamation materials' potential for revegetation, 18 inches of the lacustrine and volcanic ash-derived soil material were placed in one plot, and 12 inches of glacial outwash borrow materials from a borrow source east of the impoundment were placed in another plot. Troy Mine, Inc. asserts that the glacial outwash materials produce better tree growth than do the lacustrine and volcanic ash-derived soils (Genesis 2006, page 2-3).

The results on the glacial outwash borrow materials are mixed. The glacial outwash has a large and variable coarse fragment content. Tree growth was faster on glacial outwash with adequate fines. If the glacial outwash was too rocky, plant growth, including noxious weeds, was limited. Trees did not grow as fast on the lacustrine and volcanic ash-derived soil materials because of competition with seeded grasses and noxious weeds. The finer-grained reclamation materials also exhibited more compaction which limited plant growth (Genesis 2006, Appendix 2, page 5). The Agencies concluded that the lacustrine and volcanic ash-derived soil materials produced adequate tree growth and had a higher density of plant cover and productivity from the introduced grasses in the seed mix. Noxious weeds were widespread on all reclamation materials until Genesis (now Troy Mine, Inc.) started a weed control program in 1999. None of the test plots revealed any of the yellowing of plants observed operationally on the raw tailings.

Based on observations of the tailings test plots (DEQ 2008a), some areas of the tailings impoundment would exhibit much slower plant growth for all species where the glacial outwash material contains excessive rock fragments. The glacial outwash materials have a low water-holding capacity, and plants

would have to depend more on rooting into the tailings material to procure adequate moisture for growth.

Before mining began, a productive forest existed on the lacustrine and volcanic ash-derived soil covered tailings impoundment footprint. The Proposed Action would not replace the stockpiled lacustrine and volcanic ash-derived soil material. However, using a glacial outwash material instead would result in gradual, but slower vegetative recovery. Native revegetation would also occur more slowly because the Proposed Action does not include ripping of compacted soils or adding an organic matter amendment. Fertilization and weed management in the Proposed Action are the same as in the No Action Alternative. **Section 3.16** describes revegetation efforts in greater detail.

The Proposed Action does not include patching the bare areas that currently exist on the reclaimed embankment slopes. Eventually, these bare spots would likely revegetate with a large component of noxious weeds and other aggressive weedy invasive species like cheatgrass.

3.13.5.3 Agency-Mitigated Alternative

Mine and Mill Site

The Agency-Mitigated Alternative for the mine and mill areas would use the same rocky, glacial-growth medium from the mill pad as the Proposed Action but with additional mitigations. To limit compaction, the Agency-Mitigated Alternative would require ripping before and after the growth medium is placed. Ripping would promote better infiltration, deeper root growth, more favorable soil structure, and would set the stage for better overall soil quality on the reclaimed surfaces.

An agency approved, wood-based, organic matter amendment such as wood waste compost would be tilled into the top 12 inches, so as to result in 1,100 lbs of nitrogen per acre (FHA 2007). This amendment would be required to be free of toxic levels of heavy metals, herbicide residues, and noxious weeds. This approach would stimulate biological productivity by favoring a fungus-based soil microbial community, which would favor tree growth. An agency-approved, wood-based, organic matter amendment would enhance reclamation success on the mine areas over both the No Action Alternative and the Proposed Action. The organic matter would increase infiltration, fertility, and the water-holding capacity of the rocky glacial materials, all of which would speed up soil development on the reclaimed areas.

If not enough reclamation material can be salvaged from the mill site, the rocky glacial outwash gravels from the tailings impoundment borrow sites would also be used. These rocky growth media have less risk of erosion on slopes over eight percent than do the finer-grained growth media used under the No Action Alternative. Twenty-five tons/acre of coarse woody debris (larger than three inches in diameter) would be scattered across the reclaimed areas at the mine portals and mill. All disturbed ground would be covered with an agency-approved mulch.

Soil testing would be required to identify fertilizer needs in the growth media. If a need for supplemental fertilization is indicated, slow-release organic fertilizers would be used rather than the chemical fertilizers proposed under the No Action Alternative and the Proposed Action. Chemical fertilizers provide a short-term nutrient flush, which favors weedy invasive species over native species.

The Agency-Mitigated Alternative would result in the passive decommissioning of 3.8 miles of road and the active decommissioning of 2.7 miles of road (**Figure 3-10**). Many roads used for drilling decades ago have revegetated and pose a low erosion risk to the watershed. These roads would be passively decommissioned and allowed to continue to revegetate naturally. However, long-term productivity on these roadbeds is expected to be reduced as compared to treated roadbeds. Road cuts and fills in the mine area have largely revegetated over the last 30 years with alders, conifers, shrubs, and with noxious weeds. Roads to be actively decommissioned would be treated as described in **Table 2-1**, and no additional growth medium would be applied. The only growth medium would be the native rocky glacial materials recovered in place. On roads that would be recontoured, specific measures would be required for clearing established vegetation and placement of organic material back on recontoured surfaces. This treatment would improve soil function and productivity of actively decommissioned roads.

As under the No Action Alternative and the Proposed Action, the angle-of-repose portal patio slopes would not be given additional reclamation treatment. The lower slopes of the portal patios would largely not revegetate because they are too rocky and contain little material for plants to invade. They would resemble talus slopes. However, the upper slopes would be able to support some vegetation including shrubs, trees, and spotted knapweed.

Impoundment Area

The Agency-Mitigated Alternative would use the lacustrine and volcanic ash-derived soil materials to reclaim the tailings impoundment area disturbance as in the No Action Alternative. These materials would be used because they would produce better soil quality and a more productive plant growth medium due to their larger water-holding capacity. The material proposed under this alternative would eventually produce a quality soil with a more productive forested plant community, even with the presence of noxious weeds.

The Agency-Mitigated Alternative would use up to 90 percent of the lacustrine and volcanic ash-derived soil material stockpiles between Lake Creek and the toe ponds. At least 10 percent of the lower slopes of the lacustrine and volcanic ash-derived soil material stockpile, which are currently vegetated, would be left to act as erosion control berms to prevent sediment delivery to Lake Creek and the toe ponds.

As at the mill site, an agency-approved, wood-based, noxious weed-free, organic matter amendment would be tilled into the lacustrine and volcanic ash-derived soil material to result in 1,100 lbs of nitrogen per acre in the upper six inches of the growth media. Soil testing and fertilizer requirements would be the same as listed above under the Agency-Mitigated Alternative for the mine and mill pad area.

3.13.5.4 Resource Impact Summary

All three alternatives would provide reclamation of disturbed sites. The growth medium replacement plans for the tailings impoundment under the No Action and Agency-Mitigated alternatives would produce the best long-term results in terms of soil quality and plant productivity. The necessary volume of soil already exists in the soil stockpiles, and the glacial outwash borrow materials would not be needed under either of these alternatives. No additional disturbance would occur in the glacial outwash borrow areas under these two alternatives. The Agency-Mitigated Alternative would use BMPs not

included in the No Action Alternative to minimize potential impacts of erosion to Lake Creek and to the toe ponds that could possibly result from use of stockpiled materials.

3.13.5.5 Effectiveness of Mitigation Measures

No additional mitigation measures would be required for use of reclamation materials in addition to those listed in the Agency-Mitigated Alternative. The Agency-Mitigated Alternative requirements are standard proven practices for successful reclamation, and the use of these practices at the Troy Mine would produce the desired soil quality and productivity over time. The Agency-Mitigated Alternative would also require appropriate soil testing to identify other amendments, such as organic fertilizer, that may be needed to increase soil quality and revegetation success.

3.13.5.6 Cumulative Effects

Cumulative and additive effects of reclamation materials used under any of the three reclamation alternatives would produce the long-term revegetation necessary to reduce erosion potential within the Stanley Creek, Ross Creek, and the upper Lake Creek sub-watersheds. The Agency-Mitigated Alternative would provide a more productive native plant community and better hydrologic function at the mine and mill site over a shorter period of time than would the No Action Alternative or the Proposed Action. Other past, present, and reasonably foreseeable future actions in the Lake Creek watershed would not add to cumulative soil quality effects.

3.13.5.7 Regulatory Compliance

FSM guidelines require that NFSL be managed to maintain or improve soil quality (USFS 2009a). The objective with reclamation of disturbed sites is to restore soil function so that the disturbed areas can absorb and retain water, sustain appropriate native vegetation, and return to forest cover. All three alternatives would meet these guidelines on NFSL. However, the Agency-Mitigated Alternative would restore soil function in a shorter period of time.

The No Action Alternative would not include specific SWCPs and therefore would not meet current Forest Plan guidelines on NFSL. Both the Proposed Action and Agency-Mitigated Alternative would have project-specific SWCPs; however, the Agency-Mitigated Alternative would meet current standards more effectively and would better provide for future soil productivity.

The MMRA requires the reclamation of all disturbed lands to comparable stability and utility as that of adjacent lands. Where practicable, soil materials from all disturbed areas must be stockpiled and used. The No Action and Agency-Mitigated alternatives would reclaim all mining lands to comparable stability and utility; however, the Agency-Mitigated Alternative would achieve these goals more effectively and would use the soil materials that were stockpiled prior to construction of the tailings impoundment. The Proposed Action would not produce comparable utility on the reclaimed tailings impoundment.

3.14 Sound

3.14.1 Introduction

This section analyzes potential effects from noise, which is defined as “unwanted sound” that can be intermittent, continuous, stationary, or transient. The noise levels heard by a human or an animal are dependent on several variables, including distance between the source and receiver, altitude, temperature, humidity, wind speed, terrain, and vegetation. In the context of protecting the public health and welfare, noise can have adverse effects on people and the environment. The analysis in this section is based on the 1974 EPA report (*Levels Document*) (EPA 1974) that examined levels of environmental noise necessary to protect public health and welfare and a 1979 complementary summary document (EPA 1979).

Human and animal perception of noise is affected by intensity, pitch, duration, and by the auditory system and physiology of the animal. Noise levels are typically measured in decibels (dBA). As a result of the Noise Control Act of 1972, EPA developed acceptable noise levels under various conditions that would protect public health and welfare with an adequate margin of safety. EPA's *Levels Document* indicates that outdoor day-night noise levels less than or equal to 55 dBA are sufficient to protect public health and welfare in residential areas and other places where quiet is a basis for use (EPA 1979). However, the EPA guidelines are not enforceable regulations.

In evaluating the potential for noise impacts, the operational noise levels are compared to reclamation noise levels. Generally, in quieter areas, a smaller increase in noise would result in an impact, while larger increases could occur in noisier areas before an impact would be noticed. Generally, people cannot detect a change in sound levels of less than 2-3 dBA.

3.14.2 Regulatory Framework

The EPA no longer has regulatory authority governing noise. Coordination of noise control activities ceased in 1981 when responsibilities were transferred to state and local governments. There are no federal, KNF, or Lincoln County noise regulations in place for the analysis area.

DEQ analyzes noise impacts in its environmental documents under MEPA.

3.14.3 Analysis Area

The analysis area for this section is the Lake Creek watershed, with a focus on the vicinity of the Troy Mine Permit Area and the surrounding areas that could be affected by reclamation activities, such as the subdivision near the tailings impoundment.

3.14.4 Affected Environment

The project area currently has sound levels characteristic of an operating mine and mill, including heavy machinery, mill equipment, and trucks hauling concentrate to Libby. At closure, the noise impacts would be related to demolition of facilities, regrading, and to hauling growth media. The effects of other sources of human sounds (*e.g.*, highway traffic) are low and normally less noticeable.

Much of the analysis area consists of rural and forested lands. Lands located in or near wilderness areas experience day-night noise levels as low as 30 to 40 dBA (EPA 1979). Noise contributors in forest or wilderness settings typically include wind, wildlife, flowing water, overhead aircraft, and the occasional human visitor.

Other noise sources in the analysis area include vehicles on road surfaces. In addition to mining-related activities, vehicles use roads in the analysis area for recreational purposes, timber management, or for access to private lands.

3.14.5 Environmental Consequences

In this section, the project alternatives are evaluated to determine their potential impacts on the existing sound conditions within the analysis area.

The methods for assessing potential noise impacts generally include analyzing each alternative's potential, due to its location or associated activities, to:

- Introduce new sounds above current levels to an area; or
- Increase the level or frequency of existing noise producers in an area.

The specific potential impacts of each of the alternatives are discussed below.

3.14.5.1 No Action Alternative

Under the No Action Alternative, reclamation activities would follow specifications of the 1978 Reclamation Plan at the time of final mine closure. During reclamation activities, existing mine infrastructure would be demolished and removed, adits would be sealed, disturbed areas would be regraded and revegetated, and roads on NFSL would be removed or returned to KNF for maintenance and management responsibilities (see **Sections 3.8, 3.15, and 3.16** for a further discussion on regrading, roads, and revegetation plans). During reclamation, a negative noise impact would be expected because of heavy equipment use for activities such as regrading and demolition of buildings and other infrastructure. Noise generation would be typical of construction activities (generally not considered an irritant beyond 500 feet per EPA guidelines), would last only the duration of reclamation activities (1-2 years), and would be at levels similar to historical averages during mining activities (*e.g.*, heavy machinery and milling). As such, the impacts at the mine and mill area would be minor and short-term in nature. At the impoundment, regrading and placement of growth media would increase the duration of noise levels over those currently experienced at the impoundment site. These impacts would be noticeable to local residents but would be minor and would last approximately 1 to 2 years.

After reclamation is complete, human-related activities on the site would drop both in scope and frequency and would approach pre-mine levels. The area would return to recreational use and management of vegetation and wildlife habitat, but with human disturbance, vehicular use, and related sound impacts at reduced levels. After reclamation, a long-term, but minor and positive impact would be expected on sound conditions within the vicinity of the Troy Mine Permit Area.

3.14.5.2 Proposed Action

Under the Proposed Action, the *2006 Revised Reclamation Plan* would be implemented so that on-going and future reclamation activities on the Troy Mine Permit Area would follow specifications of the updated plan. Under the Proposed Action, reclamation would be carried out and the Troy Mine Permit Area would be primarily used for passive water treatment and recreational purposes. The Proposed Action would demolish and remove or bury on-site all buildings and infrastructure. Pipelines used to transport mine water to the tailings impoundment for disposal would remain in place until water treatment is no longer needed and then be removed.

Other noise sources, such as vehicles on road surfaces, would also be minimized, as recreational use on the roads that remain in service would likely be less than the traffic generated by mine operations.

On private lands at the tailings impoundment, after reclamation and revegetation is completed, sound levels associated with passive water treatment and maintenance of mine water pipelines would continue but at a much lower level and frequency than current mine activities. Recreational use of the private lands would be restricted as during operations. Public access to private and patented lands after reclamation may be restricted to prevent vandalism to water treatment infrastructure such as the above ground mine water pipelines.

The Proposed Action would result in a short-term but minor negative impact on sound during reclamation activities because of heavy equipment and a long-term but minor positive impact on sound after reclamation because of reduced motorized and human-related activities.

3.14.5.3 Agency-Mitigated Alternative

Under the Agency-Mitigated Alternative, the *2006 Revised Reclamation Plan* would be implemented and expanded to address issues identified during the public scoping and agency review processes. Reclamation activities would be carried out, and the Troy Mine Permit Area would be primarily used for passive water treatment and recreational purposes. While there are differences between the reclamation plans of Proposed Action and the Agency-Mitigated Alternative, their impact on the sound environment of the analysis area would largely be the same.

Other noise sources, such as vehicles on road surfaces, would also be minimized. The Agency-Mitigated Alternative proposes to remove and reclaim select roads that are currently in use by mine personnel (see **Section 3.15** for a discussion of proposed road removal). Decommissioning of some roads would reduce vehicle access to certain areas, but mine closure would open up other areas to non-motorized recreational access. Recreational use on the roads that remain in service would likely be less than the traffic generated by mine operations and would result in less overall noise effects.

Overall, the Agency-Mitigated Alternative would result in a short-term minor negative impact related to sound during reclamation activities due to the use of heavy equipment. It would also result in a long-term minor positive impact related to sound after reclamation due to reduced motorized and human related activities.

3.14.5.4 Resource Impact Summary

In general, all three alternatives would result in a negative noise impact for a period of one to two years, due to the use of heavy equipment during reclamation. Each would also result in a minor long-term positive noise impact, due to a reduction in traffic and human visitation. Noise levels would not return to pre-mine conditions in any alternative.

3.14.5.5 Effectiveness of Mitigation Measures

Due to the low level of potential noise impacts, no mitigation measures have been identified. Standard best management procedures to reduce noise on heavy equipment (such as sound mufflers) would be used to minimize the potential for any sound-related impacts on surrounding areas and people (*e.g.*, local homeowners and recreationists) during reclamation activities.

3.14.5.6 Cumulative Effects

Cumulative or additive effects on noise levels as a result of implementing the Proposed Action or the Agency-Mitigated Alternative would include localized, long-term improvements over operational noise levels. Localized, long-term improvements would result from the decrease in noise levels because of reduced traffic and human visitation within the existing mine area following reclamation. There would be no negative cumulative effects on noise in combination with past, present, or reasonably foreseeable future actions in the analysis area.

3.15 Transportation

3.15.1 Introduction

Transportation relates to the movement of vehicles or people throughout a network of roads. This section of the EIS characterizes Troy Mine access roads within the Lake Creek watershed and identifies potential impacts to these resources under each of the proposed alternatives.

3.15.2 Regulatory Framework

The KNF Forest Plan outlines the following transportation-specific goals (USFS 1987, II-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;
- Provide access for fire protection where needed to meet management area goals;
- Maintain a balance of open and closed roads to continue present levels of motorized access;
- Ensure big game habitat security;
- Ensure grizzly bear security to meet recovery goals; and
- Reduce road maintenance costs.

In addition, the USFS issued the final NFSR Management Rule in January of 2001. This rule revises regulations on the management, use, and maintenance of the National Forest Transportation System. The final rule removes the emphasis on transportation development and adds a requirement for science-based transportation analysis. The KNF Three Rivers District published the *Roads Analysis Report: Mt. Vernon/Troy Mine* (hereafter called Roads Analysis Report) in 2004 (KNF 2008a) as a response to this 2001 rule.

In relation to private lands, FSM 2700, Chapter 2730.3 outlines USFS policy to grant adequate access across NFSL in accordance with 36 CFR 251, Subpart D, when no reasonable alternative exists across non-federal lands (36 CFR 251.110(g); 7/2001). An example of this would be when the private land is completely surrounded by NFSL. DEQ reviews road use and reclamation plans proposed in mine permit applications to ensure compliance with proposed post-reclamation land uses.

3.15.3 Analysis Area

The analysis area for this section is the upper Lake Creek watershed, with particular emphasis on all access roads associated with and adjacent to the Troy Mine Permit Area.

3.15.4 Affected Environment

The transportation system within the analysis area serves a variety of purposes and falls under a range of USFS, county, and private jurisdictions. Two primary activities that have taken place throughout this area include mining and timber harvesting. NFSR 4626 and spurs were constructed for timber harvesting and the remaining roads on NFSL and Revett/Troy Mine, Inc. patented property were primarily constructed for mining-related purposes (KNF 2004). The mining-related roads were mostly constructed in the 1960s on NFSL, and portions of this land were subsequently patented in 1977. When the patent was issued, the roads on the patented claims became privately owned. These private roads on patented claims are listed in **Table 2-1**. The USFS retained easements on NFSRs 4628, 4629, and 4551 across the patented ground. In addition, numerous private roads exist on Troy Mine, Inc. land at the tailings impoundment area. See **Figure 3-9** for an overview of the road system in the analysis area.

In addition to serving economic uses related to forestry and mining, the extent of a road network in an area can also influence both wildlife and the level of recreational access available. Roads can impact terrestrial habitats (*e.g.*, for grizzly bear) via direct habitat loss, as barriers to movement, through an increased potential for human-wildlife interactions, and through mortality. This particular analysis area is located within Bear Management Unit 3 (BMU 3) of the Cabinet-Yaak Ecosystem (CYE), which has been designated by the USFWS as a recovery zone for grizzly bears. See **Section 3.18** for more specific information on BMU 3. Roads can also adversely affect watershed conditions. Because of high precipitation, steep topography, and areas of unstable soils, road failures have occurred periodically in this area. Roads in the analysis area also play an important role in providing access for a variety of recreational pursuits that include hunting, fishing, driving for pleasure, berry picking, and wildlife watching (KNF 2004).

3.15.4.1 Troy Mine Permit Area and Vicinity

Within the Troy Mine Permit Area, NFSR 4626 serves as the main access road to the mine and is a main connection with other NFSRs (4605 and 384) that provide recreational access to Spar Lake. Ownership and maintenance jurisdiction of this road varies along its length. **Figure 3-9** depicts roads within the analysis area and shows the agency or private landowner with jurisdiction over each road.

Public access on NFSR 4626 is restricted with a gate at the mill site. South of the mill site, NFSR 4626 provides access to the North Portal and the Mt. Vernon road system. Continuing south past the mill site, NFSR 4626 intersects with NFSR 4829, which in turn intersects with NFSR 4828. From this point, NFSR 4828 connects with Ross Creek Road (NFSR 398), the major access route to the Ross Creek Scenic Area. NFSR 4828 is gated 0.28 miles from its junction with NFSR 398. Given current road restrictions and the gate located at M.P. 0.28 on NFSR 4828, public access on Mt. Vernon between Stanley and Ross creeks is only available to non-motorized users and is the only means by which to access the Spar Peak (#513) trailhead off NFSR 4829.

3.15.4.2 Troy Mine Access Roads/Permitted Roads

Access to the Troy Mine is from MT 56 onto NFSR 4626. The State of Montana granted a “driveway and approach” permit in 1978 to construct from the junction with MT 56 at M.P. 24.6.

The USFS has evaluated roads on NFSL for environmental risk through a roads analysis process. Factors considered include timber management, fire suppression, watershed protection, wildlife protection, and reduction in road maintenance costs. A more detailed discussion of specific road management category determinations can be found in the KNF’s 2004 Roads Analysis Report, Step 5 (KNF 2004), as well as in Appendix A and B of the Roads Analysis Report (KNF 2008a).

The following list describes some of the access roads within the Permit Area:

- NFSR 4551: This road is located near the top of the ridge west of Mt. Vernon and was built for exploratory drilling. The road is located both on patented land and on NFSL. The USFS has jurisdiction on this road and maintains it as access to Trail #513. The USFS would like to convert this road to a trail.
- NFSR 4624: This road spurs off of NFSR 4628 above the South Portal and was built for exploratory drilling. It is partially on patented land and partially on NFSL. A major debris torrent appears to have originated from this road. The USFS has no need for the road.
- NFSR 4624B: This spur off of 4624 is entirely on NFSL. It was built for exploratory drilling. The USFS has no need for this road.

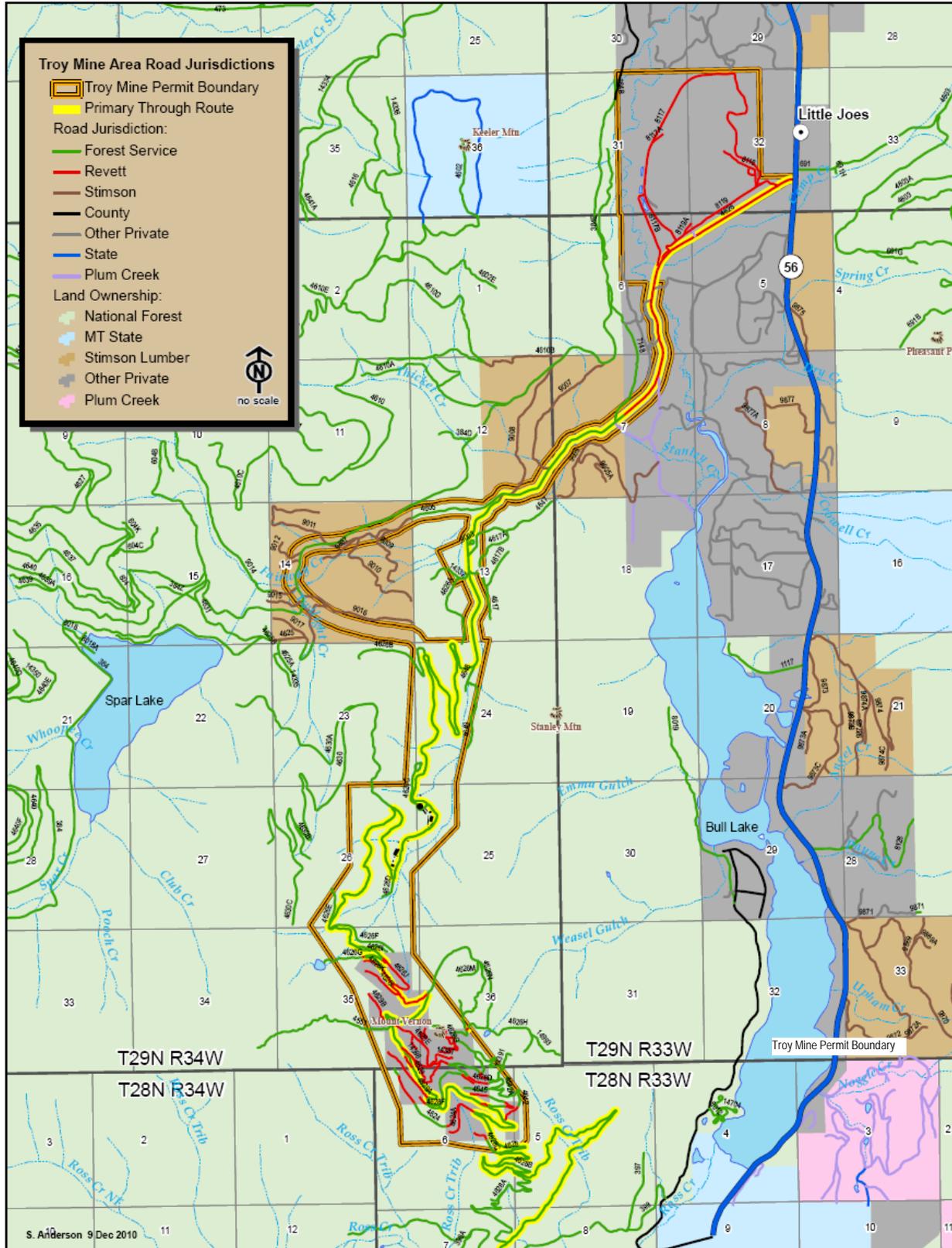


Figure 3-9. Road System in Analysis Area

- NFSR 4626: This is the main road up to the mine site (although public access is restricted through the mill site). It provides the only drivable access from the Stanley Creek drainage over to Ross Creek Road. According to the 2004 Mt. Vernon/Troy Mine Roads Analysis (KNF 2008a), this road currently presents a high risk to water quality in Stanley Creek due to mass failure potential, inadequate stream crossings, surface erosion, and snowplowing. Segments of the road are identified as a high risk to the watershed. BMPs were implemented in 2008 from the mill site to the junction with NFSR 4626F, but beyond the junction with NFSR 4626F, BMP work is needed to prevent sedimentation. Portions of this route on patented mine property do not currently have a USFS easement (public right-of-way). The USFS plans to continue to use this road for wildfire suppression on Mt. Vernon and expects that this route would serve as the primary access route to the patented land on Mt. Vernon.
- NFSR 4626C: This road provides access to percolation ponds maintained by the mine. The USFS has no need for this road.
- NFSR 4626D: This road provides access to a water storage tank at the mill site. It is a source of sediment to Stanley Creek from surface erosion. The USFS has no need for this road.
- NFSR 4626F: This road provides access to the North Portal and east and west ventilation adits. Raw cut slopes and surface runoff are a sediment concern. The road has an undersized 36-inch culvert on an intermittent tributary to Stanley Creek. The USFS has no need for this road.
- NFSR 4626G: This road spurs off of 4626 above the mill site and was built for exploratory drilling. The beginning of the road is on patented land, but the remainder is on NFSL. The outlet to a pond is partially intercepted by the road, and water runs down the road. The USFS has no need for this road.
- NFSR 4628: This road begins near Ross Creek on NFSR 398. It was originally built to provide access for exploratory drilling and adit development. It provides access to the south side of Mt. Vernon including the South Adit. The road is on both NFSL and patented land. USFS has jurisdiction on NFSR 4628 across the patented land. This road is subject to frequent rockfall and without regular maintenance would become impassable. The road has had previous mass failures and routes water and sediment down the road. The USFS plans to keep this road as long-term access for recreation and timber management.
- NFSR 4628A: This road is located south of the South Adit and was built for exploratory drilling and adit development. The road is entirely on NFSL. Troy Mine, Inc. has used this road for recent drilling operations, and it is currently gated. The USFS determined, in the Spar and Lake Subunits ROD, that this road would eventually be decommissioned and converted to a trail.
- NFSR 4628C/Revett: This route provides access to the South Adit and is partially on patented Revett property. The road routes runoff down to the South Adit. The USFS has no need for this road.
- NFSR 4629: This road lies almost entirely on patented Revett property on Mt. Vernon. It connects NFSR 4626 to NFSR 4628 and currently provides through-access from the mill site to the South Adit and to Ross Creek. This road is not needed by the USFS for motorized access but is desired as a route accessing Trail #513 by non-motorized recreationists. The USFS has jurisdiction on this road from NFSR 4628 to 4551.
- NFSR 4630A: This road is located in Twilight Creek to the west of the mill site, was built for exploratory drilling, and is on NFSL. The road has three stream crossings, one of which has previously failed. The USFS plans to keep this road for long-term access.

- NFSR 9003: This road was constructed to access the water-makeup pump station and surge pond. The road is on NFSL. The USFS has no need for this road.
- Other Mining-Related Roads on NFSL: These roads were constructed for exploratory drilling. The roads were reviewed and determined to have minor or no watershed concerns. The USFS has no need for these roads.
- Other Private Roads on Patented Land (listed in Table 2-1): These roads were primarily constructed for exploratory drilling. Some of them may have been constructed for timber harvest. These roads have not been evaluated for watershed risk.
- Other Private Roads on Troy Mine, Inc. Land: Roads are located on Troy Mine, Inc. land at the tailings impoundment (**Figure 3-9**). These roads are used to access the tailings impoundment.

3.15.5 Environmental Consequences

In this section, reclamation alternatives are evaluated to determine their potential impacts on the transportation resources within the analysis area. The issues considered include:

- Effects on road maintenance costs;
- Modifications of the road system; and
- Changes in access for recreational use.

The effects of the transportation system on wildlife are addressed in **Section 3.18**. The effects of the transportation system on watershed condition are addressed in **Section 3.9**. Depending upon the alternative chosen, certain access roads may be removed and the land reclaimed and revegetated, thus minimizing the impact and maintenance requirements of roads in the area. Specific potential impacts of each alternative are discussed below.

3.15.5.1 No Action Alternative

Under the No Action Alternative, reclamation activities would continue to follow specifications of the 1978 Reclamation Plan at the time of final mine closure. NFSR 4626 would no longer be restricted to public access through the mill site which would allow non-motorized access along NFSR 4626 to the patented land boundary. However, all other roads associated with the mining project would be removed and revegetated if approved by KNF. If KNF wants these additional roads to remain following completion of the mining project, then the maintenance of these roads would become the responsibility of KNF.

This analysis assumes that only the roads listed in **Table 2-1** would be reclaimed. There were no road reclamation details provided in the 1978 Plan. The gate currently situated at the mill site would remain in place, and motorized access would continue to be restricted beyond the gate in order to provide wildlife security. Over the snow vehicles would not be allowed.

The No Action Alternative would allow non-motorized recreational access through the mill site, decommission unneeded roads, and reduce road maintenance costs as a result of reducing the total miles of road. **Figure 3-10** illustrates roads after mine closure for the No Action Alternative.

Private roads on Troy Mine, Inc. land at the tailings impoundment were not addressed in the 1978 Reclamation Plan.

3.15.5.2 Proposed Action

Under the Proposed Action, the *2006 Revised Reclamation Plan* would be implemented, and on-going and future reclamation activities on the Permit Area would follow specifications of the updated plan. Similar to the No Action Alternative, the main access road (NFSR 4626) would remain open to the mill site with the paved portions remaining in place. Under the Proposed Action, the existing USFS roads would remain in place per USFS requirements (Genesis 2006, page 4-1). The Agencies interpret this to mean that no roads would be reclaimed at the time of closure. The gate currently situated at the mill site would remain in place, and motorized access would continue to be restricted beyond the gate in order to provide wildlife security. Over-the-snow vehicles would not be allowed.

The Proposed Action would allow non-motorized recreational access through the mill site. The Proposed Action would not decommission any roads and, therefore, would not reduce road maintenance costs associated with these roads. **Figure 3-11** illustrates roads after mine closure based on Exhibit F of the *2006 Revised Reclamation Plan*.

Private roads on Troy Mine, Inc. land at the tailings impoundment were not addressed in the Proposed Action.

3.15.5.3 Agency-Mitigated Alternative

Under the Agency-Mitigated Alternative, the roads identified in **Table 2-1** would be treated. The Agency-Mitigated Alternative would be similar to the No Action Alternative except for treatment of the road surface of NFSR 4626.

Under the Agency-Mitigated Alternative, the asphalt on NFSR 4626 would be pulverized and converted to gravel surfacing. This would reduce the long-term maintenance cost because paved surfaces deteriorate and are difficult to maintain over time. Also, any mine-associated guardrails or safety berms would be removed.

The Agency-Mitigated Alternative would allow non-motorized recreational access through the mill site, decommission unneeded roads, and reduce road maintenance costs as a result of reducing the total miles of road. The gate currently situated at the mill site would remain in place and motorized access would continue to be restricted beyond the gate in order to provide wildlife security. Over the snow vehicles would not be allowed. **Figure 3-10** illustrates disposition of the roads after mine closure for the No Action and Agency-Mitigated Alternatives.

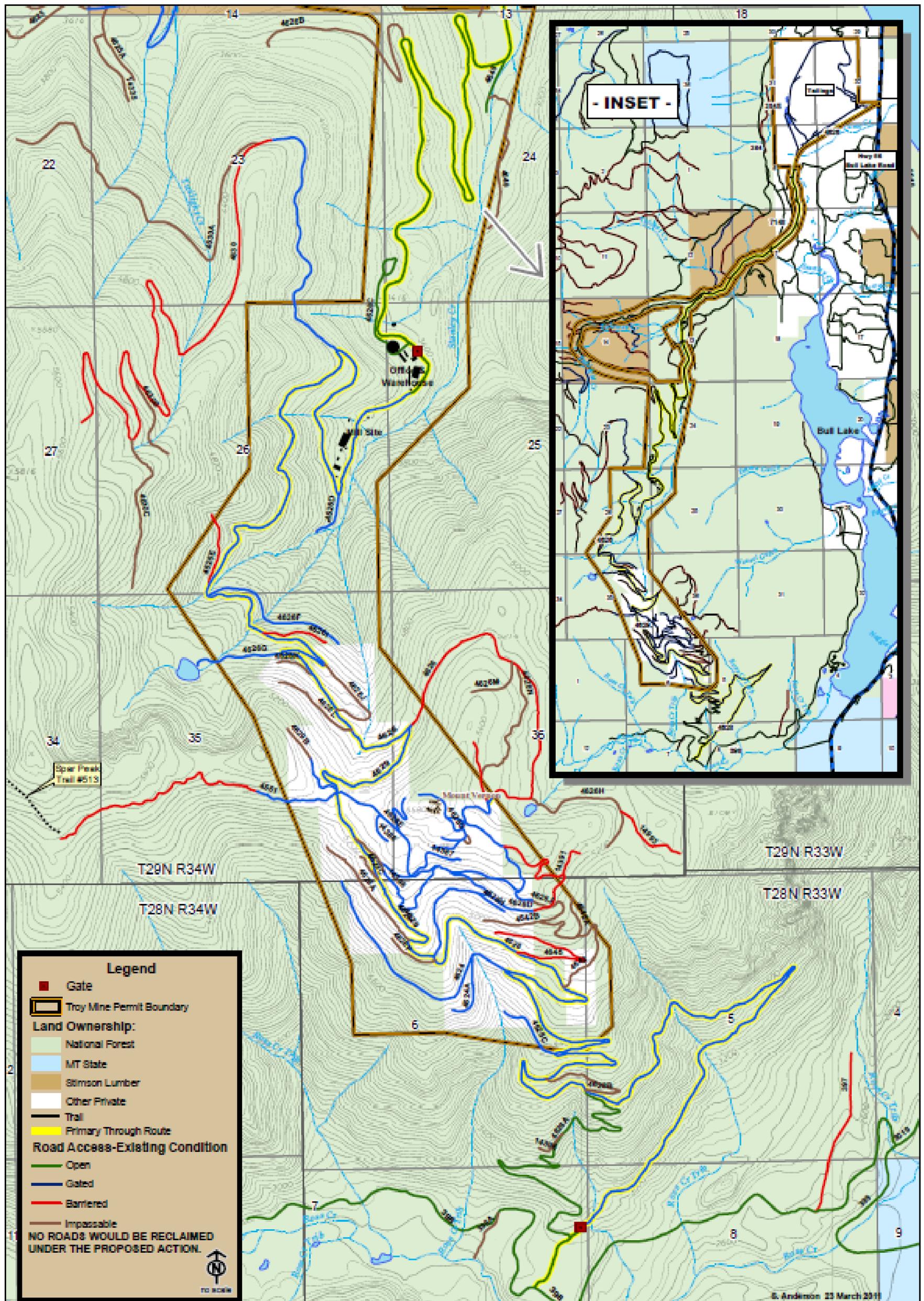


Figure 3-11. Road System Under the Proposed Action

Unneeded roads on NFSL would be removed from the NFSR system by either active or passive decommissioning. BMPs would be implemented as needed on roads where there are concerns about watershed impacts. This includes placing roads in intermittent stored service. NFSRs within the Troy Mine Permit Area would be handled as specified by USFS in the Roads Analysis Report – Troy Mine/Mt. Vernon (as Amended, March 2008) (KNF 2008a).

