Jocko Lakes Fire Salvage

Hydrology Report

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Introduction

The purpose of this document is to assess the existing conditions and determine the effects of the proposed Jocko Lakes Salvage project alternatives for consideration in determining whether or not to prepare an Environmental Impact Statement. Alternatives include: 1) No Action -Alternative 5, and 2) Modified Proposed Action – Alternative 3. As proposed the Jocko Lakes Salvage Project would salvage burned timber on about 1,657 acres of the Lolo National Forest in the Clearwater-Salmon River and Placid Lake 5th HUC watersheds near the community of Seeley Lake. The project area extends across several tributary watersheds including: Archibald Creek, Boles Creek, Finley and Slippery John Creeks, and Placid Creek (Figure 1).

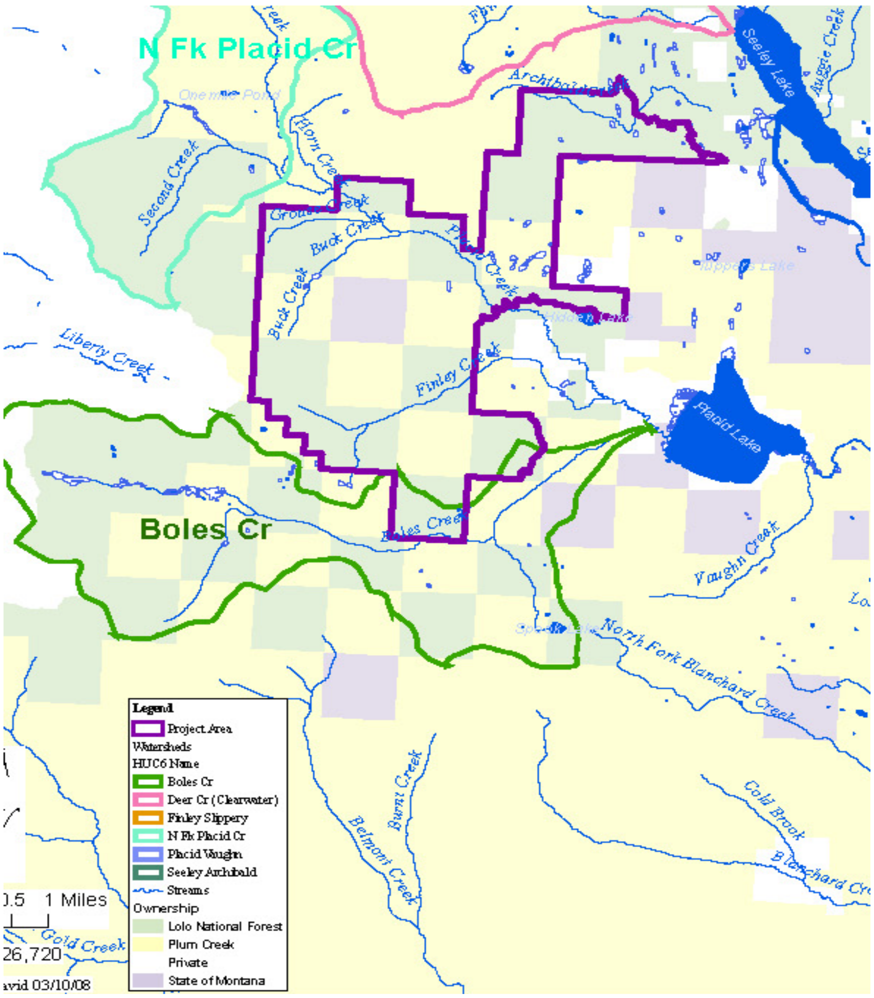

Figure 1: Map of the