The Agency-Mitigated Alternative would decommission unneeded roads, reducing road maintenance costs. In addition, existing roads would be improved to USFS specifications, and improve long-term maintenance of NFSR 4626. Private roads on Troy Mine, Inc. property at the tailings impoundment would be field reviewed by the Agencies to decide if they are needed for post-mine land uses. Roads that are not needed would be ripped, covered with reclamation materials, and revegetated.

3.15.5.4 Resource Impact Summary

Under all three alternatives there would be a substantial reduction in traffic after reclamation activities are completed. This reduction in traffic would reduce road maintenance costs on local road networks.

The Proposed Action maintains the existing road system and related road maintenance costs. The No Action and Agency-Mitigated alternatives implement BMPs on 19.2 miles of road needed for long-term access (includes stored service work) and decommissions 6.5 miles of unneeded road, thereby reducing long-term road maintenance costs as compared to the Proposed Action. The Agency-Mitigated Alternative further reduces long-term road maintenance costs by replacing the 6 miles of paved surface on NFSR 4626 with gravel.

3.15.5.5 Effectiveness of Mitigation Measures

Under the Agency-Mitigated Alternative, mitigation measures applied to the transportation system would be standard USFS road specifications and standard BMPs. BMPs are periodically reviewed for effectiveness on NFSL roads.

3.15.5.6 Cumulative Effects

Under all three alternatives there would be a substantial reduction in traffic after reclamation activities are completed. This reduction in traffic would reduce road maintenance costs on roads that receive mine traffic. The No Action and Agency-Mitigated alternatives would further reduce long-term road maintenance costs by implementing BMPs, stored service work, and decommissioning. The No Action and Agency-Mitigated alternatives would permanently reduce the miles of NFSR on NFSL.

All alternatives would allow non-motorized access through the mill site which would improve general recreational access to the area. However, there is currently no legal public access across the patented land on the north side of Mt. Vernon, so public access to Trail #513 to Spar Peak would continue to be along NFSR 4628 and 4629 on the south side of Mt. Vernon.

In combination with other past, present, and reasonably foreseeable future actions, there would be no cumulative impacts from any of the alternatives.

3.16 Vegetation

3.16.1 Introduction

Implementation of the reclamation alternatives would produce few new disturbances; therefore, this section focuses primarily on reclamation, revegetation, and on noxious weed control. A discussion of proposed, threatened, endangered, and sensitive plant species is included, along with an up-to-date list of sensitive plant species known or expected to occur within the project vicinity. Effects to old growth forest are also addressed in this section. Potential impacts to these resources under each of the reclamation alternatives are evaluated.

3.16.2 Native Plant Species and Noxious Weeds

3.16.2.1 Regulatory Framework

The regulatory framework for this section includes:

- Forest Service Northern Region Native Plant Policy (FSM 2070.3);
- The Northern Region National Forest Service Manual (FSM) 2080 – Noxious Weed Management (USFS 2009a);
- KNF Invasive Plant Management Record of Decision (ROD) 2007 (KNF 2007);
- The Montana County Noxious Weed Control Law, as amended (7-22-2101 et seq., MCA);
- The State of Montana County Noxious Weed Management Act (7-22-2116, MCA) ;
- Executive Order 13112 of 1999;
- The Federal Noxious Weed Act of 1974;
- The Federal Insecticide Fungicide and Rodenticide Act (FIFRA) Public Law 92-516;
- The Carlson-Foley Act, Public Law 90-583 of 1968; and
- The MMRA and its implementing regulations.

A brief description of each of these regulations and guidelines follows.

FSM 2070: The Vegetation Ecology section of the FSM contains the Northern Region native plant policy and provides direction on revegetation with native plant species. The policy for selection, use, and storage of both native and non-native plant materials that are used in the revegetation, restoration, and rehabilitation of NFSL is as follows:

- Ensure that genetically appropriate native plant materials are given primary consideration;
- Restrict use of persistent, non-native, non-invasive plant materials to only those situations when timely re-establishment of a native plant community either through natural regeneration or with the use of native plant materials is not likely to occur;

- Select non-native plants as interim, non-persistent plant materials provided they will not hybridize with local species, will not permanently displace native species or offer serious long-term competition to the recovery of endemic plants, and are designed to help re-establish native plant communities;
- Base the determination and selection of genetically appropriate plant materials on site characteristics and ecological setting by using the best available information and plant materials;
- Ensure that development, review, and/or approval of revegetation, rehabilitation, and restoration prescriptions (including species selection, genetic heritage, growth stage, and any needed site preparation) is done by a plant materials specialist who is knowledgeable and trained or certified in the plant community type where the revegetation will occur;
- Do not use noxious weeds for revegetation, rehabilitation, and restoration projects;
- Cooperate and coordinate within USFS and with other federal agencies, organizations, and private industry in developing native plant materials and supplies; and
- Anticipate plant material needs for both emergency and planned revegetation and develop core plant lists, planting guidelines, plant material sources and seed caches, and seed storage facilities.

FSM 2080: Noxious Weed Management section directs KNF to use an integrated weed management approach to control and contain the spread of noxious weeds onto both NFSL and adjacent lands. Activities implementing the noxious weed management program must be consistent with the goals and objectives identified in Forest Land and Resource Management Plans.

KNF Invasive Plant Management Record of Decision (ROD) 2007 analyzed the use of herbicides for weed control on the KNF. Herbicide used on KNF for weed control must be completed in accordance with this decision or any subsequent weed management decisions for herbicide use.

The Montana County Noxious Weed Control Law states that designated noxious weeds must be managed consistent with certain weed management criteria; establishes weed management districts throughout the state; gives responsibility to county boards to develop and administer the weed district's noxious weed program; establishes management criteria for noxious weeds on all lands within the weed district; and makes all efforts to develop and implement a noxious weed program covering all land within the weed district owned or administered by a federal agency.

The State of Montana County Noxious Weed Management Act at 7-22-2116 states "it is unlawful for any person to permit any noxious weed to propagate or go to seed on the person's land, except that any person who adheres to the noxious weed management program of the person's weed management 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." KNF has entered into an agreement with Lincoln County in the form of a Memorandum of Understanding (MOU) which states that "the purpose of this agreement is to document the sharing of expenses and materials between USFS and the County to accomplish mutually beneficial objectives related to the control of invasive and noxious weeds on National Forest System lands and/or private lands" within specific provisions and in accordance with a Financial and Operating Plan.

Executive Order 13112 directs federal agencies to prevent the introduction of invasive species; detect and respond rapidly to and control populations of such species in a cost-effective and environmentally-sound manner; monitor invasive species populations accurately and reliably; provide for restoration of native species and habitat conditions in ecosystems that have been invaded; conduct research on invasive species and develop technologies to prevent introduction and provide for environmentally-sound control of invasive species; and to promote public education on invasive species and the means to address them. The agencies are not to authorize, fund, or carry out actions that are likely to cause or promote the introduction and spread of invasive species. All these actions are subject to the availability of appropriations.

The Federal Noxious Weed Act states that each federal agency shall establish and adequately fund an undesirable plants management program; complete and implement cooperative agreements with state agencies on the management of undesirable plant species on federal lands under the agency's jurisdiction; and establish an integrated management system to control or contain undesirable plant species targeted under cooperative agreements.

The Federal Insecticide Fungicide and Rodenticide Act requires all pesticides, including herbicides, to be registered with the EPA. It also states that it is unlawful to use any registered pesticide in a manner inconsistent with its labeling.

The Carlson-Foley Act authorizes and directs heads of federal departments and agencies to permit control of noxious plants by state and local governments on a reimbursement basis in connection with similar and acceptable weed control programs being carried out on adjacent non-federal land. In other words, this act permits county and state officials to manage noxious weeds with herbicides on federal lands and to be reimbursed for that management, provided that other applicable laws such as NEPA are also met.

The MMRA and its implementing regulations require reclamation to comparable stability (*i.e.*, non-erosive) and utility and that reclamation plans must produce the proposed post-mine land use. While the MMRA does not require planting native species, DEQ encourages the use of native species by its operating permit holders. DEQ also works with operating permit holders to ensure they have a weed control plan approved by the local county weed board.

3.16.2.2 Analysis Area

The analysis area for project impacts and cumulative effects is the Lake Creek watershed, which includes the Spar and Lake Planning Subunits (PSUs) (**Figure 3-12** in **Section 3.18**). A review of the larger planning subunits allows consideration of the presence and spread of noxious weeds and other invasive plants in the vicinity of the Troy Mine Operating Permit Area.

3.16.2.3 Affected Environment

Vegetation within the analysis area is representative of the surrounding landscape and is composed largely of native species-dominated forested plant communities. Both natural and human-caused disturbances have influenced species composition and forest structure and health. Historically,

disturbances related to wildfire and logging have influenced much of the existing vegetation communities. Other natural disturbance agents, such as pathogens (*e.g.*, blister rust) and insects (*e.g.*, bark beetles), also play an important role in forest structure and health. In the Troy Mine Permit Area, forested communities on disturbed lands have been removed, and approximately 504 acres have been disturbed to date (Genesis 2006, Table 2-1).

The original forested habitats were diverse mixtures of native species, but human activities introduced many non-native invasive species and noxious weeds into the surrounding plant communities. Approximately 131 acres have been reclaimed over the life of the mine, including 117 acres in the tailings impoundment area (Genesis 2006, Table 2-1). Seed mixes used in these reclaimed areas included a mixture of introduced grasses and forbs, and native trees and shrubs were planted. However, introduced noxious weeds and other invasive plants, as well as native grasses, forbs, shrubs, and tree species, have all volunteered from the surrounding plant communities. Overall, the reclaimed communities are less diverse than the undisturbed surrounding communities or the disturbed areas which were previously logged.

Operationally, Genesis (now Troy Mine, Inc.) has planted and irrigated barley on the relatively inert tailings surface as a cover crop to limit blowing dust. This barley has survived on the residual nitrogen in the tailings and in the mine water used to irrigate the tailings surface.

Many native and introduced species have volunteered on raw tailings over the years. These plants have shown some yellowing which indicates a lack of nitrogen and/or some potential metal phytotoxicity from residual metals in the tailings or mine water. Many native and introduced plant species have also volunteered on road cuts in native materials and mine development rock over the life of the mine. No yellowing of plants has been observed by DEQ on the road cuts in native materials or on mine development rock on the portal patios or slopes.

Noxious Weeds

A noxious weed is a non-native plant that threatens to invade sites where it has not previously occurred and that has the potential for eliminating or adversely affecting native flora and fauna. Noxious weeds in the vicinity of the Troy Mine Permit Area include spotted knapweed (*Centaurea maculosa*), meadow knapweed (*C. pratensis*), rush skeletonweed (*Chondrilla juncea*), oxeye daisy (*Chrysanthemum leucanthemum*), Canada thistle (*Cirsium arvense*), orange hawkweed (*Hieracium aurantiacum*), meadow hawkweed (*H. pratense*), common St. John's-wort (*Hypericum perforatum*), common tansy (*Tanacetum vulgare*), Dalmatian toadflax (*Linaria dalmatica*), tall buttercup (*Ranunculus acris*), and sulfur cinquefoil (*Potentilla recta*) (KNF 2010). Many of these weeds have been detected on roads and are largely associated with disturbed areas. Some have invaded into adjacent native plant communities.

Biological controls have been released in nearby areas outside of the Troy Mine Permit Area on the KNF for several species including spotted knapweed. Species released were sulphur knapweed moth (*Agapeta zoegana*), knapweed root weevil (*Cyphocleonus achates*), and the lesser knapweed flower weevil (*Larinus minutus*). Releases were made within the analysis area in 1999 and 2000. Effects of these releases are unknown. Since the time of these releases, the release area, which had been logged and

planted with trees, has grown into a pole timber stand with much of the spotted knapweed suppressed by the dense overstory. The biological control insects may have established and migrated to other areas, but whether this happened is unknown.

Another biological control agent, the seedhead fly (*Urophora affinis*), was earlier released, and has become established on the KNF and throughout Montana. It is reducing spotted knapweed seed production.

3.16.2.4 Environmental Consequences

The method for assessing potential vegetation impacts from new disturbances generally includes analyzing each alternative's potential, due to its location or associated activities, to:

- Remove or disturb natural vegetation communities; and
- Introduce or spread noxious weeds or other invasive species.

The method for assessing potential vegetation impacts from reclamation generally includes analyzing the potential of the revegetation plans within each alternative to:

- Comply with the Forest Service Native Plant Policy;
- Comply with KNF, Montana, and County Noxious Weed Laws;
- Comply with the MMRA requirement to produce comparable stability and utility for the post-mine land use; and
- Re-establish native species-dominated, diverse, productive plant communities.

No Action Alternative

Under the No Action Alternative, reclamation activities would follow specifications of the 1978 Reclamation Plan at the time of final mine closure. The lacustrine and volcanic ash-derived soil material stockpiles around the tailings impoundment would be used to reclaim the tailings impoundment and the mine area disturbances. These stockpiles contain 824,634 cy of soil. Approximately 766,600 cy would be needed to cover the 316 acres of the tailings impoundment surface with the approved 18 inches of material (Genesis 2006, Tables 2.1 and 4.1). No additional reclamation except noxious weed control would be conducted on the revegetated tailings embankment. Soil remaining in the stockpiles would be seeded with the introduced seed and native tree and shrub planting mix, which was approved in 1978, and left in the stockpile area.

The mine and mill areas on patented and unpatented claims on NFSL would be reclaimed with stockpiled lacustrine and volcanic ash-derived soil material stored at the tailings impoundment. The USFS borrow site near the mine would also be used to supplement growth medium as needed at the mine and mill areas. About 43,560 cy of growth medium would be needed to reclaim the 27 acres of disturbance in the mine and mill area and in the tailings pipeline and road corridor area (Genesis 2006, Table 4.1).

All of the proposed soil stockpiles and borrow areas contain noxious weeds and other invasive weed seeds that would complicate reclamation efforts. The stockpile materials contain large amounts of

noxious weed seeds in the previously revegetated upper layer. Genesis (now Troy Mine, Inc.) has been controlling weeds since 1999, but noxious weed seed is long-lived. As these materials are used in other portions of the reclamation area, noxious weed control efforts would need to continue. The 1978 Reclamation Plan does not specifically mention control of noxious weeds, but the No Action Alternative would include the current noxious weed control plan that was approved by Lincoln County and KNF.

The soil stockpiles have been in place for almost 30 years and lack organic matter and soil biological productivity. Both the USFS borrow site and the tailings impoundment area borrow sites are rocky glacial materials which have the same problems and also have a larger rock fragment content. No organic matter amendments to the growth medium are proposed in the 1978 Reclamation Plan. The stockpiled lacustrine and volcanic ash-derived soil material in the tailings impoundment area has a low water-holding capacity, but its water-holding capacity is greater than the rocky glacial materials.

Reclaimed areas would be seeded, planted, and fertilized the first growing season after facility removal and regrading of the area were accomplished. A single mixture of introduced grasses and legumes and native shrubs and trees would be used for all revegetation efforts. This seed mix would be composed of common, exotic, and herbaceous grass and forb species (including sweet clover) and a mix of native and non-native woody species. Many of the woody species proposed for revegetation are native and appropriate for the areas even though the seed source may not be local (from within the KNF area).

However, none of the proposed herbaceous species are native to the area, nor was the herbaceous seed mix developed to target specific habitats (*e.g.*, upland vs. wetland) that occur on areas to be reclaimed. The herbaceous seed mix under the No Action Alternative includes: timothy (*Phleum pratense*), hard fescue (*Festuca ovina*), orchard grass (*Dactylis glomerata*), bluegrass (*Poa* spp.), brome (*Bromus* spp.), and sweet clover (*Melilotus* spp.). Many of these exotic, non-native species have been planted historically on disturbed areas on NFSL because of the lack of native plant seed sources. The use of non-native species for reclamation of the Troy Mine disturbances would increase the presence of introduced species and reduce the potential for native plants to colonize reclaimed areas. Using this proposed species mix for revegetation, even though appropriate at the time of the 1978 Reclamation Plan, would not meet current Forest Service Northern Region Policy on use of native plant materials.

Some of the planted woody species would be purchased from woody plant suppliers, and the seed source may be from outside the KNF region. These materials would meet the KNF native plant policy because the policy allows for sources from outside the region to be used when local availability is limited.

Approximately 27 acres of the mill site, office/shop areas, and other smaller disturbed areas, such as the tailings pipeline and road corridors, would be revegetated with the approved mix of seed and tree seedlings. Revegetation of approximately 15 acres at portal patios slopes would not be included in the No Action Alternative, though limited tree planting occurred in this area between 1997 and 1999.

The tailings impoundment embankment was built with compacted sandy tailings. The embankment slopes are 2H:1V between the benches with the overall slope at 4H:1V. Forty-two acres of the embankment slopes and benches were revegetated between 1995 and 1998 by utilizing the 1978

Reclamation Plan, which included covering the embankment with an average of 18 inches of stockpiled lacustrine and volcanic ash-derived soil material and seeding with the introduced herbaceous seed mix included in that plan. The resulting revegetation is dominated by planted native tree species as well as by introduced seeded grasses (*e.g.*, hard fescue) and noxious weeds. The revegetated slopes have some bare spots where the tailings are exposed. The No Action Alternative would not provide any further revegetation on any of these slopes.

The No Action Alternative would revegetate disturbed lands, which on a broad scale, could be viewed as a positive impact on vegetation resources. Even though the reclaimed forested plant communities may eventually resemble surrounding undisturbed plant communities, the new plant communities would have both short- and long-term negative characteristics. While revegetation efforts conducted in the late 1990s under the guidance of the 1978 Reclamation Plan have successfully reintroduced vegetation to portions of the Troy Mine Permit Area, the No Action Alternative would not meet current laws and standards on NFSL in a number of key areas.

Potential negative effects to vegetation under the No Action Alternative include the further spread of noxious weeds. The No Action Alternative does not address control of noxious weeds, which have become established within the activity area. Management of noxious weeds is a standard requirement not only for modern vegetation planning in general but also for activities on the KNF per the FSM on Noxious Weed Management (FSM 2080) and state and county weed control laws. A noxious weed control plan has been approved by KNF and Lincoln County. Because Genesis (now Troy Mine, Inc.) has been controlling noxious weeds since 1999, noxious weed populations have declined in the control areas. However, one of the impacts of chemical weed control is the incidental loss of some native species in the control areas.

Of particular importance are two recent invaders to KNF, meadow knapweed and rush skeletonweed. Meadow knapweed is well established on the tailings impoundment, embankment, the area surrounding the toe ponds, and on the soil stockpiles west of the impoundment. Meadow knapweed is a high priority species to be controlled. The KNF borrow source has also been invaded by rush skeletonweed, a Priority 1B noxious weed in the State of Montana. KNF is currently attempting to eradicate rush skeletonweed from the NFSL. The No Action Alternative's proposed use of the KNF borrow source would likely establish this species in the mine, mill, and tailings pipeline and road corridor areas with both indirect and cumulative negative effects to the surrounding public and private lands.

The approved noxious weed control plan, which includes the use of certified weed-free seed stocks, monitoring revegetated areas for invasion, establishing forest communities to shade out existing weeds, using competitive cover crops, and using herbicides selectively, would continue as during operations.

Past revegetation efforts in the mine, mill, and tailings impoundment areas using the approved 1978 Reclamation Plan have produced non-eroding and productive stands of vegetation on all but the angle-of-repose portal patio slopes and bare areas on the tailings embankment. The portal patio slopes are composed of rocky materials that naturally sorted as they were formed by end-dumping over the slope. The upper portions that contain the most fines would eventually become dominated by native woody

vegetation and noxious weeds. The lower slopes would likely always appear as man-made talus slopes with little or no vegetation, with the possible exception of some shrubs, trees, and spotted knapweed. The eroded portions of the revegetated tailings embankment slopes may eventually stabilize, but the shallow soil areas would probably be dominated largely by undesirable plant species.

While the No Action Alternative would successfully revegetate the Troy Mine Permit Area with a productive, non-erosive stand of vegetation except on the angle-of-repose rocky portal patio slopes, it would not do so in a manner consistent with current standards and laws. As such, the No Action Alternative would not be a feasible alternative for revegetation on public lands. The No Action Alternative would produce a plant community with comparable stability and utility that meets the post-mine land use of timber production, wildlife habitat, and recreation under the MMRA. The loss of many native species would limit wildlife habitat on public and private lands for some species, and it would take several decades for a forest-dominated habitat to develop on reclaimed lands.

After several decades, the reclaimed plant communities in the mine and mill areas would likely be dominated by native woody species that would help shade out most noxious weeds. The diverse native plant communities that were originally present in the mine and mill area would not return in the long-term as a result of the competitiveness of aggressive, introduced, seeded species, and weedy invasive species. Native plant species would also be limited by herbicides used to control noxious weeds.

After several decades, the reclaimed productive plant communities in the tailings impoundment area would also be dominated by native woody species that would help shade out most noxious weeds. The diverse native plant communities that were originally present in the tailings impoundment area would also not return in the long-term on these private lands. Noxious weeds and other invasive weedy species would not be eradicated from any of the reclaimed areas, and new invader weed species would likely spread beyond the vicinity of the Troy Mine Permit Area. The loss of native plant species diversity and the continued presence of invasive weedy species, such as rush skeletonweed, would be an unavoidable adverse and irreversible impact under the No Action Alternative.

Proposed Action

Under the Proposed Action, the *2006 Revised Reclamation Plan* would be implemented, and on-going and future reclamation activities on the Troy Mine Permit Area would follow the specifications of the updated plan. Reclamation materials proposed for reclaiming disturbed areas would include both the USFS borrow site at the mine site and the glacial outwash borrow sites near the tailings impoundment. The lacustrine and volcanic ash-derived soil stockpiles near the tailings impoundment would be used only if other sources do not provide sufficient volumes.

About 766,600 cy of glacial outwash borrow materials would be needed to cover the 324 acres of tailings impoundment area disturbances with the approved 18 inches of growth medium (Genesis 2006, Tables 2.1 and 4.1). No additional reclamation except noxious weed control would be done on the tailings embankment. Approximately 16 new acres of private land would be disturbed to salvage, haul, and stockpile undisturbed soil from the borrow sites, to obtain the glacial outwash growth medium, to

regrade the borrow sites to 2H:1V slopes, and to cover the borrow sites with growth medium (Genesis 2006, Table 2.1).

The mine and mill areas would be reclaimed with growth medium from the USFS borrow site. The lacustrine and volcanic ash-derived soil material stockpile at the impoundment area would be used to supplement the growth medium needed at the mine and mill areas. About 32,400 cy of growth medium would be needed to reclaim the 35 acres of disturbance in the mine, mill, and the tailings pipeline and road corridor area. About one acre of new ground would be disturbed to obtain the growth medium needed and to reclaim the USFS borrow area (Genesis 2006, Table 2.1).

All proposed borrow areas contain noxious weeds and other invasive weed seeds that would complicate reclamation efforts. The reclamation borrow materials would contain fewer noxious weed species and seeds than the soil stockpiles near the impoundment. In particular, rush skeletonweed seed in the USFS borrow site would be spread throughout the area where that material is proposed to be used.

All reclamation materials would have the same problems with lack of organic matter, lack of soil biological productivity, and large coarse fragment content as described in the No Action Alternative. No organic matter amendments to growth media are included under the Proposed Action. The rocky glacial outwash borrow materials and the rocky growth medium approved for use for the mine and mill areas have an even lower water-holding capacity than the lacustrine and volcanic ash-derived soil materials stockpiled near the tailings impoundment. Rocky material would favor the growth and establishment of spotted knapweed.

Unlike the No Action Alternative, revegetation under the Proposed Action would be tailored to specific areas, with five different seed/planting mixtures of native grasses, legumes, shrubs, and trees proposed for site-specific use on the basis of pre-mine species occurrence, establishment potential, growth characteristics, borrow stabilization qualities, commercial availability, experience gained from previously completed reclamation activities, and post-mine land use objectives (Genesis 2006, Tables 6-1 and 6-2). Three upland mixes (grassland, low elevation forest, and upper elevation forest) plus two wetland mixes (herbaceous wetland and forested wetland) would be used, with a focus on native species within each species mix.

The seed mixes would be composed of native perennial herbaceous grass and forb species with a mix of native woody species. Many of the native plant species proposed to be seeded would be cultivars that are commercially available but that may not be native to the KNF area. While many of the species proposed for revegetation efforts are native and appropriate for the specific planting areas, the seed source may not be from the KNF region as noted in the No Action Alternative.

The use of native species for reclamation of the Troy Mine disturbances would increase the potential for native plant species to colonize the reclaimed areas. The use of native plant seed from outside KNF is largely an unavoidable consequence of needing to get large areas of disturbance seeded and reclaimed at one time to limit noxious weed invasion and to limit control efforts that use herbicides.

Reclaimed areas would be seeded, planted, and fertilized the first growing season after facility removal and regrading of the area was accomplished. Species would be planted by broadcast seeding, drilling, or hydroseeding processes, which would be based upon topography, rockiness, and on sub-site size. Seeding would be coordinated with other reclamation activities and would generally occur in the fall or early spring, dependent on weather.

Fertilizer would be applied (except within 200 feet of a perennial stream) to speed up growth. Mulching with unspecified materials would be used on steep slopes to minimize erosion. Annual ryegrass, a fast-growing introduced annual species, would be added in proposed forested areas to minimize the potential for soil erosion and invasion by noxious weeds while slower growing woody species take hold. Irrigation would also be used, if required, during the first growing season to promote stand development on the tailings impoundment surface.

Native woody species would be planted, transplanted, or allowed to invade naturally on the basis of sub-site size and characteristics. Large disturbed areas and the presence of aggressive invasive species limit the potential of natural colonization of native herbaceous and woody species.

The approved noxious weed control plan, which includes the use of certified weed-free seed stocks, monitoring of revegetated areas for invasion, the establishment of forest communities to shade out existing weeds, the use of competitive cover crops, and selective herbicide use, would continue as during operations. Finally, monitoring of revegetated sites would occur during the pre-closure and closure phases of the reclamation process, and if poor growth is noted, additional site remediation would occur.

Thirty-five acres of the mill site, office/shop areas, and other smaller disturbance areas that include the tailings pipeline and road corridors, would be revegetated with approved mixes of seed and tree seedlings (Genesis 2006, Table 2.1).

As under the No Action Alternative, the tailings impoundment embankment has already been reclaimed during operations and no further reclamation would be done under the Proposed Action. In addition, wetlands that have formed around the toe ponds installed at the base of the embankment would be maintained.

Test plots on the tailings impoundment surface were completed in Cell 2 by using 18 inches of stockpiled lacustrine and volcanic ash-derived soil material or by using 12 inches of rocky glacial outwash borrow from a borrow area east of the tailings impoundment (Genesis 2006). The test plots were seeded with the approved seed mix and planted with tree seedlings, and some conifers were transplanted from the borrow area with a loader. Test plot data show that the reclaimed plant community is largely dominated by seeded grass species (*e.g.*, hard fescue), planted conifers, and by transplanted native conifers. Genesis (now Troy Mine, Inc.) concluded that reclamation that used the rocky glacial borrow materials had better tree growth than stockpiled soils (Genesis 2006, page 2-6). The Agencies concluded that the glacial outwash borrow material has a large rock fragment content, and revegetation success was variable based on the rock content. The use of coarse borrow materials would also favor growth of spotted knapweed.

Except for the steep portal patio slopes, the Proposed Action would revegetate 359 acres of disturbed lands with mostly native plant species, which would have a positive impact on vegetation (Genesis 2006, Table 2.1). Revegetation efforts would be tailored to sub-site specific characteristics and would make both the short- and long-term stabilization and growth of previously disturbed lands more likely. Based on the range of elevations and habitats, from sub-alpine to high meadows and wetlands, using a variety of seed mixtures would make the initial and on-going success of efforts much more likely than if a single plan and seed mixture were used site-wide as in the No Action Alternative. In addition, the use of mostly native species would produce a more natural reintegration of the planted areas with the surrounding vegetation mosaic once regrowth has occurred. The likelihood of both sub-site and site-wide revegetation success would be high given the flexibility of the revegetation plan under the Proposed Action, which includes multiple seed mixtures, site preparations, seeding plans, mulching and ground cover schemes, weed control, varying potential for fertilizer and irrigation use, and the short-term monitoring of revegetated areas.

Many of the herbaceous and woody species proposed for revegetation efforts are native and appropriate for reclamation use even though the seed source may not be from the KNF region. Revegetation on unpatented claims in the mine, mill, and tailings pipeline and road corridor areas would meet current Forest Service Northern Region Policy on using native plant materials on public lands.

Potential negative effects to vegetation from noxious weed invasion and spread would be minimized under the Proposed Action. Due to the presence of many noxious weed species on the Troy Mine Permit Area, both short-term management of existing populations and long-term management to minimize their spread would be needed for any reclamation effort to be considered successful.

Management of noxious weeds under the Proposed Action would also comply with the FSM on Noxious Weed Management (FSM 2080) and with state and county weed control laws. Noxious weed populations would continue to decline in the control areas. However, the use of chemical herbicides would continue to produce incidental loss of some native species in the control areas. Under the Proposed Action, the use of certified weed-free seed stocks and the long-term application of herbicides to the proposed borrow sources prior to redistribution would combine to limit the potential spread of weed populations during revegetation activities. In general, existing populations of noxious weeds would be controlled from spreading, and new populations would be minimized under the Proposed Action. However, noxious weeds would not be eradicated from any of the reclaimed areas.

The meadow knapweed on the tailings impoundment, embankment, and on the area surrounding the toe ponds would most likely persist despite control efforts. Use of the USFS borrow source would potentially establish rush skeletonweed in the mine, mill, and tailings pipeline and road corridor areas with negative indirect and cumulative effects to the surrounding public and private lands.

The Proposed Action would likely be successful in revegetating the Troy Mine Permit Area with a productive non-erosive stand of mostly native vegetation except on the angle-of-repose rocky portal patio slopes. The Proposed Action would do so in a manner consistent with current standards and laws, and therefore, it would be a feasible alternative for revegetation on public lands.

As in the No Action Alternative, the Proposed Action would reclaim plant communities in the mine, mill, and tailings impoundment areas. These areas would be dominated by native woody species that would help shade out most noxious weeds after several decades. The diverse native plant communities that were originally present in these areas would not return in the long term even though native species would dominate the seed and planting mixtures. This would be caused by the competitiveness of aggressive introduced weedy invasive species and by the indirect impacts of the weed control program.

Overall, noxious weeds and other invasive weedy species would not be eradicated from any of the reclaimed areas. The loss of native species diversity and the presence of invasive weedy species on all disturbed areas would be unavoidable adverse and irreversible impacts of disturbance under the Proposed Action.

The Proposed Action would produce a plant community with comparable stability (*i.e.*, non-erosive) and utility that meets the post-mine land use of timber production, wildlife habitat, and recreation under the MMRA. The loss of many native species would limit wildlife habitat for some species, and it would take several decades for a forested habitat to develop on the reclaimed lands. The forested community on the tailings impoundment would not likely be as productive as the forested community under the No Action Alternative because of the low water-holding capacity in the glacial outwash materials that would be used for a growth medium.

In summary, the Proposed Action would minimize some of the potential short- and long-term negative effects on vegetation resources. Previously disturbed sites would be revegetated with mostly native species and would blend somewhat with the surrounding plant communities. Noxious weeds would be largely controlled and eventually reduced by shading from trees. There would be minimal additional impacts to existing vegetation communities.

However, even with efforts to comply with KNF native plant standards on public lands under the Proposed Action and even with new plant communities being dominated by native tree species, the original diverse native plant communities would not return on public and private lands in the long-term. Noxious weeds would not be eradicated from the reclaimed areas, and rush skeletonweed would be spread with potential effects beyond the vicinity of the Troy Mine Permit Area.

Agency-Mitigated Alternative

Under the Agency-Mitigated Alternative, the *2006 Revised Reclamation Plan* would be implemented and expanded to address issues identified during the public scoping and the Agencies' review processes. Reclamation materials proposed for use at the mine and mill areas would be salvaged rocky glacial materials stored in the mill pad at the mine site. If the mill and mine sites do not contain enough material, reclamation materials would be supplemented with the rocky, glacial outwash gravels taken from the borrow sites east of the tailings impoundment.

At the tailings impoundment, the fine-textured lacustrine and volcanic ash-derived soil materials in the stockpiles would be used on private lands, regardless of the weed seed content, because of their larger water-holding capacity. No new disturbance would take place under the Agency-Mitigated Alternative. Tailings areas that had been previously reclaimed with glacial outwash borrow materials would be

reclaimed again by using the lacustrine and volcanic ash-derived soil materials unless it could be documented that the majority of the reclaimed area contained a productive, native species-dominated community with no meadow knapweed. The same volume of growth medium would be needed to reclaim the tailings impoundment as in the No Action Alternative, and the same number of acres would be covered.

In the Agency-Mitigated Alternative, the revegetated slopes of the tailings embankment would be inspected, and any bare areas where the tailings are exposed would be recovered with lacustrine and volcanic ash-derived soil materials and replanted. The seed mix proposed under the Proposed Action for the tailings impoundment surface would be used. The amount of soil needed to reclaim bare spots on the embankment would be minimal in comparison to the volume needed to reclaim the 324 acres of disturbance in the tailings impoundment area.

The Agency-Mitigated Alternative would include a plan to minimize destruction of the revegetated plant community on the lower outer slopes of the lacustrine and volcanic ash-derived soil materials stockpiles in order to limit potential sediment impacts to Lake Creek and the toe ponds. Most of the undisturbed, revegetated outer stockpile slopes would be left as a berm to prevent storm water runoff from the disturbed internal portions of the stockpile from leaving the stockpile area. Portions of the slopes that would have to be disturbed to haul soil would use BMPs such as water bars to limit potential sediment impacts to Lake Creek and to the toe ponds.

The Agency-Mitigated Alternative includes adding an agency-approved, wood-based, organic amendment in the top six inches of reclamation materials at the tailings impoundment, and in the top 12 inches of reclamation materials at the mine portals, and mill site. Approximately 1,100 lbs/acre of organic nitrogen would be added to the growth medium. This organic matter addition would benefit revegetation efforts by increasing both the nutrient levels and the moisture holding capacity in the soils. Use of a wood-based organic matter would increase the establishment potential of fungus-based, soil microbe communities which, in turn, would favor forested plant community establishment. Adding organic matter would also improve the soil water-holding capacity of the reclamation materials. The Agency-Mitigated Alternative would use mychorrizal inoculum appropriate to the plant species being established at the mine and mill site. A cover of mulch would be applied over the disturbed ground to help retain moisture and to prevent erosion. The benefit of adding organic matter is that it helps establish desirable native vegetation through increasing moisture available to plants.

The coarse growth medium used at the mine and mill areas amended with organic matter would have a higher water-holding capacity and would help native species establish and compete with weeds that may be present.

The USFS borrow source, which has been infested with rush skeletonweed, would not be used in any reclamation efforts to prevent the spread of this species. As in the No Action Alternative, the lacustrine and volcanic ash-derived soil materials used for tailings impoundment reclamation would contain many noxious weed species and seeds. Weeds would be controlled by the approved weed control plan. Spot weed control would be important in the first few years of post-reclamation but, if not done correctly,

would eliminate many desirable forb species as well as native trees and shrubs. Indiscriminant weed control with chemicals could also kill many volunteering native forb species and favor other weedy invasive species like cheatgrass.

Test plots on the tailings impoundment surface were covered by either 18 inches of stockpiled lacustrine and volcanic ash-derived soil material or by 12 inches of rocky glacial outwash borrow from a borrow area east of the tailings impoundment (Genesis 2006). In these test plots, the borrow materials and especially the finer-grained soil from the stockpiles were compacted in the construction of the test plots as well as during planting and watering (Genesis 2006, Appendix B, page 5). The Agencies concluded that the use of 18 inches of lacustrine and volcanic ash-derived soil materials would eventually produce a more productive forested plant community if the fine-grained materials were not compacted, which would limit root penetration.

If Cell 2 is not redisturbed during operations, the Agencies would have to review the reclaimed test areas for compliance with the reclamation plan under the Agency-Mitigated Alternative (**Section 2.5.2.2**). Areas reclaimed with glacial outwash borrow materials would not comply with the approved reclamation plan and would have to be redone with the approved lacustrine and volcanic ash-derived soil materials from the stockpiles. All reclamation materials used as part of the Agency-Mitigated Alternative would be mechanically treated (*e.g.*, ripping) to reduce compaction after placement. This approach would avoid the compaction problems observed on the reclaimed tailings test plots during operations.

Under the Agency-Mitigated Alternative, the length and scope of proposed revegetation monitoring would be increased, with on-going monitoring proposed until the bond is released, and a proposed final field review by the participating Agencies to determine if further effort would be required.

Changes to the reclamation plan under the Agency-Mitigated Alternative would increase the potential success of the revegetation efforts beyond those expected from implementation of the *2006 Revised Reclamation Plan* under the Proposed Action. These changes include the use of the stockpiled lacustrine and volcanic ash-derived soil materials at the tailings impoundment with its larger water-holding capacity, increased soil organic matter content by using a wood-based organic amendment to stimulate soil microbe community development in all reclamation materials, mechanical treatments to reduce compaction, and the proposed extended post-reclamation monitoring.

As in the other alternatives, the Agency-Mitigated Alternative would revegetate disturbed lands, which would have a positive impact on vegetation resources. Previously disturbed sites would be revegetated with mostly native species by using the same seed and planting mixes as in the Proposed Action. The only difference in the seed and planting mixtures would be that the Agency-Mitigated Alternative would require Troy Mine, Inc. to try to obtain local seed and planting stock that originated in the KNF region. Reclaimed forested plant communities would eventually blend somewhat with the surrounding plant communities. Noxious weeds would be largely controlled and eventually reduced by shading from the trees. As under the No Action Alternative, use of borrow sites would be minimized as a way to minimize additional impacts to existing vegetative communities in the borrow sites. As with the other

alternatives, new plant communities would be dominated by native tree species that would help shade out most noxious weeds over time. Even with the proposed improvements to the revegetation plan to comply with KNF native plant standards, the original, diverse native plant communities that existed pre-mine would not return in the long-term on public and private lands. Noxious weeds and other invasive weedy species would not be eradicated from any of the reclaimed areas. These are largely unavoidable impacts of mine disturbance.

3.16.2.5 Resource Impact Summary

Overall, while all three alternatives would meet the minimum objective of revegetating previously disturbed land, the No Action Alternative would not sufficiently meet current standards on public lands, and thus would be considered not feasible as far as revegetation is concerned.

The Proposed Action and Agency-Mitigated Alternative would produce plant communities with comparable stability and utility that meet the post-mine land use of timber production, wildlife habitat, and recreation under the MMRA. The loss of many native species would limit wildlife habitat for some species, and it would take several decades for a forested habitat to develop on the reclaimed lands.

The Proposed Action and the Agency-Mitigated Alternative would reclaim the disturbed areas to productive, native-species dominated plant communities, which on a broad scale would be viewed as a positive result for vegetation resources. Both the Proposed Action and the Agency-Mitigated Alternative would minimize short- and long-term negative effects to the site and to regional vegetation by reclaiming previously disturbed land back to a more natural vegetated state. But the Proposed Action would spread rush skeletonweed through the use of material from the USFS borrow source. In all alternatives, diverse native plant communities would not be fully re-established, and noxious weeds would not be completely eradicated. Thus, noxious weeds would have the potential to continue to spread into surrounding natural areas.

There would be little new disturbance from implementing the reclamation alternatives. In general, all three alternatives would revegetate areas that have been disturbed for over 30 years. Land that was disturbed for the development of the mine and associated facilities when mining began in the 1970s would be covered with a growth medium to promote vegetation and would be reseeded or planted, thereby returning the land to a more natural, mostly vegetated state. Even though most of the site would eventually become reforested, the diverse native plant communities that were originally present would never fully re-establish.

3.16.2.6 Effectiveness of Mitigation Measures

No additional mitigation measures, beyond those included in the Agency-Mitigated Alternative (*e.g.*, organic matter amendment, etc.) would be required for revegetation. Regardless of these additional revegetation measures, noxious weeds would not be eradicated and the diverse native species that existed in the original plant communities would not return. The No Action Alternative is not practicable as discussed in other sections.

3.16.2.7 Cumulative Effects

No Action Alternative

While the No Action Alternative would reclaim the mine permit area, the use of non-native, aggressive species such as sweet clover would be detrimental to native species within the permit area and potentially beyond. In spite of continued weed control, using reclamation materials from the USFS borrow area and introduced species for revegetation ensures that the No Action Alternative would result in a disturbed landscape that is dominated by introduced herbaceous grasses and by invasive weedy species and noxious weeds, including both well-established and new invader species.

Proposed Action and Agency-Mitigated Alternative

As a result of implementing the Proposed Action or Agency-Mitigated Alternative reclamation plans, cumulative or additive effects on regional vegetation resources would include revegetation of disturbed lands with native species and continued noxious weed control, which eventually would produce forested plant communities that resemble surrounding undisturbed lands. Revegetation and noxious weed control would minimize the potential spread of noxious weeds into surrounding natural areas. Regardless of weed control efforts, noxious weeds and other weedy invasive species would continue to spread in the area as a result of other past, present, and reasonably foreseeable future actions as well as a result of the competitiveness of the weedy species. Intact native plant communities would continue to decrease in the watershed as new disturbances occur and as noxious weeds and other aggressive introduced species spread. The Proposed Action would facilitate the spread of rush skeletonweed throughout and likely beyond the mine permit area, but the Agency-Mitigated Alternative would avoid this effect by using reclamation materials not contaminated with rush skeletonweed.

3.16.2.8 Regulatory Compliance

Because the No Action Alternative includes planting of non-native species, it would not comply with the Forest Service Northern Region Native Plant Policy. Use of the USFS borrow source (which contains rush skeletonweed, a new invader weed species) under both the No Action Alternative and the Proposed Action would not comply with the KNF noxious weed MOU with Lincoln County. The No Action Alternative would use the lacustrine and volcanic ash-derived soil materials from near the tailings impoundment to reclaim the mine and mill areas. However, another new invader species, meadow knapweed, is found in those materials. Use of these reclamation materials on NFSL under the No Action Alternative would not comply with the KNF noxious weed MOU with Lincoln County.

The Agency-Mitigated Alternative would better comply with the regulatory framework because it would not use the USFS borrow area containing rush skeletonweed and would limit the use of lacustrine and volcanic ash-derived soil material containing meadow knapweed to private lands. In the Proposed Action and Agency-Mitigated Alternative, the use of native plant materials would comply with the Forest Service Northern Region Native Plant Policy.

3.16.3 Proposed, Threatened, Endangered, and Sensitive Plants

3.16.3.1 Regulatory Framework

The regulatory framework for this section includes:

- Forest Service Sensitive Species Policy (FSM 2670.32);
- Endangered Species Act (ESA) of 1973;
- The National Forest Management Act (NFMA) (36 CFR 219.19);
- The KNF Forest Plan of 1987; and
- Montana Natural Heritage Program.

Forest Service Sensitive Species Policy: FSM 2670.32 provides guidance to KNF on management of sensitive species with the objective of ensuring that sensitive species do not become threatened or endangered through USFS actions. To implement this objective, the policy directs Regional Foresters to identify sensitive species found within each region. Actions that could affect sensitive species must be analyzed, avoided, and minimized as much as possible while maintaining species viability.

The **ESA** 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 requires federal agencies to ensure that any agency action (any action authorized, funded, or carried out by the agency) would not likely 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.

The **NFMA** directs the USFS to manage habitat so that it maintains viable populations of existing native and desired non-native plant species. Forest Service Manual (FSM) 2670.22 requires the maintenance of viable populations of native and desired non-native plant species and avoidance of actions that may cause a species to become threatened or endangered. A viable population is defined as one that has the estimated numbers and distribution of reproductive individuals needed to ensure its continued existence and that is well-distributed throughout the planning area and KNF.

Sensitive species are administratively designated by the Regional Forester (FSM 2670.44) and managed under the authority of NFMA. FSM 2670.5 defines sensitive species as “those plant and animal species identified by a Regional Forester for which population viability is a concern, as evidenced by:

- a. Significant current or predicted downward trends in population numbers or density; and
- b. Significant current or predicted downward trends in habitat capability that would reduce a species' existing distribution.”

The **KNF Forest Plan** establishes forest-wide 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 (USFS 1987, II-1).

DEQ has no direct regulatory control over sensitive species but evaluates potential effects on sensitive species listed by the Montana Natural Heritage Program and attempts to limit impacts to those species.

3.16.3.2 Analysis Area

The analysis area for project impacts and cumulative effects is the Lake Creek watershed, which includes the Spar and Lake PSUs (**Figure 3-12** in **Section 3.18**). Activities would only take place in the vicinity of the Troy Mine Permit Area. Review of the larger planning subunits allows consideration of plant species known to occur in the vicinity of the project area that may have higher potential to be present within the impacted area.

3.16.3.3 Affected Environment

No endangered plant species are known or suspected to occur on KNF. Additionally, no populations of threatened plant species are known to occur; however, two threatened species, water howellia (*Howellia aquatilis*) and Spalding's catchfly (*Silene spaldingii*) are suspected to occur on KNF. "Suspected" means that the species has the potential to occur, but has not been observed on KNF to date. Of the 52 threatened and sensitive plant species known or suspected on KNF, seven sensitive species are known to occur, and five additional sensitive species are believed to have potential to occur in the vicinity of the project area within the Spar and Lake Planning Subunits. However, none of these species are suspected to occur within the Troy Mine Permit Area. These 12 plant species plus *Howellia aquatilis*, and *Silene spaldingii*, are listed on **Table 3-18** (KNF 2010).

The Spar and Lake PSUs contain one population of *Botrychium pedunculatum* (stalked moonwort), seven populations of *Clarkia rhomboidea* (diamond Clarkia), one population of *Dryopteris cristata* (crested shield-fern), two populations of *Heterocodon rariflorum* (western pearl-flower), three populations of *Lomatium geyeri* (Geyer's biscuit-root), one population of *Mimulus breviflorus* (short-flowered monkeyflower), and two populations of *Phegopteris connectilis* (northern beech fern).

Table 3-18. Threatened and Sensitive Plant Species

Species	Habitat	Conclusion	Justification
Threatened Species			
<i>Howellia aquatilis</i> (water howellia)	Glacial ponds and river oxbows that dry in late summer	No Effect	No habitat in activity area
<i>Silene spaldingii</i> (Spalding's catchfly)	Palouse Prairie grassland	No Effect	No habitat in activity area
Sensitive Species			
<i>Botrychium ascendens</i> (upward-lobed moonwort)	Roadsides	No Impact	Activities occur in disturbed areas not likely to provide habitat for this species. Species is not known to occur within the project area.
<i>Botrychium crenulatum</i> (wavy moonwort)	Riparian forests, open wet meadows, and roadsides	No Impact	Activities occur in disturbed areas not likely to provide habitat for this species. Species is not known to occur within the project area.
<i>Botrychium hesperium</i> (western moonwort)	Snow fields, moist road ditches, meadows and grasslands in the montane zone	No Impact	Activities occur in disturbed areas not likely to provide habitat for this species. Species is not known to occur within the project area.
<i>Botrychium paradoxum</i> (peculiar moonwort)	Mature western redcedar stands or grasslands and meadows	No Impact	Activities occur in disturbed areas not likely to provide habitat for this species. Species is not known to occur within the project area.
<i>Botrychium pedunculatum</i> (stalked moonwort)	Old growth western redcedar in floodplains and meadows	No Impact	Activities occur in disturbed areas not likely to provide habitat for this species. Known population in analysis area is protected.

Species	Habitat	Conclusion	Justification
<i>Clarkia rhomboidea</i> (diamond Clarkia)	Submaritime bedrock meadows and open ponderosa pine forest	May Impact*	Activities occur in disturbed areas not likely to provide habitat for this species. Known populations in analysis area are protected.
<i>Corydalis sempervirens</i> (pink corydalis)	Post-fire plant communities and forest openings	No Impact	Activities occur in disturbed areas not likely to provide habitat for this species. Species is not known to occur within the project area.
<i>Dryopteris cristata</i> (crested shield-fern)	Riparian forests and open wet meadows	No Impact	Activities occur in disturbed areas not likely to provide habitat for this species. Known population in analysis area is protected.
<i>Heterocodon rariflorum</i> (western pearl-flower)	Road shoulders, open soil areas near talus slopes, and submaritime bedrock meadows	May Impact*	Activities occur in disturbed areas not likely to provide habitat for this species. Known populations in analysis area are protected.
<i>Lomatium geyeri</i> (Geyer's biscuit-root)	Rock outcrops and submaritime bedrock meadows	No Impact	Activities occur in disturbed areas not likely to provide habitat for this species. Known populations in analysis area are protected.
<i>Mimulus breviflorus</i> (short-flower monkeyflower)	Rock outcrops and submaritime bedrock meadows	May Impact*	Activities occur in disturbed areas not likely to provide habitat for this species. Known populations in analysis area are protected.
<i>Phegopteris connectilis</i> (northern beech fern)	Moist old growth, riparian areas, stream edges, and weeping walls	No Impact	Activities occur in disturbed areas not likely to provide habitat for this species. Known populations in analysis area are protected.

May Impact* = May impact individuals or habitat but will not likely contribute to a trend towards federal listing or cause a loss of viability to the population or species.

3.16.3.4 Environmental Consequences

The method for assessing potential vegetation impacts generally includes analyzing each alternative's potential, due to its location or associated activities, to remove or disturb threatened, endangered, or sensitive species, or their habitat.

There would be little new disturbance as a result of implementation of any of the reclamation alternatives. In general, all three alternatives would revegetate areas that have been disturbed for over 30 years. Land that was largely stripped for the development of the mine and associated facilities in the 1970s would be covered with a growth medium to promote vegetation and then seeded or planted, thereby returning the land to a more natural vegetated state.

No Action Alternative

While the No Action Alternative would revegetate the Troy Mine Permit Area, there would be continuing weed control needed as during operations. Use of stockpiled soils either from the tailings impoundment or from the USFS borrow materials would spread meadow knapweed and rush skeletonweed. In addition, native species would not be used in the revegetation effort. While these actions would not have direct impacts to proposed, threatened, endangered, or sensitive plant species, the overall result would be an increase in noxious and invasive species within both the mine permit area and the surrounding areas. There may be indirect effects to sensitive plant species such as *Clarkia rhomboidea*, which occur on open dry hillsides in the analysis area and which could be impacted by the spread of spotted knapweed.

Proposed Action

The use of native species for revegetation, along with control of noxious weeds, would make the Proposed Action an improvement over the No Action Alternative. Because the Proposed Action would not use stockpiled soils from the tailings impoundment area, the potential spread of meadow knapweed would be less than with the No Action Alternative. However, borrow material from the USFS borrow site would be used, and this material contains rush skeletonweed. Thus, the spread of this weed throughout the Troy Mine Permit Area and likely beyond could pose a hazard to sensitive plant species that may occur in dry open sites, such as *Clarkia rhomboidea*.

Agency-Mitigated Alternative

The Agency-Mitigated Alternative would be an improvement over the Proposed Action because it would not use the USFS borrow site, which contains rush skeletonweed, for growth media and would limit of the use of soil stockpiles containing meadow knapweed to private lands. Therefore, the Agency-Mitigated Alternative would not spread this new invader weed further. Rush skeletonweed could have potential indirect impacts to proposed, threatened, endangered, and sensitive plant species if it were to spread. The use of weed-free organic matter as a soil amendment would encourage desirable native species to establish in the mine permit area. This organic matter amendment increases the potential success of revegetation efforts and decreases the potential for off-site impacts to proposed, threatened, endangered, and sensitive plants from invasive species.

3.16.3.5 Resource Impact Summary

Even though the site would eventually become reforested, the diverse native plant communities that were originally present would never fully re-establish. While communities of threatened and sensitive plant species are known or thought to occur in the general area of the Troy Mine, these species have not been identified within the Troy Mine Permit Area.

3.16.3.6 Cumulative Effects

No Action Alternative

While the No Action Alternative would largely revegetate the Troy Mine Permit Area, the use of non-native, aggressive species in the seed mix, such as sweet clover, and the invasion by other aggressive noxious and invasive weedy species would be detrimental to native species within, and potentially beyond, the permit area. The indirect impacts of chemical weed control efforts would limit some native plant species from establishing. The use of stockpiled soils on NFSL from the tailings impoundment area containing meadow knapweed, and the use of coarse borrow material from the USFS borrow area containing rush skeletonweed for revegetation would ensure that this alternative would produce new plant communities containing noxious weeds. Finally, this spread of weeds beyond the Troy Mine Permit Area and the efforts to eradicate new invader noxious weeds would potentially affect sensitive plant species within the analysis area.

Proposed Action

Cumulative or additive effects on native vegetation as a result of implementing the Proposed Action would include long-term, localized improvements to native plant revegetation and the control of noxious weeds through reclamation of previously disturbed land to a more natural, vegetated state. Both planting native species and controlling noxious weeds would somewhat decrease the potential spread of noxious weeds (especially meadow knapweed) into surrounding natural areas on NFSL. However, noxious weeds may continue to spread in the area as a result of other past, present, and reasonably foreseeable future actions on both public and private lands. Intact native plant communities would continue to decrease in the watershed as new disturbances occur and as noxious weeds and other aggressive, introduced species spread. The Proposed Action would increase the spread of rush skeletonweed throughout the mine permit area and likely beyond. Finally, the spread of weeds throughout and beyond the Troy Mine Permit Area has the potential to impact sensitive plant species within the analysis area.

Agency-Mitigated Alternative

Cumulative or additive effects on native vegetation would be largely the same as for the Proposed Action. However, the Agency-Mitigated Alternative would not use reclamation materials on NFSL containing either meadow knapweed or rush skeletonweed. The Agency-Mitigated Alternative would not promote the spread of rush skeletonweed throughout or beyond the Troy Mine Permit Area. The spread of weeds beyond the Troy Mine Permit Area would have less potential to impact sensitive plant species within the analysis area under the Agency-Mitigated Alternative than under either the No Action Alternative or the Proposed Action.

3.16.3.7 Regulatory Compliance

All three alternatives would be in compliance with the Forest Plan, with Forest Service Policy on Sensitive Species (FSM 2670.32), and with the Endangered Species Act. USFS is mandated to maintain viable populations of all native and desirable non-native species under the National Forest Management Act.

3.16.3.8 Statement of Findings

Based upon this evaluation and the available information on these species' needs, the three alternatives and associated activities would:

- have “No Effect” on water howellia or Spalding’s catchfly;
- “May Impact Individuals or Habitat, But Would Not Likely Contribute to a Trend Toward Federal Listing or Cause The Loss of Viability” to the population or species for diamond Clarkia, western pearl-flower, and for short-flowered monkeyflower; and
- have “No Impact” on the viability of other known or suspected threatened or sensitive plant species of the KNF.

3.16.4 Old Growth Forest

3.16.4.1 Regulatory Framework

The Forest Plan directs KNF to maintain a minimum of 10 percent old growth (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).

The most recent Forest-wide old growth assessment as documented in the Forest Plan Monitoring and Evaluation Report (KNF 2009b) shows that KNF has 221,536 acres (11.9 percent) old growth designated. The Forest Plan established that maintaining 10 percent old growth habitat is sufficient to support viable populations of old-growth dependent species (Vol. 1, II-1, 7, III-54; Vol. 2, A17).

3.16.4.2 Analysis Area

The analysis area for project impacts and cumulative effects is the Lake Creek watershed which includes the Spar and Lake PSUs (**Figure 3-12**). The activity area is the vicinity of the Troy Mine Permit Area.

3.16.4.3 Affected Environment

The analysis area contains 9,028 acres (10.9 percent) of designated effective and replacement old growth (ROG) below 5,500 feet. Approximately 5,618 acres (6.8 percent) is designated effective old growth, and 3,410 acres (4.1 percent) is designated replacement old growth (**Table 3-19**). Replacement old growth (ROG) has many old growth characteristics, but not enough to be currently considered effective old growth. Replacement old growth is expected to become old growth in time.

Table 3-19 also shows the minimum acres required to be designated to meet Forest Plan standards. Designated old growth stands in the project area support the habitat conditions described in “Old Growth Forest Types of the Northern Region” (Green *et al.* 1992, corrected February 2005). Forest-wide acres are updated as of February 2008, and project area acres are updated as of November 2010.

Old growth stands in the analysis area are mainly composed of old western larch, western redcedar, western hemlock, ponderosa pine, Douglas-fir, and other conifers. Old growth management area designations in the project area were made to conserve the best old growth attributes available and to provide the best distribution, size, habitat type coverage, and quality of what is available. These old

growth stands are physically connected to other old growth stands where possible, or are interconnected to adjacent old growth stands by stands composed of 100+ year old age classes.

**Table 3-19. Old Growth Forest Acres Under 5,500 feet Elevation on NFSL
 in the Analysis Area and Forest-wide**

STATUS	Lake Creek Analysis Area Acres (Percent)	KNF Acres (Percent)
Total NFSL	105,315	2,200,200
Total NFSL below 5,500 feet elevation	83,117	1,869,222
Minimum acre designation required by Forest Plan	8,312 (10%)	187,000 (10%)
DESIGNATED OLD GROWTH (OG) (in MA 13, or Old Growth Management Area)		
Designated effective OG	5,618 (6.8%)	139,374 (7.5%)
Designated Replacement Old Growth (ROG)	3,410 (4.1%)	62,633 (3.3%)
Designated unknown (KNF Forest Plan)	0	19,499 (1%)
Total designated OG and ROG	9,028 (10.9%)	221,536 (11.9%)
UNDESIGNATED EFFECTIVE OG AND ROG		
Undesignated effective OG	427 (<1%)	60,730 (3.2%)
Undesignated ROG	438 (<1%)	36,229 (1.9%)
TOTALS FOR BOTH DESIGNATED AND UNDESIGNATED OG AND REPLACEMENT OG		
Total designated and undesignated effective OG	6,045 (7.3%)	199,839 (10.7%)
Total designated and undesignated replacement OG	3,848 (4.6%)	98,892 (5.3%)
All old growth acres below 5,500 feet	9,893 (11.9%)	298,731 (16%)

Less than one percent of the analysis area falls into the category of undesignated effective old growth. These stands have data that indicate the presence of some old growth structural criteria and are being tracked for possible designation in the future. Many of the undesignated effective old growth stands are small isolated stands or are linear stands located adjacent to open road systems.

The most recent Forest Plan Monitoring Report (KNF 2009b) indicates KNF has 1,869,222 acres below 5,500 feet elevation (minus lakes and highways). Using the stand-level data, there are currently 199,839 acres or 10.7 percent of KNF acres below 5,500 feet that are old growth (designated or undesignated). An additional 98,892 acres are replacement old growth (designated and undesignated). Forest-wide, old growth or replacement old growth on KNF totals 298,731 acres or 16 percent of acres below 5,500 feet based on the stand-level data. As described in the Forest Plan Monitoring Report (KNF 2009b), the Forest Inventory and Analysis data are summarized forest-wide and do not measure old growth based on the criteria in the Forest Plan. The Forest Inventory and Analysis data estimate effective old growth forest-wide at 9.0 percent of the Forest, with a 90 percent confidence interval of 7.2 to 10.9 percent. The acres of old growth from the stand-level inventory are just within the confidence interval for the Forest Inventory and Analysis data. However, it must be noted the Forest Inventory and Analysis data are measuring a different land base (all lands, not just lands below 5,500 feet in elevation). Also, to account for changes from when the Forest Inventory and Analysis data were collected, any plots with disturbance (*e.g.*, wildfire) were excluded from consideration as old growth. This is a conservative estimate, since some wildfires may not have affected old growth characteristics. The Forest Plan Monitoring Report (KNF 2009b) indicates the Forest is meeting its Forest Plan requirements for managing 10 percent of the forest as old growth habitat well distributed across KNF lands below 5,500 feet elevation.

3.16.4.4 Environmental Consequences

There is a limited quantity of old growth habitat located within the Troy Mine Permit Area primarily adjacent to roadways. Reclamation activities are not expected to occur in, or impact these areas; thus, effects to old growth forest will not be discussed further.

Since none of the alternatives would impact old growth stands within either the Spar and Lake PSUs or within the Troy Mine Permit Area, there would be no change in the quantity of old growth forest, and the analysis area would continue to meet Forest Plan standards for old growth. All alternatives would re-establish forested vegetation within the Troy Mine Permit Area. Re-establishment of forested cover would create the possibility of old growth within the mine permit area on NFSL after 150+ years. In this sense, the alternatives may be considered an improvement over the existing condition, but the chance of old growth establishment on this site cannot be determined with any accuracy.

3.16.4.5 Resource Impact Summary and Cumulative Effects

None of the three alternatives would have any effect on old growth, and therefore, there would be no cumulative effects to old growth.

3.16.4.6 Regulatory Compliance

All alternatives are consistent with Forest Plan direction to maintain a minimum of 10 percent old growth below 5,500 feet in elevation in each third-order drainage or compartment, or a combination of compartments (Kootenai Supplement #85, Supplement to Forest Service Manual 2432.22).

3.17 Visual/Scenery

3.17.1 Introduction

This section addresses visual quality as viewed from travel routes within the Lake Creek watershed and discusses how visual quality could be evaluated on NFSL, private, and patented lands. Additionally, potential impacts to these resources under each of the reclamation alternatives will be identified.

3.17.2 Regulatory Framework

The regulatory framework for this section includes the visual quality objectives of the Forest Plan (described in **Section 3.17.4.1**) and the USFS Visual Management Assessment System. This system provides a framework to consistently inventory visual resources on NFSL and provides measurable standards to manage these resources. DEQ has no regulatory authority but reviews visual quality effects on private lands within its environmental documents.

3.17.3 Analysis Area

The analysis area for the visual quality analysis is the Lake Creek watershed with an emphasis on Visual Quality Objectives (VQOs) for travel routes within the vicinity of the Troy Mine Permit Area.

3.17.4 Affected Environment

The current visual quality in and around the Troy Mine Permit Area was defined by describing the visual landscape character at locations within the analysis area. Each of these locations was evaluated in terms of its visual significance based upon viewing opportunities provided along important travel routes in the area. Visual quality and VQOs were described on the basis of visual condition class, distance zone, and sensitivity levels (KNF 2001). Each of these visual specifications is described below.

Visual Condition Classes

The existing visual condition is defined in terms of how the visual character of the landscape has been altered by human activities. The landscape is categorized into four condition classes based on the percent of that landscape's apparent visual alteration by human activities. The four classes are defined as follows:

- **Natural Appearing:** Natural landscape character "appears" intact or complete and is free of obvious management activities.
- **Slightly Altered:** Landscape character "appears" slightly fragmented. Some management activities are evident, but the overall level of disturbance is low.
- **Moderately Altered:** Landscape character "appears" moderately fragmented. Management activities are more noticeable and begin to contrast with their surroundings. The level of disturbance is moderate.
- **Heavily Altered:** Landscape character "appears" extremely fragmented. Management activities are very noticeable and dominate the view. The level of disturbance is high.

Distance Zones

Visual landscapes are divided into three distance zones:

- Foreground;
- Middleground; and
- Background

Foreground is defined as up to one-half of a mile from the viewer. Middleground extends from the foreground up to five miles from the viewer. Background extends from five miles from the viewer to the horizon.

Sensitivity Levels

Sensitivity levels are a measure of concern for scenic quality. Sensitivity levels are determined for land areas viewed by those: 1) traveling through the area on developed roads and trails; 2) using areas such as campgrounds and visitor centers; or 3) recreating at lakes, streams, and other water bodies. Three sensitivity levels are employed:

- Level 1 - Highest Sensitivity;
- Level 2 - Average Sensitivity; and
- Level 3 - Lowest Sensitivity.

3.17.4.1 Forest Plan Visual Quality Objectives

The Forest Plan (USFS 1987) provides VQOs for Management Areas within the analysis area. Potential VQOs include:

- **Preservation:** Provides for ecological change only.
- **Retention:** Management activities are not evident to the casual forest visitor.
- **Partial Retention:** Management activities may be evident but must remain visually subordinate to the characteristic (natural-appearing) landscape.
- **Modification:** Management activities may visually dominate the characteristic (natural-appearing) landscape, but must use established form, line, color, and texture and should appear as a natural occurrence when viewed in middleground or background.
- **Maximum Modification:** Management activities may visually dominate the characteristic (natural-appearing) landscape, but they must look like natural occurrences when viewed as background.

3.17.4.2 Travel Routes

The main travel routes that cross the analysis area and from which the Troy Mine Permit Area may be viewed as well as their sensitivity levels are:

- **Sensitivity Level 1 Travel Routes** - MT 56 and Ross Creek Road (NFSR 398), as well as views from Bad Medicine Campground, Dorr Skeels Campground, and Spar Lake Campground;
- **Sensitivity Level 2 Travel Routes** - County roads and Spar Lake Road (NFSR 384); and

- **Sensitivity Level 3 Travel Routes** - the remainder of the roads within the analysis area (KNF 2001).

Area 1 – MT 56: MT 56 runs from north to south down the middle of the analysis area. Most views of the KNF are limited to background views, with some middleground views in the vicinity of Keeler Mountain and Stanley Mountain. The analysis area, except at Bull Lake, is only visible in areas that have received timber management along the travel routes. Otherwise, dense forest blocks views of the area. Most of the private land along MT 56 has had moderate to heavy timber harvest activity or is developed residential subdivision. The forest is a mix of ponderosa pine, larch, Douglas-fir, and lodgepole pine. The area is only partially visible in the foreground view from United States Highway 2 (US 2) and MT 56. A number of roads run through the area along with a power line corridor running east to west. The visual condition class of NFSL within this area is moderately to heavily altered (KNF 2001).

Area 2 – Copper Mountain: Copper Mountain is visible for short durations while traveling on MT 56 but is limited to background views. It is also visible from the Chase Cutoff road (Lincoln County road). The east side of the ridge is characterized by many natural openings interspersed with heavily forested areas. The southern end of the ridge is on private land and some evidence of past logging is visible. Older clearcuts are visible, but have regenerated and are blending into the setting. Overall, the area has recovered sufficiently so that the opening appears natural. The visual condition class is slightly to moderately altered (KNF 2001).

Area 3 – Grouse Mountain: The northeast side of the Grouse Mountain ridge around to the nose of the ridge is visible in background views from MT 56. Numerous natural openings are scattered along the northeast slope intermingled with stringers of forest. The southwest-facing slope is more heavily forested with smaller openings. Tree species are predominantly ponderosa pine, lodgepole pine, and Douglas-fir. The visual condition class is slightly altered (KNF 2001).

Area 4 – Pony Mountain: The Pony Mountain area contains a number of clearcuts and has a high road density. It is not visible from any of the major viewing locations along MT 56, but the lower slopes are partially visible from MT 56. The remaining forest is closed canopy comprised of mixed conifer species. The visual condition class is heavily altered from past management activity (KNF 2001).

Area 5 – Keeler Mountain: The east face of Keeler Mountain is visible for fairly long durations from MT 56 in the middleground view. The lower elevations adjacent to Spar Lake Road (NFSR 384) are not visible due to the surrounding forest. The slope consists of many small openings with rock outcrops on steep slopes. At the present time, the visual condition class of the USFS-managed portion of this slope is natural appearing.

Area 6 – South Fork Keeler: This area is not visible from any of the major viewing locations. The ridgeline from Spruce Mountain to the northeast is roadless. The forest is composed of closed canopy stands with little scenic variation. The area has had some previous harvest, and the visual condition class is slightly to moderately altered (KNF 2001).

Area 7 – Thicket Creek: This area is not visible from any of the major viewing locations. The Thicket Creek drainage has had a number of timber sale units harvested in the past, most of which were

clearcuts. The drainage also has an extensive road system. The visual condition class of the drainage is moderately altered (KNF 2001).

Area 8 – Stanley Mountain: This area is visible from a number of Sensitivity Level 1 roads and viewing areas (campgrounds and water bodies) (KNF 2001).

- **MT 56:** This is the main travel route in the area. Once past Angel Island, the middleground and background scene is dominated by Bull Lake and its backdrop of forested slopes. The ridge framing the backside of the lake includes Mt. Vernon and Stanley Mountain and contains a mix of distinctive landscapes consisting of steep, heavily forested slopes bisected by steep incised drainages. A few small openings exist on the slope. The ridge was split in the past by an earthquake-induced slide that created a rocky sheer cliff behind Bad Medicine Campground (locally known as the Spires). Some management activities are visible. Both parcels of private land on the west side of Bull Lake have had timber harvest. These cutting units are discernible but generally blend into the surrounding landscape. NFSR 4628, which goes from the Ross Creek Road up to Mt. Vernon, is visible on the open slope to the south of the Spires.
- **Boats on Bull Lake:** The view of the analysis area is generally the same as from MT 56 depending upon viewer location on the lake.
- **Dorr Skeels Campground:** The views from this campground are of Bull Lake and Stanley Mountain to the west and of Bull Lake and the Angel Island subdivision to the south.
- **NFSR 398 and NFSR 8019 to Bad Medicine Campground:** This travel route initially passes through approximately one-half of a mile of private land, which has been logged. Once across Ross Creek, views are limited to foreground views of heavily forested areas; additionally, portions of Ross Creek and some riparian areas below the road are visible for brief periods. The west side of the ridge is not visible from any of the major viewing locations, and the visual condition class is slightly altered. The areas to be reclaimed are not visible from this viewing location.

Area 9 – Twilight Creek: The Twilight Creek drainage is a small drainage leading into Fairway Creek. The lower end of the drainage is on Plum Creek lands and has received heavy management activity. The visual condition class of upper portions of the drainage on NFSL is slightly altered (KNF 2001).

Area 10 – Camp/Madge Creeks: The Camp/Madge Creek area, outside of the wilderness, has had moderate to heavy timber management activity in the past. Lower portions of the drainages have a high road density, and the forest in this area is fairly open with some small grassy areas. This area is not visible from MT 56. The upper portion of the area is a grassy opening with scattered trees and rock outcrops. This area is in the middleground view from MT 56 (KNF 2001).

Area 11 – Ross Creek: The Ross Creek area is a major recreation area. Both the Bad Medicine Campground and the Ross Creek Cedars Scenic Area attract large numbers of visitors. From MT 56 to the Cedars, visibility is generally limited to roadside foreground views. An overlook on NFSR 398 provides background views into the Cabinet Mountains to the east, and some views of the south side of Mt. Vernon. Views from this trail system are generally of forest interspersed with grassy shrub openings in the foreground view, and heavily forested stands in the middleground view, with many background views of upper elevation rocky ridges and mountaintops above timberline (KNF 2001).

3.17.4.3 Visual Quality Objectives by Management Area

The Forest Plan describes VQOs for Management Areas (MA) within the analysis area (**Table 3-20**) and the VQOs for MAs within the Troy Mine Permit Area are shown in **Table 3-21**. Detailed descriptions of MAs can be found in **Table 3-14**.

Table 3-20. Forest Plan VQOs for Analysis Area Management Areas (MA)

MA	VQOs
2, 5, 21	Retention
6	Partial retention in foreground
7, 8	Preservation
16	Modification
17	Partial retention
30	Not applicable. The nature of the drawdown area does not lend itself to visual management.
3, 10, 11, 12, 13, 14, 18, 19, 24	Maximum modification for areas of low viewing significance; modification in areas of moderate viewing significance; and partial retention in areas of high viewing significance.

Source: KNF 2001

Table 3-21. Forest Plan VQOs for Management Areas (MA) within the Permit Area

MA	VQOs
2	Retention
11, 12, 13	Maximum modification for areas of low viewing significance; modification in areas of moderate viewing significance; and partial retention in areas of high viewing significance.
2og	N/A - Area of old growth within MA 2
Private	N/A - Private Land

Source: KNF 2001

3.17.5 Environmental Consequences

Visual quality of the Troy Mine Permit Area was addressed in the 1978 EIS. In this section of the EIS, the reclamation alternatives are evaluated to determine potential impacts on visual resources within the analysis area and how reclamation activities would minimize visual effects of the heavily altered disturbed lands that currently exist.

The method for assessing potential visual resource impacts generally includes analyzing each alternative's potential, due to its location or associated activities, to affect visual quality. The following questions must be answered:

- How would any new disturbances impact the visual or scenic quality, both natural and man-made, of an area both locally and from all locations from which it can be viewed?
- How would reclamation minimize the visual effects of disturbed lands?

Specific potential impacts of each of the alternatives are discussed in further detail below.

3.17.5.1 No Action Alternative

Under the No Action Alternative, reclamation activities would continue to follow the specifications of the 1978 Reclamation Plan at the time of final mine closure. Existing mine infrastructure would be demolished and removed, adits would be sealed, and disturbed areas would be regraded and revegetated (**Sections 3.8** and **3.16**). The mine, the mill area, and the tailings impoundment area, however, would not be returned to their approximate original (pre-disturbance) contours. These locales would always appear man-made. Less than one acre of new disturbance would result under the No Action Alternative.

Per KNF approval, roads no longer deemed necessary for recreational or management access would be removed, and the remaining NFSL roads returned to KNF management control (see **Section 3.15**). Road cut and fill slopes that would not be returned to original contours would remain visible on the landscape in the future. Roads reclaimed as part of mine closure would eventually blend into the landscape and end up with a slightly altered look.

In general, most of the Troy Mine Permit Area (including NFSL and patented lands at the mine and mill areas) would be returned to a relatively natural, vegetated state. This would transition the area from a heavily altered visual condition class to a moderately altered class. Relatively level portions of the disturbed areas that are covered with a growth medium would have the potential to eventually transition to a slightly altered visual condition class as revegetation efforts take hold and a canopy begins to develop. The angle-of-repose rocky portal patio slopes would not revegetate and would appear as rocky talus slopes, especially near the bottom of the slopes where coarse development rock has accumulated due to natural sorting.

While some level of modification would always be evident upon close examination of previously disturbed areas in the foreground, the Troy Mine portals and mill areas are generally not visible from sensitive viewing locations (*e.g.*, MT 56 and surrounding campgrounds). Also, due to the surrounding past, present, and potential future timber operations, NFSL in the Troy Mine Permit Area should blend

well with the altered visual character of the general area as a whole after reclamation. A long-term positive effect to visual resources would be expected under the No Action Alternative because the reclaimed NFSL would return to a generally natural look. These reclaimed lands would largely blend with surrounding stands to provide a generally scenic, if slightly altered to moderately altered, view after several decades.

Private lands at the tailings impoundment are at a lower elevation and are surrounded by forested lands. Reclamation of the tailings impoundment with the lacustrine and volcanic ash-derived soil materials would eventually provide a productive forested landscape that would return the existing heavily altered visual condition to a slightly to moderately altered landscape after several decades.

The No Action Alternative would retain some roads for access to private lands and would continue to have a visual effect. Most of the lands would still be reclaimed, and the overall visual effect would not change.

3.17.5.2 Proposed Action

Under the Proposed Action, the *2006 Revised Reclamation Plan* would be implemented, and on-going and future reclamation activities on the Troy Mine Permit Area would follow specifications of the updated plan. Under the Proposed Action, the proposed reclamation activities on both public and patented land at the mine and mill area would produce a recontoured and revegetated landscape that would eventually blend with surrounding lands to provide a moderately to slightly altered visual condition class. This would be an improvement over the heavily altered scenic class that currently exists. Reclamation activities would be generally similar to the No Action Alternative, and overall visual quality at the mine and mill areas would be similar to that of the No Action Alternative.

On private lands at the tailings impoundment, approximately 16 more acres would be disturbed to salvage glacial outwash materials proposed for use in reclaiming the tailings impoundment surface. While these materials would produce a less productive forest, in general the long-term effects on visual quality would be minimal. Overall visual quality at the tailings impoundment area would be similar to that of the No Action Alternative.

3.17.5.3 Agency-Mitigated Alternative

Under the Agency-Mitigated Alternative, the *2006 Revised Reclamation Plan* would be expanded upon to address issues identified during the public scoping and agency review processes. The Agency-Mitigated Alternative would provide for a recontoured and revegetated landscape that would eventually blend with surrounding lands to provide a moderately to slightly altered visual condition class, which would be an improvement over the heavily altered scenic class that currently exists. While reclamation activities would generally be similar to the No Action Alternative and the Proposed Action, the Agency-Mitigated Alternative would have a greater chance of success in establishing vegetation (**Sections 3.8 and 3.16**). Overall, the resulting visual quality at the mine and mill areas would be similar to the No Action Alternative and the Proposed Action.

Reclamation of the tailings impoundment with the lacustrine and volcanic ash-derived soil material would result in a forested landscape that would eventually return the heavily altered visual condition to a slightly to moderately altered visual class after several decades. No new disturbed acres would be needed under the Agency-Mitigated Alternative to obtain growth medium. Potential effects of the Agency-Mitigated Alternative would be similar to the No Action Alternative.

3.17.5.4 Resource Impact Summary

In general, all three alternatives would improve visual resources by reclaiming previously disturbed, non-scenic, mining lands to a vegetated condition that would eventually blend with surrounding forested areas after several decades as trees grow to a size large enough to obscure disturbed landscapes. While the Troy Mine Permit Area is largely not visible to surrounding sensitive viewing locations (*e.g.*, MT 56 and surrounding campgrounds) because of forest stands and ridgelines, some of the disturbed site is visible to recreationists who might be backcountry hiking or camping in areas, including the Cabinet Mountains Wilderness. Although the Troy Mine Permit Area would never return to pre-mine visual quality, this potential increase in scenic potential over operational levels would provide a long-term positive effect on visual resources for all of the alternatives.

3.17.5.5 Effectiveness of Mitigation Measures

No mitigation measures would be required for visual resources because none of the alternatives has a potential for more than minimal negative impacts. Standard reclamation practices have been proven to be effective methods for returning lands to a more natural state, thereby reducing visual impacts.

3.17.5.6 Cumulative Effects

Cumulative or additive effects on visual resources as a result of any of the alternatives would include improvements to both the quality and quantity of vegetation in the Troy Mine Permit Area, which, in turn, would have a small positive additive effect on the scenic value of the analysis area viewshed. Other past, present, and reasonably foreseeable future actions in the watershed (*e.g.*, homebuilding, roads, and highway upgrades) would continue to reduce the scenic quality of the area over time.

3.17.5.7 Regulatory Compliance

All three alternatives would be in compliance with the KNF Forest Plan, which establishes visual quality objectives for each MA within KNF, because reclamation would restore disturbed areas to more natural appearing conditions that would be consistent with the VQOs for each MA within the permit area.

3.18 Wildlife

3.18.1 Introduction

The KNF provides habitat for many species of wildlife, including portions of the Troy Mine Permit 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's Department of Fish, Wildlife and Parks (FWP) regulates game and fur

bearing animal populations. Projects proposed on federal lands that might impact species protected by the Endangered Species Act (ESA) require consultation with the U. S. Fish and Wildlife Service (USFWS).

Part of the reclamation project associated with the Troy Mine Permit Area occurs on the KNF. Therefore, this EIS selects wildlife species for detailed analysis that may be affected by reclamation activities. The selected wildlife species include: 1) Species listed as threatened, endangered, or proposed under the Endangered Species Act and which require an effects analysis by the USFWS; 2) Sensitive species, designated by the Regional Forester and for which the disclosure of project effects is required; and 3) Management indicator species (MIS), identified in the Forest Plan (USFS 1987, Appendix 12) and which represent a particular habitat or habitat complex that sustains growth and successful reproduction. The wildlife portion of this chapter is divided into four sections: threatened and endangered species, sensitive species, MIS, and migratory birds.

The analysis area for each species is determined by the requirements of that species but generally falls within the Lake Creek watershed. For determining trends towards viability, the analysis area for each species was determined by using the viability analysis concepts described by Ruggiero *et al.* (1994). Species viability is tiered to the KNF forest-wide conservation plan (Johnson 2004a).

The affected environment for each species is described and generally includes wildlife resources found within the analysis area that could potentially be impacted by mine closure and reclamation in the Troy Mine Permit Area. Wildlife resources include federally-listed threatened and endangered species, KNF sensitive species and/or MIS (**Table 3-22, 3-25, and 3-26**), and important forest habitats. A number of wildlife species have been selected for detailed analysis in the sections below. Species not affected by any alternative (*e.g.* habitat not present within the analysis area) have been reviewed but will not be discussed in detail in this EIS. Important forest habitats, such as old growth forest, are discussed in the Vegetation Section (**Section 3.16**) and in relation to the wildlife species that using those habitats.

Wildlife analyses include baseline conditions (created by all past management practices and natural events); direct and indirect effects of proposed reclamation alternatives; and cumulative effects of past, present, and reasonably foreseeable future actions.

3.18.2 Regulatory Framework

The regulatory framework includes numerous laws, policies, and management direction applied to wildlife resources and their habitats on public lands. The regulatory framework is detailed in the KNF Forest Plan (Forest Plan, USFS 1987) and includes direction to facilitate grizzly bear recovery and augment the existing grizzly population; manage elk habitat for potential habitat carrying capacity; manage habitats so that endemic vertebrate species have sufficient habitat to maintain viable population levels; and to maintain big game habitat to support huntable populations. A revision to the Forest Plan is currently undergoing an extensive review process. The State of Montana does not have similar requirements on private lands.

Several key laws, policies, and management plans are also outlined below:

- **The National Forest Management Act (NFMA) of 1976** (16 USC 1600) directs USFS 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.”
- **The Endangered Species Act of 1973**, as amended, requires federal agencies to undertake programs conserving threatened and endangered species and prohibits them from carrying out or authorizing any action that may jeopardize a listed species or its designated critical habitat. It mandates that the effects of management activities and land uses be evaluated in a biological assessment for listed species. If a project may affect a federally-listed species or critical habitat, Section 7 consultation must be initiated with the USFWS.
- **The Bald and Golden Eagle Protection Act of 1940** (16 USC 668-668d) prohibits all commercial activities and some non-commercial activities involving bald or golden eagles, including their feathers or parts, and makes it illegal “...without being permitted to do so as provided in this subchapter, (to) take, possess, sell, purchase, barter, offer to sell, purchase or barter, transport, export or import, at any time or in any manner any bald eagle commonly known as the American eagle or any golden eagle, alive or dead, or any part, nest, or egg thereof of the foregoing eagles.”
- **The National Bald Eagle Management Guidelines (NBEMG)** (USFWS 2007b) provide the recommendations for avoiding disturbance to bald eagles. The NBEMG recommends the following: maintain buffer distance between nest and activity; maintain landscape (natural vegetation) buffers between nest and activity; and avoid certain activities during the breeding season.
- **Montana Bald Eagle Management Plan (MBEWG 1994)**. As a revision of the 1986 Montana Bald Eagle Management Plan, this plan gives landowners and resource managers information on bald eagle biology and management guidelines to make informed decisions about land use and to promote conservation of the species and its habitat. This Plan also serves as the conservation and management plan now that bald eagles are delisted. An addendum to the Management Plan was prepared on recent changes in federal bald eagle regulations and to make project planning recommendations for bald eagle conservation (MBEWG 2010).
- **The Migratory Bird Treaty Act of 1918** (16 USC 703-712) implements various treaties and conventions among the U.S., Canada, Mexico, and Japan to protect migratory birds. Under the Act, taking, killing, or possessing migratory birds is illegal. Executive Order 13186 (January 10, 2001) requires federal agencies to ensure that environmental analyses of federal actions evaluate the effects of actions and agency plans on migratory birds, with emphasis on species of concern.
- **Northern Rockies Lynx Management Direction EIS and ROD** (USFS 2007). The Final EIS and ROD for the Northern Rockies Lynx Management Direction (NRLMD) were completed in March of 2007 to amend the Forest Plan by providing lynx habitat management objectives, standards, and guidelines. The decision replaces the interim application of the Lynx Conservation Assessment and Strategy (LCAS) (Reudiger *et al.* 2000). The direction provided in the NRLMD is applied to lynx habitat at the lynx analysis unit (LAU) scale. The KNF has delineated 47 LAUs which approximate the size of a lynx home range. KNF forest-wide lynx habitat descriptions have been updated to reflect the lynx habitat terminology from the NRLMD.

- **1987 Northern Rocky Mountain Wolf Recovery Plan** (USFWS 1987). The delisting action on the gray wolf was vacated by the U.S. District Court, reverting management of gray wolf to the 1987 Northern Rocky Mountain Wolf Recovery Plan. The plan outlines steps to recover wolf populations in portions of their former range in the northern Rocky Mountains. The plan emphasizes gray wolf recovery through natural processes and the conservation of suitable habitat in appropriate recovery areas including northwestern Montana.
- **Selkirk/Cabinet-Yaak Grizzly Bear Interim Access Management Rule Set** (IGBC 1998). The Rule Set serves as an interim guideline for assessing grizzly bear habitat until Forest Plans are revised on the Kootenai, Lolo, Idaho Panhandle, and Colville National Forests. It addresses: 1) habitat security; 2) Core; 3) road management strategies; 4) coordination with state wildlife agencies; 5) no net increases in Open Motorized Route Density (OMRD) and Total Motorized Route Density (TMRD); and 6) Monitoring requirements for Core, OMRD, and TMRD.
- **1993 Grizzly Bear Recovery Plan** (USFWS 1993) identifies the sequence of actions necessary for conservation and recovery of the grizzly bear, ultimately resulting in the removal of the species from “threatened” status in the conterminous 48 states.
- **Montana State Elk Management Plan** (FWP 2004). The plan provides guidance to wildlife and land managers for planning and policy decisions on elk. It was also intended to help FWP personnel prioritize field activities, manage time and budgets, make elk management recommendations, and coordinate management with other state and federal agencies and private landowners. The plan was to remain current through annual updating. Managing Montana’s elk populations at levels compatible with other land uses and meeting the current and future demand for hunting and other recreation has become increasingly complex, demanding increased comprehensive planning.

3.18.3 Analysis Area

The analysis area for each species generally falls within the Lake Creek watershed and includes the Spar Planning Subunit (PSU) and a portion of the Lake PSU (**Figure 3-12**). Potential habitat for the species analyzed below is typically found in both PSUs. This analysis area adequately addresses potential disturbance or displacement that would occur to most species as a result of reclamation activities associated with closure of the project. Analysis at the Lake Creek watershed scale allows for the consideration of effects associated with reclamation activities, without minimizing the potential effects from considering too large an area. Management units for the grizzly bear and Canada lynx serve as the analysis areas in the Lake Creek watershed for these species.

The mine, mill, and utility corridor lie within the Spar PSU. The Spar PSU includes grizzly Bear Management Unit 3 (BMU 3), patented land located atop Mt. Vernon, and part of the Troy Polygon (**Figure 3-13**). The Troy Polygon is an area considered unoccupied by grizzly bears and, therefore, does not have any forest land/management opportunities for grizzly bear recovery (USFS 2009b) within the Cabinet-Yaak Recovery Zone (CYRZ) (USFWS 1993). Spar PSU also contains portions of two Lynx Analysis Units (LAUs): Ross and Keeler.

Lake PSU contains most of the tailings impoundment area, BMUs 1 and 2, and the Crowl LAU. The tailings impoundment area is on private property in the Troy Polygon and a small portion of private property in the Troy Mine Permit Area west of Lake Creek lies within the Spar PSU.

3.18.4 Threatened and Endangered Wildlife Species

Threatened and endangered species are managed under the authority of the ESA and the NFMA. See the Regulatory Framework section above for agency direction from the ESA and NFMA. A current threatened and endangered species list was obtained from the USFWS website (<http://montanafieldoffice.fws.gov>), updated 8/10/2010. **Table 3-22** shows species status in the analysis area. The USFWS previously concurred with potential listed species distribution maps and resulting consultation areas for the KNF (USFWS 2001).

Table 3-22. Threatened and Endangered Wildlife Species Found within the Analysis Area

Species Name	Status in Analysis Area	Comments
Grizzly Bear (<i>Ursus arctos horribilis</i>), Threatened	Known	Project activities would occur within BMU 3.
Canada Lynx (<i>Lynx canadensis</i>), Threatened; Designated Critical Habitat	Suspected	Project activities would occur within Ross LAU.
Gray Wolf (<i>Canis lupus</i>), Endangered	Known	Suitable habitat throughout the analysis area (USFWS 2001).

3.18.4.1 Grizzly Bear

Grizzly Bear Background

Grizzly bear population ecology, biology, habitat description, and relationships identified by research are described in USFWS (1993), in the annual progress reports for the Cabinet-Yaak grizzly bear research (Kasworm et al. 1989-2009), and by Kasworm and Manley (1988). This information is incorporated by reference. Grizzly bear occurrence data come from recent Three Rivers Ranger District (District) wildlife observation records, from KNF historical data found within the Natural Resource Information System (NRIS) database, and from other agencies (Montana Natural Heritage Program (MNHP) and USFWS).

Reclamation project activities would take place in BMU 3 and in a small area outside of the recovery zone, which includes the private property within the Troy Polygon (Figure 3-13). Although portions of BMUs 1 and 2 are found within the analysis area, reclamation activities would not occur in either BMU. Therefore, the analysis boundary for direct, indirect, and cumulative effects is BMU 3.

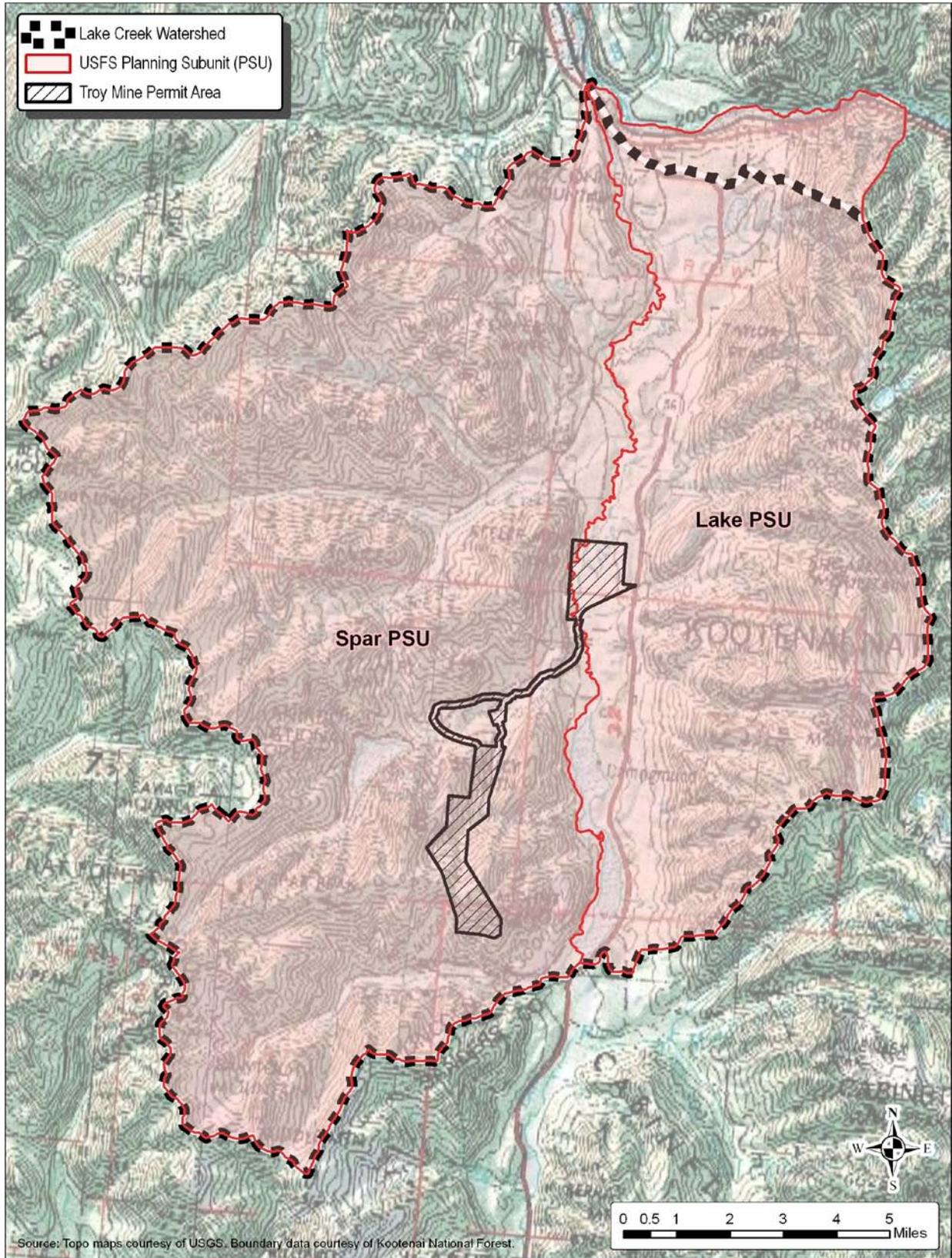


Figure 3-12. Lake Creek Watershed and Planning Subunits

On December 13, 2006, the U.S. District Court ruled to set aside the Grizzly Bear Access Amendment decision of 2004, which would have amended the 1987 Forest Plan (KNF *et al.* 2009). Subsequently, the USFWS rescinded their Biological Opinion, which included updated direction for addressing habitat component standards established in that 2004 decision. As a result, KNF direction for managing grizzly bears reverted back to the standards and analyses that were in place prior to the Access Amendment, as summarized by Johnson (2007). These standards and analyses will remain in place until a new final access amendment EIS and ROD are completed. These requirements come from the 1987 Forest Plan, the 1995 Amended Biological Opinion and Incidental Take Statement on the 1987 Forest Plan, and from the Selkirk/Cabinet-Yaak Grizzly Bear Interim Access Management Rule Set (SCYE 1998).

The proposed project is in the CYRZ (USFWS 1993). The CYRZ is large and diverse, meaning that grizzly bear habitat and use in one part of the ecosystem may not be reflected throughout the entire ecosystem. Breaking the ecosystem down into smaller units (*i.e.*, BMUs) allows analysis of effects associated with the activity's area of influence so that potential effects will not be minimized by considering too large an area (IGBC 1990). The BMUs are biologically meaningful to grizzly bears in that they 1) are based on the average size of a female bear's home range, 2) provide seasonal and elevational movement in response to needs (*e.g.* food and denning habitat), and 3) provide contiguous, unobstructed habitat which allows for displacement (*i.e.*, Core) (Christensen and Madel 1982, IGBC 1990). Delineating BMU boundaries by using topographical features creates a recognizable unit for consistent management and allows for identification of management needs or concerns, activity planning, scheduling, coordination, and monitoring (IGBC 1990) within and among adjacent Ranger Districts.

Affected Environment

Grizzly bears and their associated habitats are found both on the KNF and in the analysis area. There are two grizzly bear recovery zones in KNF, the CYRZ and the Northern Continental Divide Recovery Zone. Habitat conditions in the CYRZ have been improving steadily since 1987 as documented by Johnson (2002), Summerfield *et al.* (2004), and by the annual Forest Plan monitoring reports on threatened and endangered species habitat (KNF 2009b). Currently, the CYRZ grizzly bear population is estimated at a minimum of 47 grizzly bears, with a 78 percent probability of a downward population trend (Kasworm *et al.* 2009). Grizzly bear mortality is generally caused by factors beyond USFS control (*e.g.* management removal due to food attractant on private land, hunter mistaken identity or defense of life, and illegal kill by a human).

Recently, two grizzly bears have been released into BMU 3 to augment the population in the Cabinet Mountains portion of the CYRZ, one in the autumn of 2009 and the second in the summer of 2010. Three other bears were tracked by global positioning system (GPS) collars between 2006 and 2008. One known den site is monitored by USFWS scientists. No females with cubs have been detected in BMU 3 since 1978. Research records indicate one known death (cause unknown) in this BMU in 1959 (Kasworm 2008b).

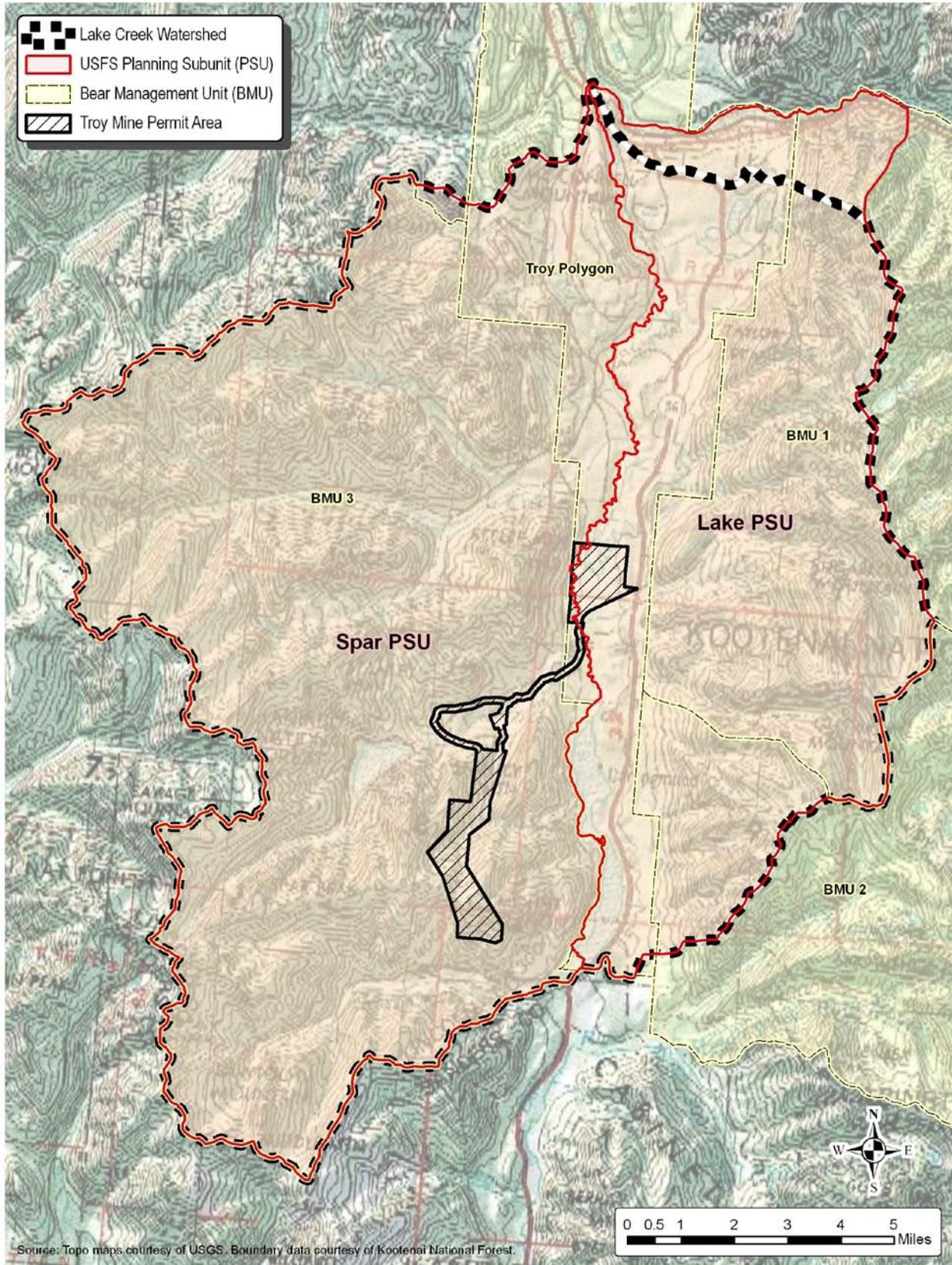


Figure 3-13. Bear Management Units

The grizzly bear management goal on the KNF is to provide sufficient quantity and quality of habitat for grizzly bear recovery. Several measures are used to gauge whether habitat objectives are being met. These measures are implemented within the authority of the USFS to minimize human-caused grizzly bear mortalities.

Road density is an important indicator of the quality of grizzly bear habitat available and is the primary measure of how the Troy Mine reclamation project may affect the grizzly bear. The following analysis describes the potential effects, including cumulative effects, of each of the alternatives. The analysis examines how these measures are implemented and, thus, how the grizzly bear recovery objectives are met.

Objective 1. Provide adequate space to meet the spatial requirements of a recovered grizzly bear population.

Habitat components are based mostly on road density and are used to evaluate the quality of grizzly bear habitat. **Table 3-23** shows current, Bear Year 2009, Habitat Component status in the analysis area (KNF 2010).

Table 3-23. Habitat Component Status for BMU 3

Habitat Component	Current
Habitat Effectiveness (HE) (standard $\geq 70\%$)	74%
Core Area (standard $\geq 59\%$ of BMU)	62%
Open Motorized Route Density (OMRD) (standard $\leq 33\%$ of BMU ≥ 1 mi./sq.mi.)	27%
Total Motorized Route Density (TMRD) (standard $\leq 26\%$ of BMU ≥ 2 mi./sq.mi.)	26%
Linear Open Road Density (ORD)(standard ≤ 0.75 mi./sq.mi.)	0.57

Habitat Effectiveness: Habitat Effectiveness (HE) is calculated as a percentage of the BMU and should be maintained equal to or greater than 70 percent of the BMU in order to achieve recovery goals. It is the total BMU acres minus Management Situation 3 lands (see Glossary) and all land farther than $\frac{1}{4}$ mile from open roads and major activities. Current HE, at 74 percent, is better than the standard.

Core Areas: Grizzly bear Core habitat (Core) requirements include no motorized access (roads or trails) during the active bear season, and Core must be at least 0.3 miles from open or gated roads. The goal is that federal agencies will maintain or attain a Core area of at least 55 percent in the BMU. Another goal is that no net loss of Core area will occur on federal ownership within the BMU and that blocks of Core habitat function as displacement areas. Current BMU 3 Core, at 62 percent, is better than the standard.

Open Motorized Route Density (OMRD): OMRD is calculated for each BMU by using moving window analysis (see Glossary) that includes open roads, other roads not meeting all restricted or reclaimed criteria, and open motorized trails. A road is considered open if it has not been effectively restricted or reclaimed to prevent motorized access. The goal is for no net increase in OMRD on NFSL within any BMU. Current OMRD, at 27 percent, is better than the standard of less than or equal to 33 percent.

Total Motorized Route Density (TMRD): TMRD is calculated for each BMU by using moving window analysis that includes open roads, restricted roads, roads not meeting all reclaimed criteria, and open motorized trails. The goal is for no net increase in TMRD on NFSL within any BMU. The current TMRD of BMU 3 at 26 percent meets the standard.

Linear Open Road Density (ORD): ORD is calculated on Management Situation 1 lands (see Glossary) for any BMU and should not exceed 0.75 miles per square mile. Individual bear analysis areas (BAA) may exceed 0.75 miles per square mile if the entire BMU meets the standard, and the BAA is where the activity is occurring or prior consultation has established a different level for the BAA. The current ORD in BMU 3, at 0.57 miles per square mile, is better than the standard of less than or equal to 0.75 miles per square mile. **Table 3-24** shows ORD for each BAA within BMU 3.

Table 3-24. Linear Open Road Densities in BMU 3

Bear Analysis Area	Current ORD (mi./sq.mi.) by BAA
4-3-1	0.88
4-3-2	0.52
4-3-3	0.10
4-3-4	0.97
4-3-5	0.58
4-3-6	0.26
4-9-4	0.25
Total BMU 3	0.57

Objective 2. Manage for an adequate distribution of bears across the ecosystem.

This objective addresses maintenance of movement corridors and access to seasonal resources for grizzly bears. Size and proximity of harvest units will not be addressed because no harvest units are proposed for the Troy Mine reclamation project.

On a larger scale, movement corridors among Core areas exist across the BMUs that run north to south, between the Kootenai and Clark Fork rivers. The BMUs are adjacent to one another in the West Cabinet Mountains and in the Cabinet Mountain Wilderness where the MT 56 corridor is the border between these two mountain ranges. Servheen *et al.* (2003), identifies linkage zones based on landscape views from the Linkage Zone Prediction Model. The analysis area contains the northern end of a wildlife linkage zone that connects the West Cabinet Mountains with the Cabinet Mountain Wilderness from the south end of Bull Lake to the Lincoln County border. This linkage zone actually extends south into Sanders County, to about two miles from the junction of MT 56 and Highway 200. Recommended habitat management for linkage zones is to maintain hiding cover, forage, and seasonal movement corridors for bears and other wildlife to cross the Bull River Valley between mountain ranges.

Guidelines on seasonal components propose activities to avoid known spring and denning habitats during their periods of use. Research conducted by Wakkinen and Kasworm (1997) in the Selkirk and Cabinet-Yaak Ecosystem indicates that major activities should be scheduled to avoid known spring habitats during the spring-use period (April 1 to June 15) and known denning habitats during the denning period (December 1 to March 31).

Objective 3. Manage for an acceptable level of mortality risk.

Most human-caused grizzly bear mortalities on the KNF have resulted from encounters between bears and big game hunters (Kasworm and Manley 1988). Grizzly bear vulnerability to human-caused mortality is partially a function of habitat security. Therefore, mortality risk can be partially assessed by using habitat factors that maintain or enhance habitat security. These include opening size, movement corridors, road density, and displacement (Core) areas which are addressed under the other objectives. Minimizing the potential for grizzly-human conflicts also includes addressing attractants that may be introduced by a proposed project.

Objective 4. Maintain/improve habitat suitability with respect to bear food production.

An important food source for the grizzly bear is the huckleberry (*Vaccinium* spp.). Huckleberries are available within the Troy Mine Permit Area and grow along Stanley Creek. Also, riparian habitats themselves are generally considered to be valuable feeding sites. The huckleberries and riparian habitat will be evaluated in the alternatives below.

Objective 5. Meet the management direction outlined in the Interagency Grizzly Bear Guidelines (51 Federal Register 42863) for Management Situations 1, 2, and 3.

Meeting objectives 1 through 4 helps to meet the intent of the Interagency Grizzly Bear Guidelines (Buterbaugh 1991), with key project considerations being Core, HE, and changes in road density.

Objective 6. Meet the interim management direction specified in the July 27, 1995, Incidental Take Statement (McMaster 1995).

This objective is met by Core, OMRD, TMRD, and ORD standards as addressed in Objective 1.

Outside the Recovery Zone

The tailings impoundment is private property owned by Troy Mine, Inc. Also, most of the tailings impoundment lies within the Troy Polygon which itself is not managed for grizzly bear as stated

previously (**Figure 3-13**). Moreover, all roads used for proposed reclamation activities in the Troy Polygon are currently open to motorized access for mining operation activity.

Environmental Consequences

Direct and Indirect Effects

Reclamation activities in the tailings impoundment area would be located within the Troy Polygon where no reoccurring bear use has been documented. Because these areas have been used historically and would be used in the future, no new impacts to grizzly bears would result from any of the reclamation alternatives proposed for this area. The likelihood of bear use on this private land during reclamation would be negligible.

Objective 1

Reclamation activity for all alternatives would take place over an approximately 2-3 year period and would require heavy equipment use comparable to use in current mining activities. The effects of road reclamation and use of existing roads for other reclamation activities (*e.g.*, removal of structures, mining equipment, recontouring of slopes, etc.) would not be expected to increase disturbance of bears in those areas impacted by current mining activities. All alternatives include reclamation and/or road stabilization work on a number of roads; the specific roads and the detail of reclamation work vary by alternative (see **Transportation Section 3.15**). Most of the roads proposed for reclamation or stabilization are already restricted to motorized access, except NFSR 4626 up to the mill site and NFSR 9003. All alternatives would keep NFSR 4626 open up to the mill site, maintaining the current open status. The No Action and Agency-Mitigated alternatives would reclaim NFSR 9003, which is currently open to motorized access. This short loop road, which extends approximately 250 feet off NFSR 4626, offers little if any access opportunities for motorized use. With respect to BMU 3, habitat component standards are expected to remain at, or potentially become better than, standards for HE, Core, OMRD, TMRD, and ORD for all alternatives.

Habitat Effectiveness: HE would not decrease during Troy Mine reclamation as there would be no new open roads created, and reclamation activities would generally occur in the same areas as present mining activities. HE would be expected to improve once all activities have been completed.

Core Areas: There would be no net loss of Core as Troy Mine reclamation activities do not occur within Core boundaries, and no new open or restricted roads would be created. The Proposed Action would not reclaim any roads and would maintain Core status after the project is finished. The No Action and Agency-Mitigated alternatives propose reclaiming a number of roads. Once project activities cease, a small amount of new Core habitat would possibly be created.

Open Motorized Route Density: All three alternatives propose to keep NFSR 4626 gated at the mill site and restricted to motorized traffic beyond the mill site towards Mt. Vernon. Except for NFSR 9003, all other roads listed in Table 2-1, are either behind gates or on patented and private land and would remain restricted to motorized traffic. The No Action and Agency-Mitigated alternatives propose to reclaim NFSR 9003, which would contribute a negligible decrease in OMRD. Therefore, all of the

alternatives would maintain current OMRD status and would continue to be better than standard for BMU 3.

Total Motorized Route Density: No net increase in TMRD would occur as none of the mine reclamation alternatives propose new roads. The No Action and Agency-Mitigated alternatives also propose to reclaim a number of roads, which would potentially improve TMRD to better than the standard.

Linear Open Road Density: All three alternatives would keep NFSR 4626 gated at the mill site and restricted to motorized traffic beyond the mill site towards Mt. Vernon. Except for NFSR 9003, all other roads listed in Table 2-1, are either behind gates or on patented or private land and would remain restricted to motorized traffic. The No Action and Agency-Mitigated alternatives propose to reclaim NFSR 9003, which would contribute a negligible decrease in ORD. Therefore, all of the alternatives would maintain current ORD status and would continue to be better than standard for BMU 3.

Objective 2

No alternatives propose any timber harvest, and no reclamation alternatives would result in a loss of vegetative structure. Reclamation would eventually re-establish forested habitats on most of the disturbed lands and would improve vegetative structure within several decades.

The identified linkage zone south of Bull Lake would not be impaired by any of the alternatives. The Proposed Action would leave NFSR 4628 in place as is and would not change current conditions in that area. The No Action and Agency-Mitigated alternatives propose road stabilization for NFSR 4628 and would not impair the long-term availability of the linkage zone.

Most proposed activities for all alternatives would take place in areas currently receiving regular use during mining operations. The one exception is NFSR 4628, which accesses the South Adit, does not receive regular mining use beyond NFSR 4628C. Beyond the southern end of the Troy Mine Permit Area towards Ross Creek, BMU 3 has known bear activity (Kasworm 2010). Disturbance and displacement of bears would be expected from the road storage activities south of the more regularly used mining operation sites. Reclamation activities are expected to occur over an approximately two to three year timeframe during the snow free period (April to September). For most of the Troy Mine Permit Area, this timeframe does not change the current condition experienced by bears. The No Action Alternative and Proposed Action do not have any activity restrictions during the important spring bear-use period (April 1 – June 15) and would potentially cause disturbance and avoidance by foraging bears. The Agency-Mitigated Alternative would specify road work on the segment of NFSR 4628 from the junction with NFSR 4628C to Ross Creek outside this period to allow for spring forage opportunities.

No known dens occur within the Troy Mine Permit Area. Activities taking place during the winter months (December 1 to March 31) are not expected to negatively impact grizzly bears.

Objective 3

Revegetation would occur throughout the Permit Area. The No Action Alternative would use an introduced grass and forb species mix and does not differentiate which species would be used in various habitat types. Sweet clover (*Melilotus* spp.) is included in this mix and could create human-grizzly

conflicts in areas where it is planted. Both the Proposed Action and the Agency-Mitigated Alternative would use native grass and forb species mixes that do not include bear attractants. Under the Proposed Action and Agency-Mitigated Alternative, vegetation as a food attractant would not be expected to create human-grizzly bear conflicts.

Taking into consideration the status of the habitat components listed above, the cumulative risk of mortality would not change appreciably due to implementing mine reclamation alternatives. It is important to note that human-caused grizzly bear mortality is also a function of other factors, such as regulation of big game hunting, which are beyond the authority of the USFS to control. Hunting regulation is the responsibility of the State of Montana.

Objective 4

The huckleberry (*Vaccinium* spp.) is an important food source for grizzly bears in this ecosystem (USFWS 1993). No alternatives would decrease this important food source, because proposed activities are directed at sites that are currently disturbed. However, once project activities are completed, huckleberries from adjacent sites may serve as a source for colonization on newly reclaimed sites over time.

The alternatives do not propose activities within currently undisturbed riparian habitat and would follow other KNF riparian management guidelines, Montana Streamside Management Act (HB 731), and INFISH guidelines. The No Action Alternative would leave the intermittent drainage across the mill site in the existing culverts; therefore, there would be no addition to current riparian areas. The Proposed Action and Agency-Mitigated Alternative would replace the culverts with a rock-lined channel leaving only a slight potential for increased riparian area. Adherence to riparian area standards would ensure protection of the food resources in this important zone.

Objective 5

All three alternatives would meet this objective by meeting Objectives 1-4 above.

Objective 6

All three project alternatives would meet this objective by meeting the Core, OMRD, TMRD, and ORD standards addressed in Objective 1.

Cumulative Effects

Past, present, and reasonable foreseeable future actions in the analysis area are presented at the beginning of Chapter 3 (**Sections 3.2 and 3.3**). Past harvest and natural disturbances have provided a variety of vegetation age classes and successional stages across the analysis area, thus diversifying the landscape. In some cases, past timber harvests and fires even improved habitat for huckleberries and other forage favorable for grizzly bears and big game.

Also, open road densities have declined in the past several years because of restricting/reclaiming roads through decisions intended to facilitate grizzly bear recovery. The No Action and Agency-Mitigated

alternatives would restrict/reclaim additional roads and would therefore have a cumulative beneficial effect.

Basic road maintenance, pre-commercial thinning, mushroom picking, prescribed burning, timber hauling, wildlife habitat improvement projects, and various recreational uses are additional activities that would continue within the analysis area. Potential recreation that has been restricted beyond the mill/office site during mining activities may increase slightly, but likely not far beyond the existing gate location because the road would remain restricted to motorized access after reclamation. Generally, these activities would not have adverse impacts on wildlife species but may incidentally affect wildlife use temporarily within some areas. However, they are not likely to affect the viability of this species.

All alternatives could encourage huckleberry expansion in BMU 3 through reclamation activities by creating potential habitat adjacent to current huckleberry habitat. All of the activities listed above (including reclamation) may disturb a grizzly bear or cause it to temporarily avoid an area until human actions are finished. Although disturbances would affect availability of huckleberries, reclamation alternatives would not create a cumulative effect on potential grizzly bear disturbance.

Mining activities would cease as reclamation activities begin, and reclamation would have no cumulative effect on bear disturbance as the two activities would not take place simultaneously.

With respect to patented lands, there are no known non-mining related activities proposed at the top of Mt. Vernon. Therefore, no cumulative effects on grizzly bears are expected related to this parcel of patented property as part of any of the alternatives.

The likelihood of bear use occurring on private land at the tailings impoundment area, which is within the Troy Polygon, during reclamation would be negligible, and the potential cumulative impacts of displacement would be discountable.

No alternatives are expected to have cumulative effects on grizzly bears or their habitat on NFSL. The standards for Core, HE, and road densities would continue to be met, if not improved upon, following completion of reclamation activities. All alternatives, in combination with the baseline conditions and past, present, and reasonably foreseeable future projects are not expected to have a measurable effect on the grizzly bear or its habitat or to increase grizzly bear mortality.

Regulatory Compliance

ESA: The No Action Alternative, if approved today, would not be in compliance with ESA (*e.g.*, use of sweet clover in the seed mix). The Proposed Action and Agency-Mitigated Alternative are expected to comply with ESA because 1) they meet all standards and guidelines established by USFWS through the IGBC; and 2) consultation with USFWS would occur through the proper procedures.

Forest Plan Consistency: The Proposed Action and Agency-Mitigated Alternative meet Forest Plan goals as they apply to the grizzly bear and as stated in:

- Pages: II-1 #2, #3, #5, II-2 #12, and II-22-23;
- Appendix 8 which addresses grizzly management situation guidelines and augmentation discussion; and
- Appendix 8 which assumes that grizzly bear habitat standards will be adapted based on consultations with USFWS (page 8-7).

NFMA: The Proposed Action and Agency-Mitigated Alternative would comply with NFMA direction to provide for diverse populations of plant and animal communities with Forest Plan standards and guidelines (Johnson 2004a). The No Action Alternative would not comply because of the use of introduced grass and forb species.

Statement of Findings

The No Action Alternative would reclaim most roads but it does not address specific reclamation techniques or seasonal timing for roadwork. Furthermore, it uses an introduced species seed mix, including sweet clover. However, because reclamation activities would not result in new roads or disturbed areas and because mining activities would have ceased, the overall effect of the No Action Alternative would be to improve habitat conditions for the grizzly bear in the long-term. The No Action Alternative is determined to *“May Affect, but is not Likely to Adversely Affect”* the grizzly bear.

The Proposed Action would not include road reclamation. However, it also would not build or open roads to motorized traffic, and therefore, would maintain current road densities and motorized access levels. Compared to the No Action Alternative, the Proposed Action is more specific in defining the reclamation techniques to be used and uses native seed mixes for revegetation that do not include sweet clover. The overall effect of the Proposed Action within the Troy Mine Permit Area would be to improve habitat conditions for the grizzly bear in the long-term. The Proposed Action is determined to *“May Affect, but is not Likely to Adversely Affect”* the grizzly bear.

The Agency-Mitigated Alternative would reclaim most roads, use native seed mixes that do not include sweet clover for revegetation, and provide seasonal restrictions on road reclamation work. Overall, the Agency-Mitigated Alternative would improve habitat conditions for the grizzly bear in the long-term and address some of the potential short-term effects. In short, the Agency-Mitigated Alternative would have a determination of *“May Affect, but is not Likely to Adversely Affect”* the grizzly bear.

Therefore, all alternatives *“May Affect, but are not Likely To Adversely Affect”* the grizzly bear. This determination is based on:

- reclamation activities would be comparable to or less than the existing activity during mine operations, and long-term effects would be beneficial through reclamation of habitat to varying levels of quality;

- BMU 3 currently meets the standards and interim guidelines for the Cabinet-Yaak Ecosystem and would continue to meet standards after Troy Mine reclamation; and
- no increase in bear mortality would be expected from reclamation activities.

Canada Lynx

Canada Lynx Background

Lynx population ecology, biology, and habitat description and relationships are described in Ruggiero *et al.* (2000) and in Ruediger *et al.* (2000). These studies are 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 on the effects of the NRLMD (USFWS 2007c). Lynx occurrence data come from recent District wildlife observations, NRIS, and from other agencies (FWP, MNHP, and USFWS).

The Final EIS for the NRLMD Record of Decision was completed in March 2007 (USFS 2007). This decision amended the Forest Plan by providing lynx habitat management objectives, standards, and guidelines. The decision replaced the interim application of the Lynx Conservation Assessment and Strategy. The direction provided in the NRLMD is applied to lynx habitat at the lynx analysis unit (LAU) scale. The KNF has delineated 47 LAUs which approximate a lynx home range size. KNF forest-wide lynx habitat has been updated to reflect the lynx habitat terminology from the NRLMD.

The effects analysis follows the standards and guidelines established in the NRLMD. Only the standards and guidelines applicable to the proposed Troy Mine project are analyzed, and they are only applied to lynx habitat on federal lands (in compliance with the ROD). Those standards and guidelines considered but found “not applicable” are found in the EIS project file. Lynx habitat in impacted LAUs was mapped by using the timber stand database version of the KNF model. Connectivity was evaluated by visually examining lynx habitat and by reviewing past management activities to identify possible movement areas and potential areas where lynx travel may be hindered. Here, ridgelines and draws were considered high value movement areas.

The scale for direct, indirect, and cumulative effects analysis is the LAU(s) that may be impacted by the proposed federal action (**Figure 3-14**). Adjacent LAUs are also considered for connectivity effects.

Affected Environment

On March 24, 2000, the USFWS listed the contiguous U.S. distinct population segment of the Canada lynx as threatened (Clark 2000). National population and habitat status descriptions found in that document are incorporated by reference. To date, there are two known occurrences of lynx documented within the analysis area; in the Spar PSU in the upper Spar drainage, and one known occurrence of lynx within the Lake PSU as listed in the MNHP and NRIS databases.

On February 25, 2009, the USFWS issued a final rule which revised critical lynx habitat. The lynx analysis area in this EIS does not fall within critical lynx habitat and currently, all LAUs meet the NRLMD standards (USFS 2007c).

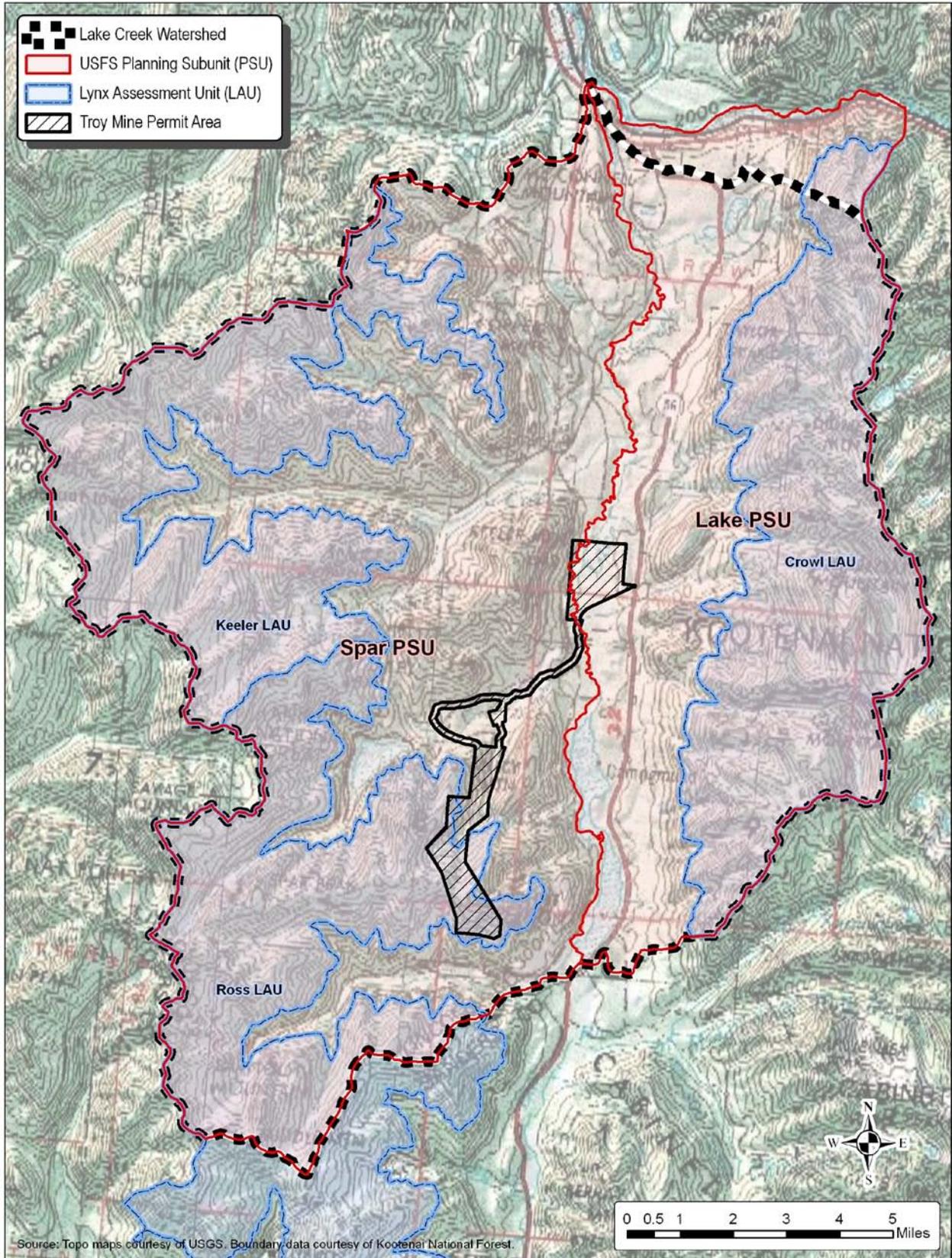


Figure 3-14. Lynx Analysis Units

The analysis area includes portions of three LAUs: Ross and Keeler in the Spar PSU and Crowl in the Lake PSU. Reclamation activities would only occur in the Ross LAU, and the adjacent LAUs would only be considered for connectivity concerns.

There is one identified linkage corridor (USFS 2004) in the project area between the Crowl LAU and the Ross LAU. This linkage corridor is south of Bull Lake and is the same linkage corridor discussed in the grizzly bear section.

Environmental Consequences

Direct and Indirect Effects

Reclamation activities proposed in the tailings impoundment area are not located within the Ross LAU, and therefore, there would be no direct effects on Canada lynx from activities located on these private lands.

The following management direction applies to all NFSL that are known to be occupied by Canada lynx. The goals, objectives, standards, and guidelines address the risk factors found to threaten lynx populations.

Objectives, Standards, and Guidelines Applicable to All Management Projects in Lynx Habitat

Objective ALL O1: Maintain or restore lynx habitat connectivity in and between LAUs and in linkage areas.

The most likely point of access to the one identified linkage corridor south of Bull Lake would be from a more southern portion of the Ross LAU, south of Ross Creek. None of the alternatives propose any reclamation in this part of the LAU, nor do any of them propose activities where the Ross and Keeler LAUs join. Thus, the alternatives would not be expected to impair the linkage between these two LAUs.

Objectives, Standards, and Guidelines Applicable to Human Use Projects in Lynx Habitat

Objective HU O1: Maintain the lynx's natural competitive advantage over other predators in deep snow, by discouraging the expansion of snow-compacting activities in lynx habitat.

All roads identified as restricted within the Troy Mine Permit Area are currently restricted to all motorized activities year-long, including snow vehicles. Because none of the alternatives would increase motorized access, the lynx's competitive advantage in deep snow would be maintained.

Objective HU O2: Manage recreational activities to maintain lynx habitat and connectivity.

None of the alternatives would increase recreational opportunities; the alternatives would return pre-operational recreational access to public lands. Access via roads open to motorized use would not increase. A small increase in foot traffic from the gate currently located at the mill/office site may occur, but would be limited to access by non-motorized means.

Guideline HU G4: For mineral and energy development sites and facilities, remote monitoring should be encouraged to reduce snow compaction.

No new mineral or energy development sites would occur under the reclamation alternatives. However, water quality monitoring would follow mine closure and reclamation activities until such time as the regulating agencies determine that their standards have been met. Monitoring activities would take place at pre-existing sites so that no new effects would be observed and any new monitoring sites would be established only during the non-winter period.

Guideline HU G5: For mineral and energy development sites and facilities that are closed, a reclamation plan that restores lynx habitat should be developed.

Because lynx were not listed when the No Action Alternative was originally proposed in the 1978 EIS, this alternative did not address restoring lynx habitat in the Permit Area. In addition, the plant species mix proposed for reclamation includes non-native species and does not account for differences in habitat type along the elevational gradient. Therefore, the No Action Alternative would have limited benefits to lynx habitat.

Both the Proposed Action and the Agency-Mitigated Alternative would follow direction provided in the NRLMD. These alternatives would occur within and along already disturbed sites, such as roads, and therefore would cause minimal vegetation manipulation. Both alternatives include native plant species mixes and apply different plant species composition to different habitat types along the elevational gradient. These alternatives would improve the habitat at a faster rate which would provide greater benefits to lynx habitat.

Guideline HU12: Winter access for non-recreation special uses and mineral and energy exploration and development, should be limited to designated routes or to designated over-the-snow routes.

All three alternatives would be the same with respect to winter access. Post-mine closure winter motorized access would be restricted, and therefore, no effects would result.

Objectives, Standards, and Guidelines Applicable to All Projects in Linkage Areas Subject to Existing Rights

Objectives LINK O1: Work with other land owners on solutions to reduce potential adverse impacts on lynx and lynx habitat.

See Objective ALL O1 for linkage areas. The only private lands within the Ross LAU are the patented lands located on the top of Mt. Vernon. No alternative proposes any activity on the top of Mt. Vernon other than reclamation and stabilization along restricted roads. No other activities would be proposed on the patented property. All three alternatives would meet this objective on linkage zones between public and private lands.

Cumulative Effects

No known non-reclamation activities are proposed for the patented land on top of Mt. Vernon, and activities proposed on private property in the tailings impoundment area are not located within the Ross LAU, therefore there would be no cumulative effects on these private lands.

The analysis area has received regeneration harvests in the recent past, currently analyzed as unsuitable, but in a few years these stands will become early successional forage habitat. In addition, the Sparring Bulls project plans an additional 139 acres of regeneration harvest that would temporarily change lynx habitat into unsuitable condition (KNF 2010). However, none of the alternatives propose to alter the existing vegetation, would not increase the amount of unsuitable habitat, and would not contribute to cumulative effects with respect to forage habitat. Activities within the Ross LAU are limited to sites already disturbed and to existing roads. Movement corridors within and between the LAUs in the project area would remain available and with vegetative structure for lynx movement.

Regulatory Compliance

ESA: All the alternatives would be in compliance with ESA. This statement is based on: 1) they would be consistent with the ESA; and 2) consultation with USFWS would occur through proper procedures.

Forest Plan Consistency: All three alternatives would comply with Forest Plan direction on threatened and endangered species with respect to lynx (Forest Plan Vol. II-1 #7, II-22) and with the NRLMD.

NFMA: The Proposed Action and Agency-Mitigated Alternative would comply with NFMA direction to provide for diverse populations of plant and animal communities by compliance with Forest Plan standards and guidelines (Johnson 2004a). The No Action Alternative would not comply because of its use of introduced grasses and forbs.

Statement of Findings

The No Action Alternative, the Proposed Action, and Agency-Mitigated Alternative would all result in a determination of “*May Affect, but is Not Likely to Adversely Affect*” the lynx or its habitat. This determination is based on the analysis that: 1) All objectives, standards, and guidelines in the 2007 NRLMD would be met, and 2) no disturbance to lynx, its habitat, or to its prey base would occur over the long term.

In addition, all three alternatives are not likely to result in the destruction or adverse modification of proposed critical habitat.

3.18.4.2 Gray Wolf

Gray Wolf Background

Strategies to protect and recover wolf populations in Montana as well as their ecology, biology, and habitat descriptions are outlined in the Northern Rocky Mountain Wolf Recovery Plan (USFWS 1987). On April 2, 2009, the USFWS identified a Northern Rocky Mountain distinct population segment of the gray wolf, removing all but the Wyoming population from the List of Endangered and Threatened Wildlife (USFWS 2009). However, this rule was vacated on August 5, 2010 by the U.S. District Court in Missoula, Montana, relisting the gray wolf as an endangered species within the Northwest Montana Recovery (NWMT) area. The NWMT is one of three wolf recovery areas identified for the Northern Rocky Mountain wolf population (Sime *et al.* 2010); the KNF is within the NWMT. Information for this recovery area is provided by the Montana Gray Wolf Conservation and Management 2009 Annual Report (Sime *et*

al. 2010) and is incorporated here by reference. Wolf occurrence data come from recent District wildlife observation records, NRIS database, and from other agencies (FWP, USFWS).

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 KNF Forest Plan big game management recommendations. For this project area, elk management recommendations were applied (**Section 3.18.6.1**). They include cover/forage ratios, road densities, opening sizes, key habitat features, movement areas, habitat effectiveness levels, and security levels.
- 2) **Suitable and somewhat secluded denning and rendezvous sites:** Gray wolves are sensitive to disturbance near denning and rendezvous sites (Thiel *et al.* 1998, Claar *et al.* 1999, Frederick 1991). Recommendations to protect dens from human disturbance include 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. Similar restrictions can be implemented for rendezvous sites. Evaluation of potential impacts would include analysis of how each alternative would maintain the habitat integrity of the denning and rendezvous sites.
- 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 principal factors limiting wolf recovery in most areas (Leirfallom 1970, USFWS 1978, USFWS 1987, Thiel 1978, all in Frederick 1991). These components can generally be measured by maintaining Open Road Density (ORD) standards required by the Forest Plan and by following big game habitat recommendations for security habitat.

The analysis area for addressing direct, indirect, and cumulative effects on the gray wolf and their habitat is the Lake Creek watershed.

Affected Environment

At the end of 2009, there were 101 wolf packs statewide with 37 meeting breeding pair criteria. The population estimate for Montana's packs is 524 individuals, including a minimum of 166 pups (Sime *et al.* 2010). The KNF is home to 16 resident packs (six with breeding pairs) and six transboundary packs located primarily in Canada, Idaho, and adjacent National Forest lands in Montana (Sime *et al.* 2010, Laudon 2010). These packs had a total of 70 wolves at the end of 2009 (Mack *et al.* 2010, Sime *et al.* 2010). An estimate of 80 wolves was recorded in 2008 (Mack *et al.* 2009, Sime *et al.* 2009). If pack movement, unknown pack numbers, and losses due to depredation (five unknowns, ten lost to hunting, eight removed for depredation) are all considered, the numbers between years are similar, if not slightly increased. Also, recent survey efforts suggest there may be two new packs on the KNF in 2010 (Laudon 2010).

FWP implemented a statewide general hunting season in 2009 which resulted in 72 wolves being harvested; seven from resident packs in the KNF and three from transboundary packs elsewhere in the state (Sime *et al.* 2010). Two resident packs had eight total wolves lethally removed due to depredation in 2009 (Sime *et al.* 2010) and a third pack (eight individuals in 2009) was removed in early 2010 (Laudon 2010). This reduction contributed to a higher level of documented mortality than in 2007 or 2008. It is not specified if the six human-caused wolf deaths (harvested or other) in the Panhandle Wolf Management Zone of Idaho occurred within the Montana transboundary packs or not (Mack *et al.* 2010).

The Twilight wolf pack uses the Spar PSU area as a portion of its home range. The pack was established in 2008; a total of eight wolves were documented, including five pups (Sime *et al.* 2009). Currently, the pack includes four adults and no longer includes a breeding pair. A single wolf was harvested in the 2009 general hunting season; the other “missing” wolves are unaccounted for as none are radio collared. No known livestock depredations are attributed to this pack (Sime *et al.* 2010).

Prey Base

The Spar PSU supports year-round habitat for most big game species, with white-tailed deer being the most abundant found in the area. Other big game species include elk, mule deer, moose, and mountain goats. Together, this mix of species provides a year-round prey base for wolves. The elk was chosen as the Management Indicator Species (MIS) for the Spar PSU which is identified as a high emphasis area for elk management (Johnson 2004a). See the MIS section (**Section 3.18.6**) for more information on elk habitat conditions and population status in the Spar PSU.

Den and Rendezvous Sites

No den sites for this pack have been located at this time. There is speculation of a rendezvous site near Spruce Lake that has been used in the analysis area since the pack was established. This area continues to be monitored on a yearly basis. This pack has never been radio collared, and only a few days of surveys were conducted in 2009. Once individual wolves can be fitted with radio collars, their activities will be monitored and will provide additional information on their use of the analysis area.

Sufficient Space with Minimal Exposure to Humans

Management Area 12 (MA 12, non-winter big game habitat) and grizzly bear management have the most restrictive ORD standards in the Forest Plan at ≤ 0.75 mi/m². If ORD for the BMU(s) in a project area meets the grizzly standard, it also achieves big game management recommendations for the project area (Schrenk 1995). Most of the NFSL between the tailings impoundment and the patented property on Mt. Vernon are classified MA 12. ORD in BMU 3 (0.57mi/mi²) currently meets Forest Plan standards (USFS 2009b). Security habitat recommendations for elk are within recommended levels (see MIS section on elk). The analysis area meets the standard for sufficient space with minimal exposure to humans.

Environmental Consequences

Direct and Indirect Effects

Reclamation activities on private and patented lands within the Troy Mine Permit Area could result in some short-term disturbances of wolves and their prey species. However, under all three alternatives, the long-term results of reclamation would not be expected to affect available habitat and disturbance levels.

Prey Base

As discussed in the MIS effects analysis, all alternatives would maintain or improve habitat conditions for elk. This would be primarily through reducing traffic and noise associated within the current mining operations and the reclamation activities. Therefore, prey conditions for wolves are likely to be maintained under any of the alternatives.

Den and Rendezvous Sites

The suspected rendezvous site is over a mile from any reclamation work proposed by any of the alternatives. Also, reclamation activities would be expected to be similar to the everyday mining operations. Wolves have continued to use this rendezvous site despite activity at the mine; therefore, reclamation activities would not be expected to have an increased effect. No den sites are known at this time.

Sufficient Space with Minimal Exposure to Humans

ORD in the Spar PSU meets grizzly bear and big game standards. While reclamation work is being completed on some of the more remote and less used roads, wolves may temporarily avoid the area but transient use could still occur.

For all alternatives, any proposed reclamation and/or BMP work would occur on roads that already exist on the landscape. Also, no roads would be built, and motorized access would not increase. The Proposed Action would not reclaim any roads. The No Action and Agency-Mitigated alternatives would reclaim several roads; however, only NFSR 9003 is currently open to motorized access. Therefore, implementing these alternatives would decrease ORD in BMU 3.

Cumulative Effects

Past timber harvest, mining activities, and road construction projects and natural events have shaped much of the existing habitat conditions found within the analysis area.

Prey Base

Within the past two years, the Twilight Pack was identified in the project area. Establishment of a pack in this project area is a good indicator that a sufficient prey base exists. Other predators already in the project area and competing with the wolf for big game prey include the grizzly bear, mountain lion, black bear, and the coyote. The alternatives would maintain habitat security and result in no net increase in ORD. Past analyses (over the last 10 years) in this analysis area show that big game habitat management standards are being met.

Timber Harvest

Timber harvest activities have occurred and are expected in the Spar PSU. These activities have provided forage for big game and have created more openings in lower elevation stands on big game ranges. Although harvest activities may create short-term disturbances to wolves and their prey species, wolf numbers have increased since 2002. Short-term potential disturbances from the alternatives would not result in a negative cumulative impact on wolves, and mortality risk for wolves and associated prey species is not expected to increase.

Private land development

Land development activities such as construction of roads, clearing of vegetation, construction of residences, and installation of improvements, all make a variety of changes to the landscape. Depending on the magnitude, type, and location of developments and the amount of private land on the landscape, these activities can have negative effects, including the loss of hiding cover and localized disturbance on wolves and their prey species.

While there may be some short-term direct effects on wolves and their prey species, long-term effects on private lands would not be expected. Therefore, there would be no cumulative effect under the three alternatives.

Hunting

On-going hunting activities are regulated by the FWP, and the USFS influences hunter access through road management. After mine reclamation is complete, there may be a slight increase in non-motorized access to the Mt. Vernon area, but access would remain limited and use levels would be low. With the generally limited amount of these activities on private, patented, and state lands, potential cumulative effects to the wolf would be minimal.

Regulatory Compliance

ESA: All alternatives would be expected to be in compliance with ESA because all alternatives address and maintain key habitat components which are identified in the Wolf Recovery Plan (USFWS 1987).

Forest Plan Consistency: The alternatives would meet Forest Plan direction that applies to the gray wolf, threatened and endangered species, and big game recommendations: Pages: II-1 #3, #5, #7, #12 and II-22-23.

NFMA: The Proposed Action and Agency-Mitigated Alternative would comply with NFMA direction to provide for diverse populations of plant and animal communities by compliance with Forest Plan standards and guidelines (Johnson 2004a). The No Action Alternative would not comply because of its use of introduced grasses and forbs.

Statement of Findings

The No Action Alternative, Proposed Action, and Agency-Mitigated Alternative would all result in a determination of “*May Affect, but is Not Likely to Adversely Affect*” the gray wolf. This determination is based on the analysis that: 1) the alternatives would meet Forest Plan big game management

recommendations; 2) the prey base in the area supports at least one known wolf pack; 3) the alternatives would not affect known denning or rendezvous sites; 4) transient use could continue, but with a possible short-term avoidance of activity areas; and 5) mortality risk to the wolf would not be expected to measurably increase during or after reclamation activities.

3.18.5 Sensitive Wildlife Species

The sensitive species analysis in this document meets requirements for a biological assessment as outlined in FSM 2672.42.

Sensitive species are administratively designated by the Regional Forester (FSM 2670.5) and managed under the authority of NFMA. FSM 2670.22 requires maintaining viable populations of native and desired non-native species and avoiding actions that may threaten or endanger a species.

The NFMA directs the USFS 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 USC 1604(g) (3) (B)). Providing ecological conditions that support diversity of native plant and animal species in the planning area satisfies the statutory requirements. The USFS’s focus for meeting the requirements of NFMA and its implementing regulations is on assessing habitat to provide for diversity of species.

The Forest Plan establishes forest-wide 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 (Forest Plan II-1).

In 2010, USFS personnel identified a current listing of all sensitive wildlife species known to occur on the KNF (**Table 3-25**). This species list was used to help determine which species may be present in the analysis area.

Table 3-25. Sensitive Wildlife Species

Sensitive Species	Status Within Project Area	Comments Specific to Spar Planning Subunit
Bald Eagle <i>(Haliaeetus leucocephalus)</i>	K	Suitable habitat found within the analysis area. See further discussion below in Sensitive Species section.
Black-Backed Woodpecker <i>(Picoides arcticus)</i>	K	Suitable habitat identified within the analysis area. See further discussion below in Sensitive Species section.
Coeur d'Alene Salamander <i>(Plethodon vandykei idahoensis)</i>	K	Suitable habitat identified along riparian zones within the analysis area. See further discussion below in Sensitive Species section.
Common Loon <i>(Gavia immer)</i>	K	Suitable habitat found within the analysis area. See further discussion below in Sensitive Species section.
Fisher <i>(Martes pennanti)</i>	K	Suitable habitat identified within old growth habitat and along riparian zones within the analysis area. See further discussion below in Sensitive Species section.
Flammulated Owl <i>(Otus flammeolus)</i>	S	Preferred habitat exists on Douglas-fir/ ponderosa pine ecosystems within the analysis area. See further discussion below in Sensitive Species section.
Harlequin Duck <i>(Histrionicus histrionicus)</i>	S	Suitable habitat present along lower elevation, large creeks within the analysis area. See further discussion below in Sensitive Species section.
Peregrine Falcon <i>(Falco peregrinus)</i>	K	Suitable habitat found within the analysis area. See further discussion below in Sensitive Species section.
Townsend's Big-Eared Bat <i>(Corynorhinus townsendii)</i>	K	Suitable habitat found within the analysis area. See further discussion below in Sensitive Species section.
Western Toad <i>(Bufo boreas)</i>	K	Suitable habitat found within the analysis area. See further discussion below in Sensitive Species section.

Sensitive Species	Status Within Project Area	Comments Specific to Spar Planning Subunit
Wolverine (<i>Gulo gulo</i>)	K	Suitable habitat identified along high elevation ridgelines within the analysis area. See further discussion below in Sensitive Species section.
Northern Bog Lemming (<i>Synaptomys borealis</i>)	NS	Preferred habitat does not occur within the analysis area. Closest known occurrence is 55 air miles to the north near Northwest Peak. Therefore, this species is not impacted by proposed reclamation project and will not be considered in further analyses.
Northern Leopard Frog (<i>Rana pipiens</i>)	NS	Preferred habitat does not occur within the analysis area. Closest known population is 75 air miles to the northeast near Eureka. Therefore, this species is not impacted by proposed reclamation project and will not be considered in further analyses.

* Status Key:
K = This species is known to occur within the project area
S = This species is suspected to occur within project area.
NS = This species is not suspected to occur within the project area, and is, therefore, dropped from further evaluation.

3.18.5.1 Bald Eagle

Bald Eagle Background

Eagle population ecology, biology, habitat description, and relationships identified by research are described in MBEWG 1991, MBEWG 1994, MBEWG 2010 USFWS 1995, USFWS 1999a, and in USFWS 2007a. That information is incorporated by reference. Eagle occurrence data come from recent District wildlife observation records, NRIS database, and from other agencies (FWP and USFWS).

The analysis area for project impacts and cumulative effects to individuals and their habitat is all lands within the bald eagle habitat area boundaries agreed to by the USFWS (2001). This bald eagle habitat area consists of a corridor approximately one mile on either side of Lake Creek from Bull Lake to the Kootenai River.

Affected Environment

The bald eagle was officially removed from the threatened species list on August 8, 2007. It was immediately placed on the Forest Service Northern Region's sensitive species list for a period of five years, after which time a status review will be made to determine if the eagle needs to remain on that list. In Montana, the number of bald eagle nesting territories has grown from 31 in 1980 to 490 in 2008 (Hammond 2009). Known nesting success in 2007 was 79 percent (DuBois 2008).

Bald eagles occur as both seasonal migrants and year-round residents, and nesting has increased over the last two decades within the boundaries of KNF. Only one active nest was known to occur in 1978; however, 27 nests (11 on NFSL and 16 on private land) were known and monitored in 2007 (KNF 1978 to present). Nest success for the active nests in 2007 was 38 fledglings. This number is above the average year of 24.5 fledges over the last 20-year period (DuBois 2008).

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 versus frozen water for foraging habitat). Mid-winter bald eagle counts have averaged 96 bald eagles over the past 20 years (KNF bald eagle monitoring records). In 2009, 98 bald eagles (75 adults and 23 immatures) were tallied on the winter count.

There is one bald eagle nest site in the Spar PSU, on the south end of Bull Lake. Two nests occur in the Lake PSU; one is on the north end of Bull Lake and the other lies outside the analysis area. A winter wind event in 2009 damaged the older nest (north end of Bull Lake), and no eagles were seen perching or roosting near the site. The nest was still in disrepair in the summer of 2010. A newer nest (south end of Bull Lake) was established in 2007, and the eagle pair has produced fledglings in the past couple of years.

Eagles are occasionally observed near Bull Lake in the winter if the lake is not frozen over. Eagles are known to use the Kootenai River corridor in the winter within the Lake PSU. Besides the forage opportunities along water bodies, these raptors scavenge along US 2 and MT 56 and along the railroad tracks that parallel the Kootenai River.

The Montana Bald Eagle Working Group (MBEWG) (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. All of these risks remain in the analysis area.

The Montana Bald Eagle Management Plan (MBEWG 1994 and MBEWG 2010) recommends distance buffers based on the presence or absence of visual buffers and seasonal restrictions for heavy construction activities near bald eagle nests (active and inactive), concentrated forage areas, and winter roost sites. The area buffers range from $\frac{1}{4}$ mile to $\frac{1}{2}$ mile (depending on visual buffers) with seasonal restrictions from February 1 to August 15 (nest building, egg laying/incubation, and hatching/rearing seasons).

Environmental Consequences

Direct and Indirect Effects

None of the alternatives would include any activities closer than one mile to the active nest located on the south side of Bull Lake. This distance surpasses the $\frac{1}{2}$ mile buffer distance recommended for potentially disturbing activities near active bald eagle nest sites. None of the alternatives would result in direct or indirect effects on the active nest in the analysis area.

Lake Creek runs along the west side of the tailings impoundment. Bald eagles may use this as part of their foraging habitat. Because reclamation activity levels are expected to be similar to current mining operations, bald eagles using the area would not likely experience any new effects.

Cumulative Effects

The eagle nest on the south end of Bull Lake is near an active boat ramp and campground. It was located in 2007, and the eagles have produced fledglings in the successive years. Recreational activities are apparently not disrupting breeding or nesting efforts.

None of the alternatives would contribute to any cumulative impacts on the bald eagle or its habitat. The viability of known bald eagle populations would not be affected by implementing any of the alternatives.

Regulatory Compliance

Forest Plan Consistency: All alternatives would meet Forest Plan direction as applicable to the bald eagle and sensitive species (Pages: II-1 #5, #6, #7, II-2 #13, and II-22-23).

NFMA: All alternatives would comply with NFMA direction to provide for diverse populations of plant and animal communities by compliance with Forest Plan standards and guidelines (Johnson 2004a).

Bald and Golden Eagle Protection Act: All alternatives would be consistent with the Bald and Golden Eagle Protection Act (16 USC 668-668C 1978).

Migratory Bird Treaty Act: All alternatives would be consistent with the Migratory Bird Treaty Act (17 USC 703-712).

Statement of Findings

The No Action Alternative, Proposed Action, and the Agency-Mitigated Alternative would all result in a determination of *“May Impact Individuals and/or their Habitat, but Will Not Likely Contribute to a Trend Towards Federal Listing or Loss of Species Viability to the Population or Species”*. This determination is based on the analysis that: 1) all alternatives would meet the USFWS guidelines outlined in the NBEMG for avoiding nest disturbance; 2) the bald eagle pair that currently occupies the active nest site have exhibited some tolerance for current levels of recreational activity in the vicinity; and 3) the project would not impact bald eagle foraging opportunities throughout the year.

3.18.5.2 Black-backed Woodpecker

Black-backed Woodpecker Background

Black-backed woodpecker population ecology, biology, habitat description, and relationships are described in Cherry (1997), Hutto (1995), O’Connor and Hillis (2001), and in Powell (2000). The above information is incorporated by reference. Black-backed woodpecker occurrence data originate from recent District wildlife observation records, NRIS database, and from other agencies (MNHP).

High quality habitat is defined as recent (< 5 years old) mixed-lethal or stand-replacement fire areas where an abundance of snags are available and found to be almost restricted to early post-fire forests (Hutto 1995). Potential territories may include general forest habitat (low quality), but must include some burned or decadent acres of overstory that attract and support the beetle larvae species the woodpecker preys on (Bonn *et al.* 2007, Cherry 1997). The analysis area for addressing direct, indirect, and cumulative effects to individuals and their habitat is the Lake Creek watershed. The boundary for determining trends towards viability is the KNF.

Affected Environment

Habitat for black-backed woodpeckers consists of boreal and montane forest where beetle outbreaks have occurred as a result of disturbances caused by fire, wind, and disease. Within the analysis area, black-backed woodpecker habitat consists mainly of lower quality general forest habitat with small scattered patches of snags produced by insects and disease. This lower quality habitat supports low populations of resident black-backed woodpeckers.

Recent fires (within the last three years) in the Spar PSU (Ross Creek drainage) have provided snag habitat for black-backed woodpeckers, and therefore, the woodpeckers are expected to be found in the vicinity of the Troy Mine Permit Area (KNF 2010). Also, a single female was recorded along the west shore of Bull Lake (MNHP). Within the Lake PSU, there are also records of two individuals observed between Camp and Madge creeks (MNHP).

Environmental Consequences

Direct and Indirect Effects

None of the reclamation alternatives would remove snags in the analysis area because activities would be centered on existing disturbed sites. General forest may provide some habitat for the black-backed woodpecker, and some individuals may be present in the vicinity of reclamation activities. As reclamation activity levels would be similar to current mining operations, black-backed woodpeckers that use the area would not likely experience any new effects.

Cumulative Effects

The USFS Sparring Bulls Project is proposing a combination of activities that would remove or reduce some general forest foraging opportunities, but that would also create foraging habitat through associated prescribed burns (KNF 2010). Burned areas would consist of some trees killed by fire effects and thus would set up conditions for beetle occurrence and woodpecker foraging opportunities. Activities replicating historical conditions created by mixed-severity fires could provide high quality black-backed woodpecker habitat for two to three years, then decline, and rarely provide insect food sources beyond five to seven years (Caton 1996, Murphy and Lehnhausen 1998). The Sparring Bulls project would not reduce high quality habitat and would not affect the viability of black-backed woodpecker populations. None of the Troy Mine reclamation alternatives would affect high quality habitat; therefore, there would be no cumulative effect on black-backed woodpecker.

Firewood cutting could remove snags and reduce the availability of nesting and foraging habitat along open roads. Because none of the alternatives would increase motorized access, there would be no cumulative effect from firewood cutting.

Timber stand improvement would not impact woodpecker habitat, as stands that are typically thinned are too young to provide forage for this species. Fire suppression could directly impact the black-backed woodpecker; however, due to steep terrain and limited road access, fire suppression activities have not had an adverse effect in the analysis area. The Troy Mine reclamation alternatives would not affect fire suppression effectiveness and therefore, would have no cumulative impact on the black-backed woodpecker.

No adverse cumulative effects from reclamation activities would be expected either. Finally, the viability of known black-backed woodpecker populations would not be affected by implementing any of the alternatives.

Regulatory Compliance

Forest Plan Consistency: All alternatives would meet the Forest Plan direction applicable to the black-backed woodpecker and sensitive species (Pages: II-1 #6, #8, #17, and II-22-23).

All alternatives would be consistent with the Forest Plan direction for old growth below 5,500 feet (FP Vol. 1 II-1 #7; II-7; II-22 and 23; Appendix 17; and Kootenai FSM 2432.22 Supplement No. 85).

NFMA: The Proposed Action and Agency-Mitigated Alternative would comply with the NFMA direction to provide diverse populations of plant and animal communities by complying with Forest Plan standards and guidelines (Johnson 2004a). The No Action Alternative would not comply because of its use of introduced grasses and forbs.

Statement of Findings

The No Action Alternative, Proposed Action, and Agency-Mitigated Alternative would all result in a determination of *“May Impact Individuals or their Habitat, but will Not Likely Contribute to a Trend Towards Federal Listing or Cause a Loss of Viability to the Population or Species”* for the black-backed woodpecker. This determination is based on the following considerations: 1) the Sparring Bulls Draft EIS (KNF 2010) estimates that nearly 4,000 acres of high quality habitat would be created over the next decade within the analysis area, thereby replacing and augmenting the present habitat; 2) reclamation activities would occur in previously disturbed areas; 3) wildfires would still occur and create habitat for the woodpecker, despite fire suppression management; 4) snag levels would be maintained above Forest Plan standards; and 5) the Potential Population Index (the number of pairs the habitat could support) for the species would remain the same or slightly increase within the analysis area over time (KNF 2010).

3.18.5.3 Coeur d'Alene Salamander

Coeur d'Alene Salamander Background

Coeur d'Alene salamander population ecology, biology, habitat description, and relationships are described in Cassirer *et al.* (1994) and in Maxell (2000). The above information is incorporated by reference. Coeur d'Alene salamander occurrence data come from recent District wildlife observation records, NRIS database, and from other agencies (MNHP).

This salamander is considered a sensitive species because few populations are recorded and their habitats are isolated. Their specialized habitat consists of springs, seeps, waterfall spray zones, and damp stream banks near fractured rocks (Werner *et al.* 2004). NFSRs built in the past may have impacted some of the specialized habitats preferred or used by salamanders. Road building on the District has declined since adoption of the Forest Plan, and grizzly bear management has also reduced the number of roads open to motorized access.

The analysis area to address direct, indirect, and cumulative effects is the Lake Creek watershed. The boundary for determining trends towards viability is the KNF.

Affected Environment

Three observations from the analysis area are found in MNHP and NRIS records and are located in a seep zone on a canyon face above Spar Lake, the Ross Creek Drainage, and at Payne Creek Falls about one mile east of Bull Lake. Johnson (1999) shows Coeur d'Alene salamander presence confirmed at 13 different sites on the KNF. Salamanders have been confirmed in additional sites since 1999, so that the known sites now total 36. Known populations on the KNF are isolated by miles of unsuitable habitat that cannot be crossed (based on Maxell 2000, p 69 and Maxell *et al.* 2003, p 40).

Environmental Consequences

Direct and Indirect Effects

None of the alternatives would include activities within areas of known Coeur d'Alene salamander populations. However, road reclamation or stabilization activities may create short-term sedimentation in streams that may be inhabited by salamanders. For example, some stream crossings may be impacted by road reclamation/reconstruction work under the alternatives. Over the long term, precipitation events could continue to erode vulnerable sections of deteriorating roads, and sedimentation resulting from this may impact habitat that is used by the Coeur d'Alene salamander. Both the No Action and Agency-Mitigated alternatives would minimize this effect by either reclaiming or stabilizing roads. Under the Proposed Action, this erosion could continue in some locations and could affect the Coeur d'Alene salamander. Although there is a low risk that individuals could be impacted, it would have a minimal effect on the overall population and thus would not be expected to affect the continued viability of the Coeur d'Alene salamander within the analysis area.

Cumulative Effects

Because no new or temporary roads would be built under any of the alternatives, there would be no cumulative effect from road construction. Watershed work related to Sparring Bulls on deteriorating roads may create a short-term pulse of increased sedimentation, but the current erosion of the road surface would be mitigated in the long-term. Overall, there would be a low risk of cumulative impacts to individual salamanders.

No on-going or foreseeable actions in the analysis area are expected to impact Coeur d'Alene salamander populations or their habitats. The viability of known salamander populations would not be affected by implementing any of the alternatives.

Regulatory Compliance

Forest Plan Consistency: All alternatives would meet the Forest Plan direction applicable for the Coeur d'Alene Salamander and sensitive species (Pages: II-1 #6, #7, #13, and II-22-33).

All alternatives would be consistent with Forest Plan riparian standards and guidelines (Pages: II-28-33) as amended by INFISH.

NFMA: The Proposed Action and Agency-Mitigated Alternative would follow the NFMA direction to provide for diverse populations of plant and animal communities by compliance with Forest Plan standards and guidelines (Johnson 2004a). The No Action Alternative would not comply because of its use of introduced grasses and forbs.

Statement of Findings

The No Action Alternative, Proposed Action, and the Agency-Mitigated Alternative would all result in a determination of *"May Impact Individuals or their Habitat, But Will Not Likely Contribute to a Trend Towards Federal Listing or Cause a Loss of Species Viability"* for the Coeur d'Alene salamander. This determination is based on the following considerations: 1) no reclamation activities would occur in areas of known salamander populations; 2) none of the alternatives would build any new roads or conduct activities in undisturbed riparian areas; 3) road reclamation and stabilization work proposed in the alternatives could create a short-term pulse of sediment delivery into stream channels bisecting the affected roads and mine sites; 4) deteriorating road prisms in the analysis area could remain susceptible to erosion and may impact potential salamander habitat; and 5) the occurrence of suitable habitat and frequency of stream crossings is low within the area to be reclaimed.

3.18.5.4 Common Loon

Common Loon Background

The current status and distribution of common loons in western Montana can be found in the Third Annual Common Loon Report (Bissell 2005) and in the USFWS Conservation Plan (Evars 2004). Skaar (1989) and Dolan (1994) established interim goals and strategies for maintaining nesting habitat and stable population levels; they also described the ecology, biology, habitat use, status, and conservation of the common loon. Data from these documents are incorporated by reference.

The analysis area centers on Bull Lake, which is located in the Lake Creek watershed. The analysis focuses on direct effects to loons and their habitat. Addressed are both the shorelines within 500 feet of nesting loons (Dolan 1994) and the waters of Bull Lake. Any direct effects to loons and their habitat would be limited to these waters. Analysis of indirect and cumulative effects would also be the Lake Creek watershed. The boundary for determining trends towards viability is the KNF.

Affected Environment

Common loons have been observed in all eight planning units on the KNF (Johnson 1999). Johnson (1999) summarizes available loon habitat across the KNF. In western Montana, since the formation of the Common Loon Working Group in 1999, the total number of lakes surveyed has stabilized with the total number of adult loons counted each year ranging between 150 and 200. Annual variability in adult counts could be attributed to changing population size or possibly to survey conditions or efforts, particularly on large reservoirs and lakes (Bissell 2004). The Montana Loon Society loon count data show the total number of loons in northwest Montana has remained relatively stable over the last six years (Bissell 2004). Over the last five years, these same data show rather wide fluctuations in the number of chicks produced. Causes for lower production in some years include weather (flooding) and competition among nesting pairs.

No observations of nesting loons have been recorded for the analysis area for at least 10 years. Common loons are seen and heard on Bull, Spar, and Savage lakes but such presence is transient use. Spar Lake is not free of snow or ice until mid- to late-May, while lower elevation lakes of an adequate size on the District already support a nesting pair of loons. Human settlements along the shorelines of Bull and Savage lakes have reduced some potential nesting habitat sites. Increased recreational activities in these waters create waves or other impacts that discourage loon nesting success.

Other lakes in the analysis area are either too small for adequate loon habitat or are too high in elevation for nesting or foraging opportunities. These lakes include Milnor, Spruce, Little Spar, and Grouse lakes.

Environmental Consequences

Direct Effects

No alternative proposes activities within 500 feet of the waters of Bull Lake, and the existing transient use of area lakes by loons would be expected to continue.

Due to the popularity of these lakes for recreational use and for continued waterfront development, it is not likely that use by loons would increase. Indirect effects, such as noise disturbance from reclamation activities, would not be noticeable compared to disturbances associated with other existing uses of Bull Lake.

Cumulative Effects

Since there would be no direct or indirect effects from any of the alternatives to loon habitat, there would be no cumulative effects. Therefore, the viability of the loon population on the KNF would not be affected.

Regulatory Compliance

Forest Plan Consistency: All alternatives would meet Forest Plan direction on NFSL for sensitive species (Pages: II-1 #6, II-22-23).

All alternatives would be consistent with Forest Plan riparian standards and guidelines (Pages: II-28-33) as amended by INFISH.

NFMA: The Proposed Action and Agency-Mitigated Alternative would follow the NFMA direction to provide for diverse populations of plant and animal communities by complying with Forest Plan standards and guidelines (Johnson 2004a). The No Action Alternative would not comply because of its use of introduced grasses and forbs.

Statement of Findings

The No Action Alternative, Proposed Action, and the Agency-Mitigated Alternative would all have “*No Impact*” on the common loon or its habitat. This determination is based on the following considerations: 1) no common loon nesting or examples of successful reproduction has occurred in the analysis area for at least 10 years; 2) none of the project alternatives would impact habitat or vegetation for potential loon nesting habitat; and 3) common loon habitat and reproduction levels are stable on the district.

3.18.5.5 Fisher

Fisher Background

Fisher population ecology, biology, habitat description, and relationships are described in Powell and Zielinski (1994) and in Heinemeyer and Jones (1994). The above information is incorporated by reference. Fisher occurrence data originate from recent District wildlife observation records, NRIS database, and from other agencies (MNHP). Approximately 110 fishers from Minnesota were introduced forest-wide between 1988 and 1991 (USFS 2001). The analysis area for addressing direct, indirect, and cumulative effects to fishers and their habitat is the Lake Creek watershed. The boundary for determining trends towards viability is the KNF.

Affected Environment

Fisher observation and monitoring data indicate that historical sightings of two fisher occurred (1996, 2006) in the analysis area, along Ross Creek and Lake Creek north of the Troy Mine Permit Area. Johnson (1999) shows fisher presence was confirmed in five of the eight planning units on the KNF. A research project trapped six individual fishers in the analysis area (Vinkey 2003).

Ruediger (1994) shows the KNF as a primary habitat area for fisher. Additionally, the analysis area is assigned as a primary fisher conservation area and determined to be moderate quality fisher habitat

(Johnson 2004b). Fisher habitat has been modeled for the analysis area by using the Kootenai fisher habitat model 2008 and identified 10,980 acres of potential habitat (KNF 2010). The potential population index (PPI) (habitat acres divided by average home range acres) was calculated by using 10,000 acres as the average male and 3,700 acres as the average female fisher home range (Powell and Zielinski 1994). This index shows both male and female fishers because their home ranges overlap extensively (Powell and Zielinski 1994). Based on the average male and female fisher home range sizes and the modeled habitat acres, the PPI for the analysis area is approximately three female fishers and one male fisher (KNF 2010). By using the modeled year-long habitat acres from Johnson (1999), the minimum PPI for the KNF would be 29 male and 80 female fishers.

Since the last augmentation of the population in the early 1990s, the predator has been successful in establishing a small population in the Cabinet Mountains; however, the long-term outlook for this population is uncertain (Vinkey 2003). A variety of factors including deep snows, low habitat quality, and behavioral and genetic characteristics of the transplanted fishers may have predisposed this translocation to failure (Vinkey 2003). Since the 1990s, about four percent of the analysis area has been regeneration harvested, and about nine percent has been improvement cut. Old Growth is nearly 12 percent of the forested lands below 5,500 feet elevation and meets the Forest Plan standard of at least 10 percent (KNF 2010).

The Spar and Lake PSUs provide adequate foraging and denning habitat for fishers (KNF 2001).

Environmental Consequences

Direct and Indirect Effects

Two small stands of identified old growth habitat are adjacent to NSFR 4626. However, none of the proposed reclamation alternatives would affect old growth stands, and none of the alternatives propose activities within or immediately adjacent to undisturbed streams. Re-establishing the stream channel at the mill/office site under the Proposed Action and the Agency-Mitigated Alternative may provide better connectivity with Stanley Creek in the future. The No Action Alternative would not provide this connectivity.

All the alternatives have reclamation activity levels which are expected to be similar to current mining operations. Fisher using the area may experience disturbance and thereby avoid the area in the short-term while this activity takes place. Road reclamation and stabilization work under the alternatives would occur on existing roads that are adjacent to fisher habitat. This work would not reduce fisher habitat, but reclamation activities may disturb the fisher. In addition, the road network intersects movement corridors for the predator; however, many of these roads have received regular activity during mining operations. Therefore, reclamation activities would not further impact the fisher.

Potential fisher habitat in the Troy Mine Permit Area has likely been disturbed to some degree already due to mining operations. None of the reclamation alternatives would likely reduce PPI for the Troy Mine Permit Area.

Under all of the alternatives, reclamation activities proposed for the tailings impoundment area would be located on private property. None of the alternatives would be expected to change conditions measurably from current conditions as activities would occur in previously disturbed sites.

Cumulative Effects

No past, present, or reasonably foreseeable future projects would affect fisher habitat. Tree thinning projects would not affect habitat (other than in time), and these stands would grow trees that may actually provide shelter or forage potential for the animal. However, conversion of corporate timber lands to private real estate would decrease potential fisher habitat at the lower elevations.

Any existing old growth stands near perennial streams would continue to offer fisher habitat. The mosaic of vegetation within the analysis area would still offer habitat for fisher foraging. Suitable fisher habitat would not be decreased due to timber harvest activities; none of the reclamation alternatives would affect fisher habitat. Therefore, there would be no cumulative effects.

Regulatory Compliance

Forest Plan Consistency: All alternatives meet Forest Plan direction for sensitive species (Pages: II-1 #6, II-22-23).

All alternatives are consistent with Forest Plan riparian standards and guidelines (Pages: II-28 thru 33) as amended by INFISH.

All alternatives are consistent with Forest Plan direction for old growth below 5,500 feet (Pages: II-1 #7; II-7; II-22 and 23; Appendix 17; and Kootenai FSM 2432.22 Supplement No. 85).

NFMA: The Proposed Action and Agency-Mitigated Alternative would comply with NFMA direction on providing for diverse populations of plant and animal communities by compliance with Forest Plan standards and guidelines (Johnson 2004a). The No Action Alternative would not comply because of its use of introduced grasses and forbs.

Statement of Findings

The No Action Alternative, Proposed Action, and Agency-Mitigated Alternative would all result in a determination of *“May Impact Individuals 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 the following considerations: 1) disturbance to fishers and short-term avoidance of areas affected by large, recontouring activities and road reclamation/stabilization work in infrequently used areas would be expected; 2) no undisturbed habitat would be reduced by the action alternatives; 3) proposed reclamation activities, in general, would be comparable to current mining operation activities; and 4) no change in the species PPI for this project area would be expected.

3.18.5.6 Flammulated Owl

Flammulated Owl Background

Flammulated owl population ecology, biology, habitat description, and relationships are summarized in Hayward and Verner (1994). More recent research on nesting, food habits, home range and territories, and on 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). The above information is incorporated by reference. Flammulated owl occurrence data come from recent USFS wildlife observation records and from the NRIS database (KNF 2008b).

Johnson (2004a) determined the PPI (number of potential territories) for breeding pairs by dividing potential habitat acres by 40 acres. Potential effects of the alternatives are evaluated by assessing potential changes to habitat and the resulting PPI.

The analysis area for direct, indirect, and cumulative effects to individuals and their habitat is the Lake Creek watershed. The boundary for determining trends towards viability is the KNF.

Affected Environment

A summary of the status of flammulated owls on the KNF was documented by Johnson (1999). The summary shows that potential habitat occurs across all eight planning subunits. Forestwide, there are 237,098 acres of potential habitat (Johnson 1999). Field surveys have confirmed flammulated owl presence in six of eight planning units.

District flammulated owl observation and monitoring data indicate that owl presence has not been detected either in the analysis area or in the Troy Mine Permit Area. Flammulated owl surveys (which consist of using taped owl calls to draw a response from nesting birds) have been conducted intermittently within the analysis area over the last decade. Surveys did not detect flammulated owls in the analysis area, and it is unknown if flammulated owls actually inhabit Spar or Lake PSUs. Given the lack of dry habitat, the owls' presence is not expected; therefore surveys have not been a priority in the Spar or Lake PSUs.

Flammulated owl habitat is limited in the Spar and Lake PSUs because these sites are fairly wet. The owls are adapted to drier habitats that consist of stands of mature to over-mature ponderosa pine/Douglas-fir habitat types (KNF 2010). Flammulated owl habitat was modeled by using the USFS Region One Summary Database, which synthesizes field data gathered in the database "FSVEG" to provide an overview of the potential for a species' habitat. The vegetation model identified potential flammulated owl habitat in 551 acres within the analysis area (KNF 2010). Of these acres, only three blocks of potential habitat are 40 or greater contiguous acres in size. These blocks vary from 43 to 56 acres, and all have been intermediate harvested in the past 10 years (KNF 2010). However, over time, as the shrub and seedling understory grows, insects may increase in these stands to the point that a prey base becomes available for flammulated owls.

Based on the average flammulated owl pair territory size and the modeled habitat acres, the PPI for the NFSL within the analysis area is three flammulated owl pairs (KNF 2010). Using the nesting (modeled)

habitat acres from Johnson (1999), the minimum PPI for KNF would be 5,927 flammulated owl pairs. These estimates of PPI are considered high on the basis of actual survey results.

Environmental Consequences

Direct and Indirect Effects

None of the reclamation alternatives would affect potential flammulated owl habitat, but reclamation activities that result in revegetation in the long term could potentially increase owl habitat. However, given the amount of precipitation in the analysis area, it is unlikely that reclaimed areas would result in dry forest types such as ponderosa pine and Douglas-fir that are preferred by the owls.

Cumulative Effects

Past harvest activities may have altered potential flammulated owl habitat through such actions as regeneration harvest or stand conversions to western larch. Due to the amount of precipitation in this project area, it is highly unlikely that many dry sites (ponderosa pine and Douglas-fir) exist in this area. Past or reasonably foreseeable future pre-commercial thinning might affect the owl's prey base if the stand is being managed for dry site tree species. Wildfires and prescribed burns would reduce fuels, allow more sunlight to reach the forest floor, and may encourage more pine or Douglas-fir to regenerate in the burned areas. None of the reclamation alternatives would affect fire suppression effectiveness, and there would be no cumulative effects on owl habitat.

Regulatory Compliance

Forest Plan Consistency: All three alternatives meet Forest Plan direction for sensitive species (FP II-1 #6, II-23).

All alternatives are consistent with Forest Plan direction for old growth below 5,500 feet (FP Vol. 1 II-1 #7; II-7; and II-22 and 23; Appendix 17; and Kootenai FSM 2432.22 Supplement No. 85).

All alternatives meet Forest Plan standards for snags (FP II-1 #8; II-22 and 23; and Appendix 16).

NFMA: The Proposed Action and Agency-Mitigated Alternative would follow the NFMA direction to provide for diverse populations of plant and animal communities by complying with Forest Plan standards and guidelines (Johnson 2004a). The No Action Alternative would not comply because of its use of introduced grasses and forbs.

Statement of Findings

The No Action Alternative, Proposed Action, and the Agency-Mitigated Alternative would all have "No Impact" on the flammulated owl. These determinations are based on the following considerations: 1) no loss of potential habitat; 2) current records do not show a presence of the species in the area; and 3) the alternatives would not impact potential nesting territories or the PPI of the flammulated owl on the KNF.

3.18.5.7 Harlequin Duck

Harlequin Duck Background

Harlequin duck population ecology, biology, habitat description, and relationships are described in Cassirer *et al.* (1996). The above information is incorporated by reference. Harlequin duck occurrence data come from recent MNHP surveys, USFS wildlife observation records, NRIS database, and from other agencies (FWP).

The analysis area for direct, indirect, and cumulative effects to individuals and their habitat is the Lake Creek watershed. The boundary for determining trends towards viability is the KNF.

Affected Environment

Harlequin duck observation and monitoring data indicate that there is suitable habitat for harlequin ducks within the analysis area, but the only documented occurrences are within the Spar PSU. Harlequin duck observation and monitoring data indicate that two sightings of harlequin ducks occurred in 1988 (NRIS database). One sighting was a male and female near Spar Lake. The other sighting was of two ducks (sex unknown) on Lake Creek. Johnson (1999) shows harlequin duck breeding confirmed on a total of ten streams in six of the eight planning units on the KNF. These streams provide about 71 miles of habitat within the KNF.

Potential habitat for the duck in the analysis area is confined to the larger creeks such as Keeler and Lake creeks. This area comprises about 15 miles of riparian habitat along the main valleys in the project area. No recent surveys for this species have taken place.

Environmental Consequences

Direct and Indirect Effects

None of the reclamation alternatives would include activities in areas with potential harlequin duck habitat. Road reclamation or stabilization activities may be associated with some stream crossings, but these would be small tributaries that do not provide harlequin duck habitat.

Cumulative Effects

Because there would be no direct or indirect effects on the harlequin duck habitat from any of the alternatives, there would be no cumulative effect.

Other past, present, and reasonably foreseeable future projects would be designed with sufficient riparian buffers to protect harlequin duck habitat from adverse effects of timber management.

Regulatory Compliance

Forest Plan Consistency: All alternatives meet Forest Plan direction for sensitive species (FP II-1 #6, II-23).

All alternatives are consistent with Forest Plan riparian standards and guidelines (FP Vol. 1 II-28 thru 33) as amended by INFISH.

NFMA: The Proposed Action and Agency-Mitigated Alternative would follow the NFMA direction to provide for diverse populations of plant and animal communities by complying with Forest Plan standards and guidelines (Johnson 2004a). The No Action Alternative would not comply because of its use of introduced grasses and forbs.

Statement of Findings

The No Action Alternative, Proposed Action, and Agency-Mitigated Alternative would all have “*No Impact*” on harlequin duck. This determination is based on the consideration that none of the reclamation activities would impact potential habitat for the species.

3.18.5.8 Peregrine Falcon

Peregrine Falcon Background

Peregrine falcon ecology, biology, habitat use, status, and conservation are described and summarized in USFWS (1984, 1999b) and in Rogers and Sumner (2004). The above information is incorporated by reference. Peregrine falcon occurrence data come from USFS observation records, the NRIS database, and from other agencies (MNHP).

Because the peregrine is a previously listed species, peregrine falcon management follows direction provided in the Recovery Plan (1984) revised in 1984 and amended in 1993. That plan recommended protection of existing and potential nesting habitat and elimination of unfavorable land use practices that disturb key habitats. The plan prohibited: 1) activities that alter the character of hunting habitat, the prey base within ten miles, and/or the immediate habitats within one mile of a nest site; 2) activities within ½ mile of a nest site during the nesting period (February 1-August 1); and 3) the use of pesticides/pollutants that are harmful and that could accumulate in the falcon or its prey base. That direction is still appropriate for management of peregrine falcons as a sensitive species. There is no Conservation Assessment for peregrine falcons in Montana.

The analysis area for direct, indirect, and cumulative effects is the Lake Creek watershed. The boundary for determining trends toward viability is the KNF.

Affected Environment

In 2009, there were five active peregrine falcon territories. These active territories were monitored again in 2010. One site is located on cliffs above Bull Lake within the Spar PSU. During the summer of 2010, two adults and one fledgling were observed (Montana Peregrine Institute 2010).

Environmental Consequences

Direct and Indirect Effects

Reclamation activities under the Proposed Action would be farther than one mile from the nest site on the cliffs above Bull Lake. In the No Action and Agency-Mitigated alternatives, proposed stabilization work on NFSR 4628 would come within approximately ½ mile of the active nest site at its closest point but would remain outside the nest buffer. In addition, the rugged topography of the area would provide both a visual and a noise buffer between the nest and the activity. The road work would not alter the

character of the hunting habitat as the work would take place on an existing road. Seasonal restrictions protecting spring habitat use for the grizzly bear would also limit the season of activity for this work to the summer season after June 15, further limiting any potential for noise disturbance to the nesting peregrines on NFSL. None of the alternatives would use pesticides or pollutants, except herbicides for weed control, as part of reclamation activities.

Reclamation of disturbed areas under each of the alternatives would potentially increase vegetated areas and thus conditions for the falcon's prey species. All alternatives would result in a forested condition in the long term, and there would be no effect on peregrine falcon habitat.

Cumulative Effects

With no direct or indirect effect on peregrine falcon habitat from any of the alternatives, there would be no cumulative effect. Accordingly, there would be *No Impact* on the viability of the falcon at the Forest scale.

Other past, present, and reasonably foreseeable future projects would be conducted to avoid impacts both to peregrine falcon nesting periods and to its prey base on NFSL.

Regulatory Compliance

Forest Plan Consistency: All alternatives meet Forest Plan goals as applicable to the peregrine falcon, sensitive species, and to the MIS (Pages II-1 #5, #6, #7, II-22-23).

NFMA: The Proposed Action and Agency-Mitigated Alternative would follow NFMA direction to provide for diverse populations of plant and animal communities by complying with Forest Plan standards and guidelines (Johnson 2004a). The No Action Alternative would not comply because of its use of introduced grasses and forbs.

Statement of Findings

The No Action Alternative, Proposed Action, and Agency-Mitigated Alternative would all have "*No Impact*" on the peregrine falcon. This determination is based on the following considerations: 1) no disturbance to the falcon would occur during its breeding, nesting, or rearing periods; and 2) none of the alternatives would affect foraging opportunities for the falcon.

3.18.5.9 Townsend's Big-eared Bat

Townsend's Big-eared Bat Background

Townsend's big-eared bat population ecology, biology, habitat description, and relationships are described in the following: Christy and West (1993), Kunz and Martin (1982), the Montana Natural Heritage Program (1993), Perkins and Schommer (1991), Pierson *et al.* (1999), Reel *et al.* (1989), Ross (1967), Thomas and West (1991), and in Whitaker *et al.* (1977). The above information is incorporated by reference. Townsend's big-eared bat occurrence data come from recent USFS wildlife survey records, the NRIS database, and from other agencies (MNHP).

Suitable habitat in the analysis area is probably associated with historical mining activity (mines and tunnels), rock crevasses in cliff faces, lakes, or in stands containing large snags (usually old growth) (KNF 2001). Old growth stands were identified by using KNF old growth mapping data. Old growth forest in the Lake Creek watershed was discussed in **Section 3.16.4**.

The analysis area for potential direct, indirect, and cumulative effects on individuals and their habitat is the Lake Creek watershed. The boundary for determining trends towards viability is the KNF.

Affected Environment

Townsend's big-eared bats have been documented in the Spar PSU and more specifically, within the Ross Creek area (Hendricks *et al.* 1995, 1996, MNHP). A status summary of the Townsend's big-eared bat on the KNF 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); however, no key roosting sites (such as caves or mines) have been located.

Suitable roosting habitat such as mines and caves are found within the Spar PSU. USFS and MNHP Townsend's big-eared bat observation and monitoring data indicate that caves and tunnels for winter habitat are also available within the Spar PSU. The Troy Mine and the small privately-owned Montana Morning Claims Mine are the only mines known to exist within the analysis area. No observations of the bat have been recorded for either mine.

The Townsend's big-eared bat also has the potential to roost in tree cavities (Perkins and Schommer 1991, MNHP 1993). Larger diameter snags or trees with cavities could also be used for summer roosting. The species shows a preference for old growth forest for roosting habitat (Thomas and West 1991). As discussed in **Section 3.16.4**, the analysis area has 11.9 percent old growth, which comprises 9,893 acres. These stands and the remaining timbered habitat provide suitable roosting habitat in the form of large snags with cavities, as well as abundant foraging habitat across the forest landscape. Cavity habitat potential on NFSL within the analysis area is 75 percent.

Townsend's big-eared bats are known to feed along forest edges and can be associated either with dry or with wet type coniferous forests. Both young and mature forests are used for feeding (Thomas and West 1991), with primary foraging areas near lakes (Grindal 1996). Overall, forested stands across the analysis area provide potential foraging habitat for the bats.

Environmental Consequences

Direct and Indirect Effects

None of the reclamation alternatives would affect known roost sites, snag habitat, or old growth habitat that may contain roost sites for the bat. Currently, these bats do not roost in the Troy Mine. Those bats which use the surrounding forested habitat already tolerate current mining activities, and no alternative proposes timber harvest. Moreover, the bats would experience similar disturbances during reclamation activities as they do during the current mining operations. Under the Agency-Mitigated Alternative, gates would be installed in the Service and Conveyor adits that have the potential to allow bat access. It

is possible that after mine closure, bats could find these mine openings and begin to use it as a roost or hibernacula site. However, all other mine entrances would be sealed.

Reclamation of disturbed areas under each of the alternatives would have the potential to increase vegetated areas and thus improve conditions for insect prey species of the bats. All alternatives would produce a forested condition in the long term, and there would be no effect on Townsend's big-eared bat habitat.

Cumulative Effects

Because there would be no new direct or indirect effect on Townsend's big-eared bat habitat from any of the alternatives, there would be no cumulative effects. Accordingly, there would be no impact on the viability of the bat at the Forest scale.

Other present and reasonably foreseeable future projects on NFSL would be conducted to avoid impacts to bat roosting sites and would not affect foraging habitat for the bat (*e.g.* rivers, lakes, and meadows). Past timber harvest likely contributed to snag loss in the analysis area; however, more recent timber management projects have included snag retention requirements. Neither watershed improvement activities nor road maintenance work would affect bat habitat. Although fire suppression may affect the availability of snags across the landscape, none of the reclamation alternatives would affect the effectiveness of current fire suppression activities within the analysis area.

As the economy improves, increased development of private land is expected to continue in the project area. Habitat on federal lands is considered sufficient to provide cavity habitat to cavity dependant species. The existing 75 percent cavity habitat potential for NFSL would be above the minimum 40 percent needed to maintain self-sustaining populations of snag-dependent wildlife (Thomas 1979, pg. 72).

Regulatory Compliance

Forest Plan Consistency: All alternatives meet Forest Plan direction as applicable for the Townsend's big-eared bat and sensitive species (Pages II-1 #6, #7, #8, and II-22-23).

All alternatives are consistent with Forest Plan direction for old growth below 5,500 feet (FP Vol. 1 II-1 #7; II-7; II-22 and 23; Appendix 17; and Kootenai FSM 2432.22 Supplement No. 85).

All alternatives meet Forest Plan standards for snags and down wood (FP II-1 #8; II-22 and 23 and Appendix 16).

NFMA: The Proposed Action and Agency-Mitigated Alternative would follow NFMA direction to provide for diverse populations of plant and animal communities by complying with Forest Plan standards and guidelines (Johnson 2004a). The No Action Alternative would not comply because of its use of introduced grasses and forbs.

Statement of Findings

The No Action Alternative, Proposed Action, and Agency-Mitigated Alternative would all have a “*May Impact Individuals or their Habitat, But Will Not Likely Contribute to a Trend Towards Federal Listing or Cause a Loss of Species Viability*” finding on the Townsend’s big-eared bat. This determination is based on the following considerations: 1) no old growth would be affected by any of the reclamation alternatives; 2) the alternatives would not affect key roosting or hibernation habitat associated with caves, mines, or any buildings and would not be expected to impact the species natality or mortality rates; 3) cavity habitat in the form of snags, wildlife trees, and leave trees would continue to be provided across the KNF in managed (no less than 40 percent snag habitat levels) and unmanaged areas; and 4) disturbance associated with reclamation activities would be comparable to current mining operations.

3.18.5.10 Western Toad

Western Toad Background

Western toad ecology, biology, habitat use, status, and conservation are described and summarized in Maxell (2000) and Reichel and Flath (1995) and are incorporated herein by reference. Western toad occurrence data come from USFS wildlife observation records, NRIS database, and from other agencies (MNHP). The analysis area for direct, indirect, and cumulative effects to individuals and their habitat is the Lake Creek watershed. The boundary for determining trends towards viability is the KNF.

Affected Environment

Western toads require over-wintering, breeding/metamorphosis, and foraging habitat; they may also be dependent on habitats suitable for migration if the three required habitat types are isolated spatially (Maxell 2000). Over-wintering may take place in underground caverns or in rodent burrows (Maxell 2000). Breeding/metamorphosis takes place in aquatic sites such as shallow areas of lakes or temporary ponds, and foraging habitat is largely terrestrial uplands (Maxell 2000). The highest elevation the species has been documented in Montana is 9,220 feet.

KNF status summary of the western toad was documented by Johnson (1999), and the species has been found in seven of the eight planning units. Many surveys have been conducted on the KNF since 1993. Surveys conducted between 1993 and 1995 located only 63 adults. Of the 134 wetland sites surveyed during the 1993-94 field season, only 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 south of the analysis area during the 1997-98 field season, but evidence of breeding (tadpoles and eggs) was found at only eight sites (Corn *et al.* 1998). Historic and active breeding sites were summarized by planning unit on the KNF by Johnson (1999). Forest-wide, approximately 35 breeding sites were verified between 1995 and 1998 (Johnson 1999).

There are three known breeding sites within the analysis area. These sites are located in some of the man-made toe ponds at the Troy Mine tailings impoundment, in man-made ponds along Keeler Creek,

and in Spruce Lakes. Additional breeding habitat is likely to occur in temporal ponds and roadside ditches. The terrestrial habitat within the analysis area is considered upland foraging habitat.

Criteria used to compare potential impacts on the western toad and its habitat between alternatives include:

- known breeding/metamorphosis habitat impacted; and
- acres of upland foraging habitat disturbed.

Environmental Consequences

Direct and Indirect Effects

The 1978 EIS predicted localized adverse effects to the eight amphibians and reptiles potentially found within the Troy Mine Permit Area. The construction of the toe ponds created habitat that is now used by western toads. None of the alternatives would affect wetlands on NFSL, and no known natural wetlands occur in any of the previously disturbed sites proposed for reclamation activities. Proposed reclamation activities would follow other KNF riparian management guidelines, the Montana Streamside Management Act (HB 731), and INFISH guidelines.

Any natural wetlands and non-wetland waters of the U.S. under the tailings impoundment were destroyed when the impoundment was constructed. Four man-made toe ponds located along the western perimeter of the impoundment embankment contain impoundment seepage, natural groundwater, and runoff from the embankment face. The three northern ponds usually contain standing water and have developed into wetland habitat, becoming documented breeding sites for the western toad.

None of the alternatives would remove the toe ponds which are located on private property and which have documented western toad breeding activity. However, each alternative proposes different reclamation activities in the vicinity of the toe ponds that would affect western toads and their habitat.

The No Action Alternative does not directly address the long-term management of the toe ponds, and it would be expected that they would remain in their present form. The stockpiled lacustrine and volcanic ash-derived soil stored west of the toe ponds would be used for reclamation materials. The tailings impoundment surface east of the toe ponds would be covered with 18 inches of the stockpiled material and revegetated. No timing of activities has been identified. Should activities occur between May 1 and September 1, there is a potential risk of mortality of breeding adults and juveniles using the toe ponds by crushing from heavy equipment (Maxwell 2010). Reclamation activities would disturb toads using the toe ponds, increase mortality, negatively affect breeding success, and crush migrating juveniles as they leave the toe ponds during hauling operations. Use of the ponds as a breeding site would be expected to continue following the completion of the hauling operation. Also, once the area has been revegetated, the tailings impoundment would increase the amount of upland foraging habitat potentially available over time.

Under the Proposed Action the stockpiled reclamation materials would remain in place and the tailings impoundment would be covered with rocky glacial outwash gravels from a borrow site east of the tailings impoundment and then revegetated. The Proposed Action would connect the ponds with inter-pond channels with an armored outfall installed as a safety measure which could result in greater long-term stability of the toe ponds. Construction of these channels (especially if deep channels without shallow edges are created) could decrease the available breeding habitat for the western toad (Maxell 2010). No timing restriction on this activity has been identified, and no BMPs have been proposed to mitigate effects on the western toad. Revegetation of the tailings impoundment would increase the amount of upland foraging habitat potentially available over the long-term.

The Agency-Mitigated Alternative proposes to remove the majority of the stockpiled reclamation materials from west of the toe ponds, cover the impoundment with 18 inches of stockpiled soils, revegetate the tailings impoundment, and create inter-pond channels between the toe ponds. This alternative would inventory fish in the ponds, and remove non-native fish species in the toe ponds in coordination with FWP. The removal of non-native fish species could result in greater breeding success for western toads that may use the toe ponds to breed. The Agency-Mitigated Alternative would specify that all of the work in the toe ponds (i.e. creating the inter-pond channels, and fish surveys and removal) would occur between September 1st to March 1st or when juvenile western toads are no longer observed at breeding sites. Channel construction would ensure that a gradual slope between the pond and the new channel would maintain shallow habitat (Maxell 2010).

Under the Agency-Mitigated Alternative, no seasonal restrictions would be applied to soil hauling operations. BMPs would be used to limit sediment impacts to Lake Creek and the toe ponds and to minimize impacts to toads during soil hauling operations. Troy Mine, Inc. would be required to map out potential haul routes and install silt fences properly (i.e. bury the lower four inches of the fence material) around the entire perimeter of both the stockpile and haul routes. The silt fences would isolate these areas and restrict toad movement between the toe ponds and Lake Creek during reclamation operation, limiting the loss of toads from crushing by heavy equipment.

Western toads have been documented to have a high fidelity to breeding sites and could be expected to work their way around silt fences until they reach the toe ponds (Maxwell 2010). Culverts would be placed under the haul routes in two or more general locations: 1) between Lake Creek and the toe ponds; 2) between the toe ponds to allow toads to move between ponds; and 3) other areas identified during an agency field review. There would be no seasonal restriction on hauling operations.

The Agency-Mitigated Alternative would reduce the potential effect on western toads and their breeding/metamorphosis habitat at the toe ponds as well as limiting direct loss of individuals from heavy equipment traffic. The placement of the culverts would allow restricted, but continual, western toad movement between Lake Creek and the toe ponds during the breeding/metamorphosis period. Reclamation of the tailing impoundment surface would not negatively affect the western toad and would increase the amount of upland foraging habitat potentially available over the long-term.

The Proposed Action would plant wetland vegetation in a portion of the impoundment area. If a portion of the tailings impoundment were to convert to wetland habitat, the result could be a slight increase in available breeding/metamorphosis habitat. The No Action and Agency-Mitigated alternatives would not create wetland habitat in the tailings impoundment area.

The Proposed Action and Agency-Mitigated Alternative would maintain the decant ponds. During closure, the mine water quality may be suitable for western toads. While the amount of shallow water habitat would be limited, toads may occasionally use the ponds in the future.

None of the alternatives would result in the disturbance of existing upland foraging habitat because reclamation activities focus on revegetating currently disturbed areas. The Proposed Action and Agency-Mitigated Alternative would reclaim the disturbed areas to productive, native-species dominated plant communities and would increase the amount of upland foraging habitat potentially available in the analysis area. The No Action Alternative would not be as successful in establishing a native-species dominated plant community as described in **Section 3.16.2**.

None of the alternatives would affect the availability of coarse downed woody material or snags that may provide cover for toad movement and foraging. On NFSL, reclamation activities are confined to previously disturbed areas, and it is unlikely that they would impact toad burrows. The tailings embankment was previously reclaimed during operations, and it contains some rodent burrows which could serve as over-wintering habitat for toads. Under the No Action and Agency-Mitigated alternatives, the stockpiled material between Lake Creek and the toe ponds would be used to reclaim the tailings impoundment. Some roads would have to be developed on the embankment to allow access to the tailings surface. These roads would impact some existing rodent burrows. The roads would be reclaimed after hauling is completed.

Under the No Action Alternative and the Proposed Action, no additional reclamation work would occur on the undisturbed, previously reclaimed portion of the embankment. Under the Agency-Mitigated Alternative, some of the bare areas on the embankment with little or no soil and vegetation would be recovered with reclamation materials and planted and/or seeded. Some potential burrow sites would be lost. Placement of reclamation materials and revegetation would occur during the non-winter months. Mortality to burrowing toads would be expected to be low.

Reclamation of roads under the No Action and Agency-Mitigated alternatives could include some ditch work where toads may potentially be found. Incidental mortality to toads on these road prisms could occur. No over-wintering burrows would be anticipated in this compacted soil. Road reclamation work under any of the alternatives would not occur near known toad breeding sites and would not be likely to affect breeding habitat through sediment pulses that may enter nearby streams.

Cumulative Effects

Past actions in the analysis area have had both beneficial effects (breeding habitat created in man-made features such as holding ponds along Keeler Creek) and negative effects (timber harvest has decreased foraging habitat and impacted over-wintering habitat). Present and reasonably foreseeable future projects would include vegetation management measures that would protect riparian zones and

wetland areas and that would provide for adequate coarse, downed woody material. These measures would minimize potential effects on foraging and breeding/metamorphosis habitats. For example, less than one acre of breeding area was impacted by road repair work that occurred in 2008 and 2009 along Keeler Creek (KNF 2010). The project occurred after the toad breeding season, and the potential pulse of sedimentation into the creek was planned to be completed prior to the next breeding season. In addition, the majority of reasonably foreseeable future projects that propose winter harvest would not occur until the ground is frozen to at least one inch in depth during the winter, thus minimizing impacts to toad over-wintering habitat (KNF 2010).

None of the alternatives would result in adverse effects to western toad over-wintering, foraging, or to breeding/metamorphosis habitat on NFSL. All alternatives propose reclamation work on currently disturbed sites that are not likely providing habitat. Moreover, proposed revegetation activities for all of the alternatives could improve upland foraging habitat within the Troy Mine Permit Area for the western toad.

Cumulatively, private timber and federal timber harvest activities, road construction, real estate developments, and the creation of openings could all affect upland toad habitat. However, suitable habitat would still occur on NFSL. The No Action Alternative and the Proposed Action would be expected to negatively impact the western toad through mortality and habitat disturbance. The Proposed Action would also create inter-pond channels potentially reducing the amount of breeding habitat. Both alternatives could reduce breeding success at one of three known breeding sites in the analysis area.

The No Action Alternative and the Proposed Action, when considered in association with past, present, and reasonably foreseeable future activities on both public and private lands, would be expected to have adverse cumulative effects that would impact the western toad. The temporary reduction in habitat from these cumulative activities in combination with the long-term increase in habitat from the reclamation activities would not likely result in a declining population trend for this species because abundant habitat is still available adjacent to these areas.

The Agency-Mitigated Alternative would have the least impact when combined with other past, present, and reasonably foreseeable future activities in the Lake Creek watershed. Movement to and between the toe ponds during the breeding season would be restricted to the use of culverts until the silt fences were removed. However, there would be no permanent loss of breeding habitat, mortality risk due to hauling operations would be reduced, and there would be the potential for an increased amount of upland habitat following reclamation of the site.

Regulatory Compliance

Forest Plan Consistency: The Agency-Mitigated Alternative meets Forest Plan direction as applicable to the western toad and sensitive species (Pages II-1 #6, #7, II-23). The No Action Alternative and the Proposed Action would not meet Forest Plan direction.

The Agency-Mitigated Alternative would be consistent with Forest Plan riparian standards and guidelines (FP Vol. 1 II-28 thru 33) as amended by INFISH.

All alternatives meet Forest Plan standards for snags and down wood (FP II-1 #8; II-22 and 23 and Appendix 16).

NFMA: The Proposed Action and Agency-Mitigated Alternative would follow NFMA direction to provide diverse populations of plant and animal communities by complying with Forest Plan standards and guidelines (Johnson 2004a). The No Action Alternative would not comply because of its use of introduced grasses and forbs.

Statement of Findings

The No Action Alternative would result in a determination of *“May Impact Individuals or their Habitat, But Will Not Likely Contribute to a Trend Towards Federal Listing or Cause a Loss of Species Viability”* to the population or species of the western toad. This finding is based on the following considerations: 1) no loss of currently available known breeding habitat; 2) temporary loss of upland movement areas due to the removal of stockpiled reclamation materials during hauling operations; 3) the risk of direct mortality during tailings impoundment and road reclamation activities; and 4) suitable habitat would remain in the analysis area and would be distributed across the KNF. Actions as described for the tailings impoundment (specifically the toe ponds) on private property would negatively impact the western toad and its breeding/metamorphosis habitat within the analysis area.

The Proposed Action would result in a determination of *“May Impact Individuals or their Habitat, But Will Not Likely Contribute to a Trend Towards Federal Listing or Cause a Loss of Species Viability”* to the population or species of the western toad. This finding is based on the following considerations: 1) potential loss of currently available known breeding habitat with the creation of inter-pond channels; 2) retention of reclamation material stockpiles and upland movement areas within the tailings impoundment area; 3) the risk of direct mortality during tailing impoundment and road reclamation activities; and 4) suitable habitat would remain in the analysis area and would be distributed across KNF. Actions as described for the tailings impoundment (specifically the toe ponds) on private property would negatively impact the western toad and its breeding/metamorphosis habitat within the analysis area.

The Agency-Mitigated Alternative would result in a determination of *“May Impact Individuals or their Habitat, But Will Not Likely Contribute to a Trend Towards Federal Listing or Cause a Loss of Species Viability”* to the population or species of the western toad. This finding is based on the following considerations: 1) no loss of currently available known breeding habitat on NFSL and minimization of habitat loss at the toe ponds; 2) timing restrictions in place to avoid the breeding/metamorphosis period on activities occurring in the toe ponds; 3) restricted movement areas during hauling operations and reclamation activities; 4) reduced risk of direct mortality during tailing impoundment and road reclamation activities; and 5) suitable habitat would remain in the analysis area and would be distributed across KNF. Actions as described for the tailings impoundment (specifically the toe ponds) on private property would temporarily impact the western toad and its breeding/metamorphosis habitat within the analysis area.

3.18.5.11 Wolverine

Wolverine Background

Wolverine population ecology, biology, habitat description, and relationships are described in Banci (1994) and Butts (1992). The above information is incorporated by reference. Wolverine occurrence data originate from recent USFS wildlife observation records, the NRIS database, and from other agencies (FWP). The analysis area for direct, indirect, and cumulative effects to individuals and their habitat is the Lake Creek watershed. The boundary for determining trends towards viability is the KNF.

Affected Environment

Wolverine observation and monitoring data indicate that one sighting occurred in 2002 and that tracks were seen in 2006 in the vicinity of Spar Lake. Johnson (1999) shows wolverine presence confirmed in seven of the eight planning units on the KNF.

Ruediger (1994) shows the KNF as a primary habitat area for wolverine. Except for denning habitat, wolverines are habitat generalists (Heinz 1996). Modeling of wolverine denning habitat identified 1,784 acres of potential denning habitat in the analysis area, with another 59,329 acres considered as foraging habitat (Johnson 2004b). Johnson (1999) modeled about 12,000 acres of wolverine denning habitat on the KNF and 563,045 acres of foraging habitat.

Environmental Consequences

Direct and Indirect Effects

None of the alternatives would include reclamation activities during the sensitive winter period when wolverines might be denning in deep snows.

Wolverine foraging may be disturbed by human activity and noise. Reclamation activity for all alternatives would take place over approximately two to three years and would require the use of heavy equipment comparable to current mining activities. Reclamation activities would occur in the same locations as current mining activities and would not expand the area of activity into currently undisturbed locations. The effects of road reclamation and use of existing roads for other reclamation activities (*e.g.*, removal of structures, mining equipment, recontouring of slopes, etc.) would not be expected to increase disturbances on wolverines in areas currently receiving regular use from mining activities. None of the alternatives proposes to increase motorized access. All roads identified as restricted within the Troy Mine Permit Area are currently restricted to all motorized activities year -long, including snow vehicles.

None of the reclamation alternatives would include timber harvest activities. Reclamation alternatives would include revegetation of disturbed areas and could increase foraging habitat in the long-term.

Cumulative Effects

Because there would be no direct or indirect effect on wolverine denning habitat from any of the reclamation alternatives, there would be no cumulative effects. Accordingly, there would be no impact on the viability of the wolverine at the Forest scale.

Throughout the analysis area, past, present, and reasonably foreseeable future projects include timber management. The noise from these activities may disturb wolverines, and the resulting changes in vegetative structure may affect available forage habitat. Recreational use such as snowmobile use in areas open to winter travel would continue to affect wolverines from the noise of the activity. Prescribed burning would stimulate forage for prey species the wolverine feeds on. None of the reclamation alternatives would affect the effectiveness of current fire management in the analysis area. Therefore, there would be no cumulative effect on forage habitat.

Regulatory Compliance

Forest Plan Consistency: All alternatives meet Forest Plan direction for sensitive species (Pages, II -1 #6, #7, II-23).

NFMA: The Proposed Action and Agency-Mitigated Alternative would follow NFMA direction to provide for diverse populations of plant and animal communities by complying with Forest Plan standards and guidelines (Johnson 2004a). The No Action Alternative would not comply because of its use of introduced grasses and forbs.

Statement of Findings

The No Action Alternative, Proposed Action, and Agency-Mitigated Alternative would all result in a determination of *“May Impact Individuals or their Habitat, But Will Not Likely Contribute to a Trend Towards Federal Listing or Cause a Loss of Species Viability”* to the population or species of the wolverine. This determination is based on the following considerations: 1) noise from the reclamation activities may disturb or cause wolverines to temporarily avoid the area; 2) disturbed areas would be revegetated which would encourage the growth of vegetation that the wolverine’s prey base depends upon; 3) no winter denning habitat would be affected by reclamation work; and 4) reclamation activities in elevations above 5,000 feet would not occur during the winter denning season.

3.18.6 Management Indicator Species (MIS)

Federal laws and direction applicable to management indicator species (MIS) include the NFMA (1976) and Forest Service Manual (FSM) 2620. The NFMA specifies that NFSL be managed to provide for diversity of plant and animal communities to meet overall multiple-use objectives. The “specific land area” (scale) for providing diversity is established in the framework as the area covered by a Forest Plan. The KNF Forest Plan goal (Forest Plan p. II-1 #7) is to “maintain diverse age classes of vegetation for viable populations of all existing native, vertebrate, wildlife species... and in sufficient quality and quantity to maintain habitat diversity representative of existing conditions.” In addition, the KNF Forest Plan includes this wildlife standard relevant to MIS: “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” (Forest Plan Vol. 1 p.II-22).

Based on the direction found in the NFMA, Appendix 12 of the Forest Plan identifies MIS as species which are used to represent particular habitats or habitat complexes. Each MIS represents a group of species that share common habitat components which are required for sustained growth and successful

reproduction. Managing the landscape to benefit a specific MIS population would be expected to have corresponding favorable effects on many other wildlife species which they represent. MIS are listed in **Table 3-26**.

Other federal resource laws that provide impetus for managing for viable wildlife populations on public land include the National Wilderness Preservation Act (1964), NEPA (1969), and ESA (1973). Information from landscape assessments conducted in the Columbia River Basin was also reviewed.

Table 3-26. KNF Management Indicator Species

Species	Habitat Represented	Comments
Grizzly Bear <i>(Ursus arctos horribilis)</i>	General Forest	See Threatened and Endangered Species Section (Section 3.18.4.1)
Gray Wolf <i>(Canis lupus)</i>	General Forest	See Threatened and Endangered Species Section (Section 3.18.4.3)
Elk <i>(Cervus elaphus)</i>	General Forest	See discussion below in MIS section (Section 3.18.6.1)
Whitetail Deer <i>(Odocoileus virginianus)</i>	General Forest	Represents similar habitat as elk. The elk was chosen for analysis based on criteria described below in the elk MIS section; therefore, whitetail deer will not be considered further.
Bald Eagle <i>(Haliaeetus leucocephalus)</i>	Rivers and Lakes	See Sensitive Species Section (Section 3.18.5.1)
Mountain Goat <i>(Oreamnos americanus)</i>	Alpine	See discussion below in MIS section (Section 3.18.6.2)
Peregrine Falcon <i>(Falco peregrinus)</i>	Cliffs	See Sensitive Species Section (Section 3.18.5.8)
Pileated Woodpecker <i>(Dryocopus pileatus)</i>	Snags, Old Growth	See discussion below in MIS section (Section 3.18.6.3)

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 because winter requirements differ. The following criteria were used to identify the elk as the MIS for general forest habitat in this EIS: 1) Forest Plan direction; 2) the biological potential of the area; 3) state wildlife management objectives; 4) public comments during scoping; and 5) the information contained within the Kootenai Conservation Plan which established management emphasis designations for elk by planning subunit (Johnson 2004a, Appendix H). The analysis area is the Lake Creek watershed which is contained within two PSUs. The Spar PSU has a high emphasis for elk, and the Lake PSU has a moderate emphasis for elk.

3.18.6.1 Elk

Elk Background

Elk population ecology, biology, habitat description, and relationships are described in Murie (1979) and in Toweill and Thomas (2002). The above information is incorporated by reference. Elk population and harvest data come primarily from FWP data. Additional information used is from recent USFS wildlife observation records and from the NRIS database.

Affected Environment

The analysis area for direct, indirect, and cumulative effects to individuals and their habitat is the Lake Creek watershed. The boundary for determining population trends towards viability is FWP big game hunting district #104 (includes both PSUs) and the KNF. The elk population in the hunting district is stable (Brown 2008).

Components typically analyzed for elk include: cover/forage ratios, thermal cover, opening sizes, movement areas, HE and ORD, security, and key habitat components (wallows, wet meadows, and bogs). No vegetation management would occur under any of the alternatives. Therefore, the components of cover/forage ratios, thermal cover or opening sizes, and vegetation management in movement areas will not be further analyzed in this document.

The HE of an area refers to the percentage of habitat that is usable by elk outside of the hunting season and 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).

Management Area 12 (MA 12, non-winter big game habitat) and grizzly bear management both have the most restrictive ORD standards in the Forest Plan at ≤ 0.75 mi/m². This road density translates into a habitat effectiveness value of 68 percent (Lyon 1984). If ORD for the BMU(s) in an analysis area meets the grizzly standard, it also achieves big game management recommendations for the analysis area (Schrenk 1995). Open road density for BMU 3, where project activities would occur, is currently better than Forest Plan standards at 0.57 mi/mi² which translates into an HE value of 74 percent.

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 Forest Plan has no standard for security. A panel of state and federal wildlife biologists convened in 1996 and identified security as an important component in elk habitat and that the Hillis *et al.* (1991) method would be used to calculate it (Johnson 2004a, Appendix H-B). This method recommends a minimum of 30 percent of an elk's fall use area be maintained as security habitat. Since elk use in the fall could be any place within the analysis area, the 30 percent minimum is measured against the NFSL acres in the analysis area. Within the analysis area, secure habitat is currently at 59 percent (KNF 2010).

The Forest Plan directs that wet meadows, bogs, and elk wallows will be avoided when building roads. When these previously unidentified areas are located, they are mapped and managed as riparian areas. Management would also follow other KNF riparian management guidelines, Montana Streamside Management Act (HB 731), and INFISH guidelines.

Environmental Consequences

Direct and Indirect Effects

Reclamation activities on the private lands at the tailings impoundment area would create disturbances, however, since mining activities would cease as reclamation activities begin there would be no overall change in on elk disturbance levels.

There would be no timber harvest associated with any of the alternatives, and there would be no new areas disturbed. All reclamation alternatives would revegetate areas disturbed by mining activities. As newly revegetated areas are established, they may provide productive foraging habitat initially, but as the forest cover matures, the quality of the forage would decline.

All three alternatives propose to keep NFSR 4626 gated at the mill site and restricted to motorized traffic above the mill site towards Mt. Vernon. All other roads listed in **Table 2-1** (except NFSR 9003) are either behind gates or on patented and private land and would remain restricted to motorized traffic. Although NFSR 9003 is an open road, the effects of motorized use on this road are negligible due to the proximity to NFSR 4626. The Proposed Action would keep this road in its current condition. The No Action and Agency-Mitigated alternatives would reclaim NFSR 9003.

Both HE and security habitat are based on open roads present within the analysis area. Therefore, no decrease in HE and security habitat would be expected during the Troy Mine reclamation project because no new open roads would be built and reclamation activities would generally occur in the same areas as present mining activities. The one exception is NFSR 4628 which does not receive regular mining use beyond NFSR 4628C which accesses the South Adit. The No Action and Agency-Mitigated alternatives propose stabilization work on this portion of road, and any elk present may experience short-term disturbance as this work is carried out.

None of the alternatives propose activities within currently undisturbed riparian habitat and would follow other KNF riparian management guidelines, the Montana Streamside Management Act (HB 731),

and INFISH guidelines. In addition, none of the alternatives would be expected to impact any unknown special habitat features for elk such as wetlands because these activities would occur in previously disturbed areas.

Cumulative Effects

Past harvest and natural disturbances have provided a variety of vegetation age classes and successional stages across the analysis area, and have succeeded in diversifying the landscape. In some cases, past timber harvests and fires provided habitat conditions favorable for big game such as elk. None of the reclamation alternatives would affect fire suppression effectiveness either.

Open road densities have declined in the past several years as a result of restricting/reclaiming roads through decisions intended to facilitate grizzly bear recovery. Because the Sparring Bulls project would maintain HE at 74 percent and only decrease security habitat from 59 to 56 percent during project activities, both percentages would remain better than standards (KNF 2010). None of the alternatives would increase motorized access during reclamation of the Troy Mine Permit Area and therefore would not have a negative cumulative effect on elk HE or security habitat.

Basic road maintenance, pre-commercial thinning, mushroom picking, prescribed burning, timber hauling, wildlife habitat improvement projects, and various recreational uses are additional activities that have occurred and would continue to occur within the analysis area. Potential activities that have been restricted beyond the mill/office site during mining activities may increase slightly, but they would likely not extend far beyond the existing gate location because the road would remain restricted to motorized access following completion of reclamation activities. These activities are generally not considered to have adverse impacts on wildlife species but they may incidentally affect wildlife use within some areas on a temporary basis. Overall, they are not likely to affect the viability of this species.

With respect to patented lands, there are no known non-mining related activities proposed at the top of Mt. Vernon. Therefore, no cumulative effects on elk are expected for this parcel of patented property as part of any of the alternatives. Due to the number of roads and homes located around the tailings impoundment area, current conditions for the elk are not expected to change due to reclamation activities. Reclamation activities are not expected to contribute any additional direct effects in the tailings impoundment area, and therefore, there would be no cumulative effect on elk disturbance on these private lands.

Hunter access to Mt. Vernon is already available from the south via NSFR 4628 and from the west via trail #513. Once mining operations cease and reclamation has been completed, use by hunters to access Mt. Vernon from the north side may increase. However, it will continue to be restricted to non-motorized access and would maintain current security habitat within the Troy Mine Permit Area.

All alternatives would establish new vegetation areas through reclamation activities that could provide some productive forage habitat for elk. All of the activities listed above, including reclamation, may disturb elk or cause them to temporarily avoid the area until human actions are finished. However, reclamation alternatives would not create a cumulative effect on potential elk disturbance.

Regulatory Compliance

Forest Plan Consistency: All alternatives meet Forest Plan direction for big game species and MIS (Pages: II-1 #3, II-2 #12, II-23-23).

NFMA: The Proposed Action and Agency-Mitigated Alternative would comply with NFMA direction to provide for diverse populations of plant and animal communities by following Forest Plan standards and guidelines (Johnson 2004a). The No Action Alternative would not comply because of its use of introduced grasses and forbs.

Elk Management Plan Consistency: The reclamation project is located in the Lower Clark Fork Elk Management Unit which is identified in the FWP Statewide Elk Management Plan. The proposed project is consistent with that document.

Statement of Findings

Based on the analysis for elk, the other general forest habitat indicators, and the KNF Conservation Plan (Johnson 2004a), habitat for general forest species should provide sufficient quality and quantity of the diverse age classes of vegetation needed for viable populations. Because sufficient general forest habitat is available, the populations of species using that habitat should remain viable.

3.18.6.2 Mountain Goat

Mountain Goat Background

Detailed mountain goat, ecology, biology, habitat use, status, and conservation are described and summarized in Brandborg (1955) and Joslin (1980). That information is incorporated by reference. Mountain goat occurrence data come from USFS wildlife observation records, the NRIS database, and from other agencies (FWP).

The analysis area for project impacts to individuals and their habitat is the Lake Creek watershed. The boundary for cumulative effects and determining trend and contribution toward viability is FWP Mountain Goat hunting district #100, district #101, and the KNF.

Affected Environment

Alpine habitat is found within the Spar and Lake PSUs. Wildlife observation records show mountain goats are known to use the suitable habitat in these subunits. FWP records for the Mountain Goat hunting district #101 (this district includes the Troy Mine Permit Area) indicate a stable population (Brown 2008).

Harvest records from the 1999 hunting season suggest that a minimum of 40 - 50 mountain goats, currently inhabit the southern portion of the Spar PSU (KNF 2001). These goats are commonly seen along the ridgeline from Spar Peak to the spires east of Mt. Vernon (NRIS), the ridgeline over Little Spar Lake from Spar Peak to Savage Mountain, and the rocky ridgelines near Sawtooth Mountain (KNF 2001). The Mt. Vernon area is also known both as a winter range and as an important spring kidding area (KNF 2001).

Environmental Consequences

Direct and Indirect Effects

The tailings impoundment area is not within mountain goat, habitat and reclamation activities on these private lands would have no direct effects on mountain goat,.

Most of the proposed activities for all the alternatives would take place in areas that currently receive regular use during mining operations. The one exception is NFSR 4628 which does not receive regular mining use beyond NFSR 4628C and accesses the South Adit. The No Action and Agency-Mitigated alternatives propose road storage work along this segment of NFSR. Mt. Vernon and the ridgeline to the west serve as a travel corridor between the spires area and Spar Peak, both of which have known mountain goat ,activity. Disturbance and displacement of mountain goats, would be expected from the road storage activities south of the more regularly used mining operation sites.

Reclamation activities are expected to occur over an approximately two to three year time frame during the snow free period, generally from April to September. For most of the Troy Mine Permit Area, this timeframe would not change the current condition experienced by mountain goats,. The Agency-Mitigated Alternative would specify that road work on the segment of NFSR 4628 from the junction with NFSR 4628C to Ross Creek would take place between April 1 and June 15 to permit spring forage opportunities for the grizzly bear. This timing would also benefit the mountain goat ,which may still be using lower elevation sites during the early spring for forage and kidding areas. The No Action Alternative and the Proposed Action would not include seasonal restrictions for any proposed road work.

None of the alternatives propose to create new roads or to increase motorized access over the top of Mt. Vernon. All roads identified as restricted within the Troy Mine Permit Area are all currently restricted to all motorized activities year-long, including snow vehicles. The Proposed Action would not reclaim any of the existing roads. However, both the No Action and Agency-Mitigated alternatives propose to reclaim several roads within the Troy Mine Permit Area. Reclamation of roads near the top of Mt. Vernon, along with the end of activities related to the current mining operations, would likely enhance goat habitat security by reducing current disturbances from roads.

All of the alternatives would occur within and along already disturbed sites, such as roads; therefore, no vegetation manipulation would result. The Proposed Action and Agency-Mitigated Alternative include revegetating disturbed sites with native plant species mixes and would apply different plant species compositions to different habitat types along an elevational gradient. These alternatives would result in recovery of forested vegetation at a faster rate than the No Action Alternative, providing greater benefits to mountain goat habitat. In the No Action Alternative, the plant species mix proposed for reclamation activities includes non-native species and does not account for differences in habitat type such as elevation. Therefore, the No Action Alternative would have limited benefits to mountain goat, habitat.

Cumulative Effects

Past, present, and reasonably foreseeable future actions include past harvest and natural disturbances which have provided a variety of vegetation age classes and successional stages across the analysis area, diversifying the landscape. In some cases, past timber harvests and fires provided habitat conditions favorable for forage for big game species.

Open road densities have declined in the past several years because roads have been restricted/reclaimed through decisions intended to facilitate grizzly bear recovery. None of the alternatives proposes to increase motorized access during reclamation of the Troy Mine Permit Area and therefore would not create a cumulative effect to mountain goat, disturbance or security related to roads.

Basic road maintenance, pre-commercial thinning, mushroom picking, prescribed burning, timber hauling, wildlife habitat improvement projects, and various recreational uses are all additional activities that would continue to occur within the analysis area. Potential activities that are currently restricted beyond the mill/office site during mine operation may increase slightly, but likely would not extend far beyond the existing gate location because the road would remain restricted to motorized access after completion of reclamation activities. Moreover, these activities are generally not considered to have adverse impacts on wildlife species but may incidentally affect wildlife use within some areas on a temporary basis. Overall, they are not likely to affect the viability of the species.

With respect to patented lands, there are no known non-mining related activities proposed at the top of Mt. Vernon. Therefore, no cumulative effects on goats are expected on this parcel of patented property as part of any alternative. The tailings impoundment area is not within mountain goat, habitat, and therefore, reclamation activities that would occur in this area would not affect the goat. Also, mining activities would cease as reclamation activities begin. There would be no cumulative effect on mountain goat, disturbance from reclamation as both activities would not be occurring at the same time.

Hunter access to Mt. Vernon already occurs from the south via NSFR 4628 and the west via trail #513. Once mining operations cease and reclamation has been completed, use by hunters to access Mt. Vernon from the north side may increase. However, it would continue to be restricted to non-motorized access and would maintain current security areas within the Troy Mine Permit Area.

All of these activities listed above, including reclamation, might disturb a mountain goat ,or cause it to temporarily avoid the area until human actions are finished. The reclamation alternatives would not create a cumulative effect on potential mountain goat, disturbance or mortality.

Regulatory Compliance

Forest Plan Consistency: All alternatives meet Forest Plan direction for big game species and MIS (Pages: II-1 #3, II-2 #12, and II-23-23).

NFMA: The Proposed Action and Agency-Mitigated Alternative would comply with NFMA direction to provide diverse populations of plant and animal communities by following Forest Plan standards and

guidelines (Johnson 2004a). The No Action Alternative would not comply because of its use of introduced grasses and forbs.

Statement of Findings

None of the alternatives would contribute any cumulative effects to the mountain goat,. None of the alternatives would increase motorized access or disturb new lands in the alpine habitat of Mt. Vernon. The No Action and Agency-Mitigated alternatives would also reclaim several roads, improving the un-roaded nature and security of Mt. Vernon for mountain goats,. The available habitat for alpine species would provide sufficient quality and quantity of the diverse age classes of vegetation needed for viable populations.

3.18.6.3 Pileated Woodpecker

Pileated Woodpecker Background

Pileated woodpecker population ecology, biology, habitat description, and relationships identified by research for the northern Rocky Mountains are described in McClelland (1979, 1977), McClelland and McClelland (1999), McClelland *et al.* (1979), and in Warren (1990). This information is incorporated by reference. Additional research conducted in the Pacific and Inland Northwest that may be relevant includes Bull (1975, 1980, 1987), Bull and Holthausen (1993), Bull and Jackson (1995), Bull and Meslow (1977), Bull *et al.* (1992), Jackman (1974), Mannan (1977), Mellen (1987), Mellen *et al.* (1992), and Thomas (1979).

Pileated woodpecker occurrence data come from recent USFS wildlife observation records, the Region One Landbird Monitoring Program (Avian Science Center, Univ. of Montana), and from the NRIS database. The pileated woodpecker is the indicator species for old growth and snag habitat on the KNF. Habitat for this species has been modeled by using all designated and undesignated old growth habitat and old growth replacement habitat, which has currently been mapped for the KNF (2010).

The PPI for the woodpeckers on the KNF has been calculated by Johnson (2003). The procedure used is 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 pileated woodpeckers as described in research by McClelland (1977) for northwest Montana, and by Thomas (1979) and Bull and Holthausen (1993) for northeast Oregon. For the PPI analysis on the KNF (Johnson 2003), replacement old growth habitat was defined as habitat that had some old growth characteristics but did not meet the Forest Plan (1987) definition of old growth, or the definition found in Green *et al.* (1992 errata corrected 2004).

Effective old growth habitat was modeled as supporting one nesting pair per 600 acres, with replacement old growth habitat supporting one nesting pair per 1000 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, because 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).

Potential effects of the reclamation alternatives are primarily evaluated on the basis of potential impacts to designated and undesignated old growth habitat.

The analysis area for direct, indirect, and cumulative impacts to individuals and their habitat is the Lake Creek watershed. The boundary for determining trends towards viability is the KNF.

Affected Environment

The modeled minimum PPI for the pileated woodpecker on the Kootenai National Forest is 425 nesting or breeding pairs (Johnson 2003). It is within the calculated historic range of variation for the minimum PPI of 335 to 554 breeding pairs (Johnson 1999).

Old growth characteristics within the analysis area are described in **Section 3.16.4**. Approximately 6,045 acres of effective old growth habitat (both designated and undesignated) and about 3,848 acres of replacement habitat (both designated and undesignated) are found within the analysis area. Existing pileated woodpecker nesting territories would likely encompass a large portion of this old growth habitat. Based solely on the quantity of old growth habitat available, the analysis area could support about 34 nesting territories (PPI) (KNF 2010). A small portion of this old growth habitat is found within the Troy Mine Permit Area (88 acres, representing 3.3 percent of permit area) (**Section 3.10.4.3**).

There are currently 9,893 acres of old growth on federal land being maintained for old growth dependent species (*i.e.*, pileated woodpecker) within the Spar PSU (KNF 2010). Distribution is good within the analysis area and provides adequate habitat for both plant and animal species needing the old growth ecosystem. The Spar PSU also contains habitat for obligate cavity nesters, such as the pileated woodpecker (approximately 75 percent of the planning subunit) (KNF 2010).

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 which are 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 pileated woodpecker was tallied 204 times at the 2,638 individual points surveyed (USFS 2003).

Environmental Consequences

Direct and Indirect Effects

There is a limited quantity of old growth habitat located within the Troy Mine Permit Area primarily along creek drainages. Reclamation activities are not expected to occur in or to impact these areas of old growth habitat potentially used by pileated woodpeckers. Also, woodpeckers using these stands are

tolerant of current mining operations and would experience similar activities from the reclamation work. Thus, there would be no effects to the woodpeckers.

Because no alternatives propose impacts to old growth stands within the Spar and Lake PSUs or with the Troy Mine Permit Area, there would be no change in the quantity of old growth forest habitat for pileated woodpeckers, and the analysis area would continue to meet Forest Plan standards for old growth. All alternatives would re-establish forested vegetation within the Troy Mine Permit Area. Re-establishment of forested cover would create the possibility of old growth within the mine permit area on NFSL after 150+ years. In this sense, the alternatives may be considered an improvement over the existing condition, though the chance of old growth establishment on this site cannot be determined with any accuracy.

Natural successional processes would continue throughout existing old growth stands and throughout stands containing old growth attributes used by pileated woodpeckers. Habitat would be provided for pileated woodpecker 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 in the analysis area.

Cumulative Effects

None of the three alternatives would have any effect on old growth habitat used by pileated woodpeckers and, therefore, would result in no cumulative effects to old growth.

Past, present, and reasonably foreseeable future projects are not expected to impact the pileated woodpecker. Timber management activities and watershed improvement work anticipated in the analysis area would not affect the pileated woodpecker (KNF 2010). Therefore, there would be no cumulative effects on pileated woodpecker from any of the reclamation alternatives.

Regulatory Compliance

Forest Plan Consistency: All alternatives are consistent with Forest Plan direction applicable to the pileated woodpecker and MIS (Pages: II-1 #7, #8, and II-22-23).

All alternatives are consistent with Forest Plan direction for old growth below 5,500 feet (FP Vol. 1 II -1 #7; II- 7; II-22 and 23; Appendix 17; and Kootenai FSM 2432.22 Supplement No. 85).

All alternatives meet Forest Plan standards for snags and down wood (FP II -1 #8; II-22-23 and Appendix 16).

NFMA: The Proposed Action and Agency-Mitigated Alternative would comply with NFMA direction to provide diverse populations of plant and animal communities by following Forest Plan standards and guidelines (Johnson 2004a). The No Action Alternative would not comply because of its use of introduced grasses and forbs.

Statement of Findings

The No Action Alternative, Proposed Action, and Agency-Mitigated Alternative would all have “No Impact” on the pileated woodpecker. Based on the analysis for pileated woodpecker, designated and undesignated old growth habitat, and old growth replacement habitat within the analysis area, none of the alternatives would have an impact on snag and old growth habitat.

3.18.7 Migratory Birds

Migratory birds are protected under the Migratory Bird Treaty Act. Executive Order #13186 (January 10, 2001) “Responsibilities of Federal Agencies to Protect Migratory Birds” was issued to support 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. This order requires federal actions on migratory birds to be part of the environmental analysis process. On January 17, 2001, the USFS and the USFWS signed a Memorandum of Understanding (MOU) to complement this Executive Order, and another MOU was signed on February 23, 2009 between the USFS and the USFWS.

NFMA requires that Forest plans "provide for the 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."

Affected Environment

Neotropical migratory birds are those bird species that migrate to more northerly latitudes to breed on the KNF each summer. Each fall, these species migrate south for the winter months to avoid harsh weather and to find more abundant food sources. Of the approximately 205 bird species known to occur on KNF as breeders, migrants, winter visitors, or as transients, about 70 species could be classified as neotropical migratory land birds.

Environmental Consequences

Responses of migratory birds to reclamation activities would depend upon their individual habitat preferences and needs. None of the alternatives would disturb new areas but they would revegetate existing disturbed areas. Some species prefer forest cover and closed canopy habitats (*e.g.*, brown creeper, golden-crowned kinglet, hermit thrush), and others prefer more open grass, forb, and shrub habitats (*e.g.*, American kestrel, calliope hummingbird, chipping sparrow). Still other bird species prefer to use edge habitats along the boundaries of forested and more open areas (*e.g.*, dark-eyed junco, western tanager, Townsend’s warbler). Over time, the reclamation activities would return disturbed areas to a more forested cover type which would also reduce the existing distinct edge habitats that occur within the Troy Mine Permit Area.

MIS selected to represent those species that use general forest habitat conditions would also represent the habitat needs for migratory birds. Maintaining suitable habitat conditions for general forest MIS species would also maintain sufficient habitat for neotropical migratory land birds.

Regulatory Compliance

There are no specific goals or standards for migratory land birds in the Forest Plan. However, it does contain the goal to “maintain diverse age classes of vegetation for viable populations of all existing

native, vertebrate, wildlife species” (Forest Plan, Vol. 1, II-1, goal #7). All alternatives would be consistent with the Forest Plan because a wide range of successional habitats would continue to be available. The alternatives would be in compliance with the Executive Order titled “Responsibilities of Federal Agencies to Protect Migratory Birds.” In addition, as habitat for MIS species would be maintained in the analysis area and across the KNF, their habitat would contribute to the maintenance of habitat and populations of neotropical migratory bird species.

3.19 Other Required Disclosures

3.19.1 Environmental Justice

Executive Order 12898, Federal Actions to Address Environmental Justice in Minority and Low Income Populations requires federal agencies address any potential for disproportionately high or adverse effects to these populations. The analysis of Environmental Justice in this EIS follows the CEQ’s guidance on Environmental Justice, (CEQ 1997), the EPA’s guidance on Environmental Justice (EPA 1998, 1999) and the U.S. Department of Agriculture’s regulation on Environmental Justice (USDA 1997b). Using these guidance documents, the following steps were taken: identification of minority and low-income populations within the analysis area, assessment of effects of the project alternatives on these populations, and determination if the effects would be disproportionately high and adverse. The U.S. Department of Agriculture’s regulation indicates an effect on a minority or a low-income population is disproportionately high and adverse if the adverse effect is appreciably more severe or greater in magnitude than the adverse effect that will be suffered by the non-minority population and/or non-low-income population.

See **Section 3.12** for a complete analysis of demographic conditions within the analysis area. Findings of the analysis in **Section 3.12** indicate that minority populations within the analysis area (Lincoln County) are smaller than those of the State of Montana and the U.S. as a whole. Minority populations include American Indians, and the analysis area is located within lands encompassed by the Hellgate Treaty of 1855 (see Section 3.5, American Indian Consultation). There is a higher percentage of the population within the analysis area that is below the poverty line than in the State of Montana as a whole.

None of the proposed reclamation alternatives would have adverse effects on minorities or low-income populations. All proposed reclamation alternatives would result in improved access to public lands for non-motorized recreational use, which would benefit all populations and would not be a disproportionately high or adverse effect on any minority or low-income population.

3.19.2 Important Farmland, Rangeland, and Forest Lands

The Farmland Protection Policy Act and USDA Departmental Regulation No. 9500-3 provide for the protection of important farmland, prime forest land, and prime rangeland. The USDA regulation, 7 CFR Part 658, implements the Farmland Protection Policy Act. Lands administered by the Forest Service in the analysis area do not include any important farmlands or prime range lands, and the definition of prime forest land does not apply to lands within the KNF. The proposed reclamation alternatives would return public lands to some level of recreational use, which is a key goal of the KNF Forest Plan.

Reclamation would also return private lands to timber production, wildlife habitat, and recreational land uses.

3.19.3 Energy Requirements and Conservation Potential

All of the proposed reclamation alternatives would require less energy than existing operations at the Troy Mine. The number of workers commuting to the area and heavy equipment use during implementation of the proposed reclamation alternatives would be less than existing operations, requiring less energy. Once reclamation activities are completed, there would be substantially less energy use than current operations, as the only long-term activities would entail water quality monitoring that only require a small number of trips into the analysis area each year. Energy requirements for these long-term monitoring activities would be insignificant. Petroleum fuel use would be similar among the proposed reclamation alternatives, and would be minimal following completion of reclamation activities.

3.19.4 Urban Quality and the Design of the Built Environment

While the analysis area is not urban, the scenic quality has been altered. With implementation of the proposed reclamation alternatives, existing mine infrastructure would be demolished and removed, adits would be sealed, and disturbed areas would be regraded, covered with growth media, and revegetated. Previously disturbed, non-scenic mining lands would be returned to a condition more consistent with the surrounding forest lands.

3.19.5 Irreversible and Irretrievable Commitment of Resources

An irreversible commitment of resources refers to the loss of future options. It applies primarily to non-renewable resources, such as minerals or cultural resources, and to those factors that are renewable only over long time spans, such as soil productivity. Examples of an irreversible commitment of resources include extinction of a threatened or endangered species, disturbance of a cultural site, loss of land production, and use of natural resources. Irretrievable commitments represent the loss of production, harvest, or use of renewable resources. For example, production or loss of agricultural lands would be an irretrievable commitment of resources, but may not be irreversible.

Implementation of the proposed reclamation alternatives would result in the irretrievable commitment of fossil fuels, including diesel and gasoline fuels consumed by construction equipment.

Chapter 4 Consultation and Coordination

This chapter provides a list of those persons responsible for preparation of the EIS. It also provides a list of agencies, organizations, and persons to whom copies of the draft EIS were distributed.

4.1 Preparers and Contributors

4.1.1 Forest Service

Name	Responsibilities	Education	Experience
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Name	Responsibilities	Education	Experience
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Name	Responsibilities	Education	Experience
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Plantenberg, Patrick	Reclamation Specialist	M.S., Range Science/Reclamation Research B.S., Plant and Soil Science/Recreation Area Management	36 years
Rolfes, Herb	Permitting	M.S., Land Rehabilitation B.A., Earth Space Science, A.S., Chemical Engineering	24 years
Strait, James	Cultural Resources	M.A., Archaeology B.S., Anthropology	15 years

4.1.3 EIS Consultant Team

Name/Firm	Responsibilities	Education	Experience
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4.2 Consultation and Coordination with Agencies, Organizations, and Individuals

On October 25, 2007, approximately 20 individuals and 68 government organizations, elected officials, or private interest groups were mailed a copy of the scoping information. In addition to federal, state, tribal, and local agencies, either a hard copy, electronic copy, or a summary of the Draft EIS has been sent to those organizations or individuals who requested a copy of this document. A copy of this Draft EIS can also be viewed at the following locations:

- DEQ website at <http://deg.mt.gov/eis.mcp>
- USFS website at <http://www.fs.fed.us/r1/kootenai/projects/projects/project.shtml?project=22452>
- Supervisor’s Office, Kootenai National Forest, Libby, Montana
- Three Rivers Ranger Station, Troy, Montana
- Montana Department of Environmental Quality, Lee Metcalf Building, Helena, Montana
- Montana State Library, Helena, Montana
- Mansfield Library, University of Montana, Missoula, Montana
- Lincoln County Library, Libby, Montana
- Troy Public Library, Troy, Montana

4.2.1 Federal, State, Tribal, or Local Agencies

Scoping material and a copy or summary of the Draft EIS were sent to the following federal, state, tribal or local agencies. Please note that a single asterisk (*) represents those agencies who received only a copy or summary of the Draft EIS. Triple asterisk (***) represent those agencies who received a letter notification of availability with the web address to access the Draft EIS; all other federal, state, tribal or local agencies received both scoping and Draft EIS materials.

Advisory Council on Historic Preservation(***)	Environmental Protection Agency
Bureau of Land Management	Environmental Quality Council (***)
City of Libby	Federal Aviation Administration (***)
City of Troy	Federal Highway Administration (*)
Coeur d’Alene Tribe	Kalispel Tribe
Confederated Salish and Kootenai Tribes	Kootenai National Forest

Kootenai National Forest Tribal Liaison
Kootenai Tribe of Idaho
Lincoln County Commissioners
Lincoln County Library (*)
Mansfield Library, University of Montana
Montana Bureau of Mines and Geology
Montana Dept of Commerce
Montana Dept of Environmental Quality
Montana Dept of Natural Resources and Conservation
Montana Dept of Revenue
Montana Dept of Transportation (*)
Montana Fish Wildlife and Parks
Montana Natural Heritage Program
Montana Office of the Governor
Montana State Library (*)
Montana Tech Library
Northwest Power Planning Council (***)
Sanders County Commissioners
SHPO

Troy Public Library
U.S. Army Engineers (***)
U.S. Army Corps of Engineers
USDA APHIS PPD/EAD (***)
USDA Natural Resources Conservation Service (***)
USDA National Agricultural Library (***)
U.S. Dept of Agriculture
USDI Office of Environmental Policy and Compliance (***)
USCG Environmental Impact Branch Marine (***)
U.S. EPA Office of Federal Activities
U.S. Fish and Wildlife Service
U.S. Forest Service
U.S. Geological Survey National Center (***)
U.S. Navy Office of Chief of Navy Operations (***)
Valley County Road Department
Wheatland County

4.2.2 Organizations and Businesses

Scoping material and a copy or summary of the Draft EIS were sent to the following organizations and businesses. Please note that a single asterisk (*) represents those organizations and businesses who received only a copy or summary of the Draft EIS; all others received both scoping and Draft EIS materials.

Alliance for the Wild Rockies
AMEC
Athens Investments, Inc.
Cabinet Back Country Horsemen
Cabinet Resource Group (*)
Camp, Dresser and McKee, Inc.
Clark Fork Coalition
Daily Inter Lake
Earthworks
Genesis, Inc.
Kootenai Valley Record
Lower Yellowstone Irrigation Project
Lincoln County Coalition
Montanians for Multiple Use
Montana Chapter American Fisheries Society
Montana Environmental Information Center (MEIC)
Montana Historical Society

Montana Mining Association
Montana Mountain Valley, LLC
Montana Trout Unlimited
Montana Wilderness Association
National Wildlife Federation
Northwest Properties, LLC
Northwest Mining Association
Rock Creek Alliance
Scotchmans Peak Wilderness (*)
Sierra Club
Society of American Foresters
The Lands Council (*)
The Western News
Troy Snowmobile Club (*)
Western Environmental Trade Association (WETA)
Wildwest Institute
Yaak Valley Forest Council

4.2.3 Individuals

Scoping material and a copy or summary of the Draft EIS were sent to the following individuals. Please note that a single asterisk (*) represents those individuals who received only a copy or summary of the Draft EIS. Double asterisk (**) represent those individuals who received scoping documents only; all other individuals received both scoping and Draft EIS materials.

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Bruce Clark (*)	Jon Tester, U.S. Senator
Carole Wright	Joshua Peterson (*)
Chas V. Vincent, Montana State Representative	Judy Hutchins
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Dasios Fotula	Linda Newstrom (*)
David Reid	Lloyd Doney (*)
Debbie Lyman (*)	Max Baucus, U.S. Senator
Dennis Rehberg, U.S. Representative	Neil Newton
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James Hill (*)	Steve Lloyd (*)
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Chapter 6 List of Acronyms

Acronym	Acronym Description
ACHP	Advisory Council on Historic Preservation
AIRFA	American Indian Religious Freedom Act
ARD	Acid Rock Drainage
ARM	Administrative Rules of Montana
ARPA	Archaeological Resources Protection Act
BA	Biological Assessment
BAA	Bear Analysis Area
BLM	Bureau of Land Management
BMPs	Best Management Practices
BMU	Bear Management Unit
CAA	Clean Air Act
CDM	Camp, Dresser & McKee, Inc.
CEQ	Council on Environmental Quality
CFR	Code of Federal Regulations
cfs	cubic feet per second
CRG	Cabinet Resource Group
cy	cubic yards
CYE	Cabinet-Yaak Ecosystem
CYRZ	Cabinet-Yaak Recovery Zone
dBA	decibel
DEQ	Montana Department of Environmental Quality
DN	Decision Notice
DNRC	Montana Department of Natural Resources and Conservation
DPS	Distinct Population Segment
DSL	Montana Department of State Lands
EA	Environmental Assessment
EIS	Environmental Impact Statement
EOB	East Ore Body
EPA	Environmental Protection Agency
ESA	Endangered Species Act
FEMA	Federal Emergency Management Agency
FONSI	Finding of No Significant Impact
FP	Forest Plan
FWP	Montana Department of Fish, Wildlife & Parks
GIS	Geographic Information System
gpm	gallons per minute
HDPE	High-Density Polyethylene
HE	Habitat Effectiveness
IDT	Interdisciplinary Team
INFISH	Inland Native Fish Strategy
IRA	Inventoried Roadless Area
KNF	Kootenai National Forest
kPa	kilopascal
kV	kilovolt
LAUs	Lynx Analysis Units
MA	Management Area
MAQB	Montana Air Quality Bureau
MBEWG	Montana Bald Eagle Working Group
MCA	Montana Code Annotated
MEPA	Montana Environmental Policy Act

MIS	Management Indicator Species
ML	Metals Leaching
MMRA	Metal Mine Reclamation Act
MNHP	Montana Natural Heritage Program
MVUM	Motor Vehicle Use Map
MOU	Memorandum of Understanding
M.P.	Mile Post
MPDES	Montana Pollution Discharge Elimination System
MT 56	Montana Highway 56
NAAQS	National Ambient Air Quality Standards
NAGPRA	Native American Graves Protection and Repatriation Act
NBEMG	National Bald Eagle Management Guidelines
NCDE	Northern Continental Divide Ecosystem
NEPA	National Environmental Policy Act
NFMA	National Forest Management Act
NFS	National Forest System
NFSL	National Forest System Lands
NFSR	National Forest System Road
NHPA	National Historic Preservation Act
NPS	Non-point Source
NRCS	Natural Resources Conservation Service
NRHP	National Register of Historic Places
NRLMD	Northern Rockies Lynx Management Direction
NWMT	Northwest Montana recovery area
OMRD	Open Motorized Route Density
ORD	Open Road Density
PCE	Primary Constituent Element
PLSS	Public Land Survey System
PM	Particulate Matter
PPI	Potential Population Index
PR	Project Record
PSD	Prevention of Significant Deterioration
PSU	Planning Subunit
RHCA	Riparian Habitat Conservation Area
RMR	Rock Mass Rating
ROD	Record of Decision
SIP	State Implementation Plans
SHPO	State Historic Preservation Office
SWCP	Soil and Water Conservation Practices
SWPPP	Storm Water Pollution Prevention Plan
TCP	Traditional Cultural Property
TMRD	Total Motorized Route Density
U.S.	United States
USC	United States Code
USACE	United States Army Corps of Engineers
USDA	United States Department of Agriculture
USFS	United States Forest Service
USFWS	United States Fish and Wildlife Service
USGS	United States Geological Survey
VQOs	Visual Quality Objectives
VRUs	Vegetation Response Units

Chapter 7 Glossary

adfluvial	Describing fish that live in lakes and migrate into rivers or streams to spawn.
adit	A horizontal opening driven into the side of a hill or mountain to access an ore deposit.
allochthonous	Said of rocks or materials formed elsewhere than their present place.
alluvial or alluvium	The general name for all sediments, including clay, silt, sand, gravel, or similar unconsolidated material deposited in a sorted or semi-sorted condition by a stream or other body of running water.
alluvial fan	Coarse material forming a fan-shaped deposit at the base of a ravine or drainage.
ambient	Existing or present.
anadromous	Describing fish that live primarily in the ocean but breed in fresh water.
angle-of-repose	The maximum (steepest) angle at which a loose material will remain stable.
attenuation	Reduction in the concentration of a constituent of concern achieved by natural physical, biological, or chemical processes.
baseflow	Groundwater inflow to streams.
bedload	Coarse particles transported on the bed of a stream; sand, gravel, cobbles, boulders.
best management practices (BMPs)	Activities or structural improvements that improve and/or control non-point source pollutants.
borrow materials	Geological materials such as rock or soil dug from one location to provide materials for another location.
cation exchange capacity	A measure of the chemical process in which cations are exchanged between a solid, such as zeolite, and a solution, such as water. Cations are elemental metals that are ionized in solution.
common ions	A water analysis that typically reports concentrations of calcium, magnesium, sodium, potassium, sulfate, chloride, hardness, total dissolved solids, alkalinity, and conductivity.
concentrate	Ore that has been processed into a more concentrated form suitable for refining.
conspecific populations	Populations of plants or animals that belong to the same species.
Core	Grizzly bear core habitat
cultivar	A variety of a plant developed from a natural species and maintained under cultivation.
debris flow	A fast moving, high density, liquefied landslide.
debris torrent	A rapid surge of water, mud, and rocks down a steep creek; a channelized debris flow.
decant pond	A basin used to hold process water for a sufficient period of time to allow solids to settle from suspension.
degradation	The process by which water quality is lowered in the natural environment.
development rock	Rock other than ore that is removed from an underground mine.

diagenesis	Changes undergone by a sediment after its initial deposition such as compaction, cementation, and replacement that occur under conditions of pressure and temperature that are normal in the outer part of the earth's crust. Excludes weathering and metamorphism.
dike	a. A bank usually of earth constructed to control or confine water. b. A tabular body of igneous rock that cuts across the structure of adjacent rocks or cuts massive rocks.
drift	A horizontal mine tunnel
embeddedness	The degree to which coarse particles (sediments) are surrounded by fine sediments.
empirical	Derived from experiment or observation.
endangered species	A species threatened with extinction.
endemic	Restricted to or native to a particular area or region.
euhedral	A mineral grain that is completely bounded by its own rational faces, and whose growth has not been restrained or interfered with by adjacent grains.
extirpation	Complete removal or destruction.
fault	A fracture in the earth's crust accompanied by a displacement of one side of the fracture with respect to the other.
forb	An herb other than a grass.
glacial-fluvial deposits	Materials deposited by glacial meltwater; outwash deposits.
glacial outwash	Sediment deposited by glacial meltwater, generally layered.
glacial till	Sediment deposited in contact with glacial ice, generally unlayered.
gradient	Slope, generally with respect to streams or groundwater.
herbaceous	Having the qualities of an herb.
historic properties	Any prehistoric or historic district, site, building, structure, or object included in, or eligible for inclusion in, the National Register of Historic Places maintained by the Secretary of the Interior. This term includes artifacts, records, and remains that are related to and located within such properties. The term includes properties of traditional religious and cultural importance to an Indian tribe or Native Hawaiian organization and that meet the National Register criteria (36 CFR Part 800 Protection of Historic Properties, Section 800.16 Definitions (1)).
hydraulic head	Potential energy contained in a water mass, produced by elevation, pressure, and velocity.
interclastic	Said of material that is introduced between rock fragments.
interspecific competition	Competition between species for resources.
lacustrine	Pertaining to, produced by, or inhabiting a lake or lakes.
lithostatic	Said of pressure within rocks.
loadout facility	A location other than the mill site, used for the loading, unloading, handling, or mixing of ore concentrate for shipment by rail.
lode-mining claim	A claim located upon deposits of mineral which are erected in or surrounded by hard rock, such as veins, fissures, lodes, and disseminated ore bodies. There are two types of claims: lode and placer. A placer claim is located in loose or unconsolidated material.

macroinvertebrate	Stream insects that are a primary food source for fish and are sensitive to metals concentrations in surface water.
Management Situation 1	Habitat contains grizzly bear population centers and habitat components needed for the survival and recovery of the species. Management decisions will favor the needs of the grizzly. Habitat maintenance and improvement and grizzly/human conflict minimization will receive the highest management priority.
Management Situation 3	Areas where grizzly bear presence is possible but infrequent. Developments such as campgrounds, resorts, or other high human use associated facilities, and human presence result in conditions which make grizzly presence untenable for humans and/or grizzlies. Grizzly habitat maintenance and improvement are not management considerations in these areas. Grizzly/human conflict minimization is a high priority management consideration.
metapopulation	A group of spatially separated populations of the same species which interact at some level.
metasedimentary	Partly metamorphosed sedimentary rock.
mitigation	An action to alleviate, avoid, eliminate, or replace the impact to the surrounding environment.
morphology	Form and structure.
moving window analysis	A GIS modeling routine which converts linear road maps into a map of road densities based on a selected pixel (cell) size. Road density is the amount of road found within a circular "window" of a selected area (e.g. 1 mi ²) centered on each pixel.
non-attainment area	A geographic area in which the level of a criteria air pollutant is higher than the level allowed by the federal standards.
noxious weeds	Physically harmful or destructive weeds as identified by the legislature.
ore	Rocks or minerals that can be mined, processed and delivered at a profit.
patented land	A parcel of land which the federal government sold to a claim holder and whose ownership can be transferred to other private parties. The minerals contained within the land also belong to the claim holder.
infiltration pond (percolation pond)	A basin constructed to allow fluids to infiltrate or trickle through a permeable media for the purpose of disposal.
piezometer	Small wells used to locate the water table and obtain groundwater measurements.
portal	The surface entrance to an adit.
portal patio crest	The patio is the normally level area formed in front of a mine opening by spreading development rock from the mine. The crest of the patio is formed by the top of the steep slope on the downhill side of the patio.

Primary Constituent Element (PCE)	The physical and biological features that are essential to the conservation of the species and that may require special management considerations or protection. These features are the PCEs laid out in the appropriate quantity and spatial arrangement for conservation of the species.
reclamation	The process of returning mined land to a viable post-mining contour, use, or condition.
redox	Redox is an abbreviation for reduction-oxidation potential. Redox potential is a measure (in volts) of the affinity of a substance for electrons.
roaded	An area with road access.
scour	An erosional process resulting from flowing water or ice.
shadow area	The area of land overlying the mine workings.
sill	A tabular igneous intrusion between rock layers.
slump	Down slope movement of geologic materials.
specific conductance	A measure of the electrical properties of a solution. Solutions containing salts can transmit electrical current whereas pure water cannot.
stochastic	A process that is non-deterministic; having a random element.
subsidence (mining induced)	Sinking down of part of the earth's surface due to mining.
subsiding	Sinking.
substrate	The base on which an organism lives.
syncline	In structural geology, a syncline is a downward-curving fold, with layers that dip toward the center of the structure.
tailings	Sand-sized or small material leftover from the milling process after the recoverable minerals have been removed from the ore.
talus slope	A sheet of rock debris mantling a slope.
threatened species	Having an uncertain chance of continued survival; likely to become an endangered species.
turbidity	A measure of the amount of suspended solids in water.
unconsolidated	Uncemented particles not lithified into rock.
waste rock	Rock that is uneconomical to mill but must be removed to gain access to an ore body. Waste rock also often comes from underground excavations for facilities, such as shops, explosives magazines, etc. Also referred to as "development rock".
waters of the U.S.	All waters which are currently used, or were used in the past, or may be susceptible to use in interstate or foreign commerce such as intrastate lakes, rivers, streams (including intermittent streams), wetlands, wet meadows, or natural ponds.
weathering	The physical and chemical breakdown of rock materials into smaller particles or chemical constituents (ions).
wetland	Areas where land is covered, often intermittently, with shallow water or contain soil saturated with moisture for a defined portion of the year.

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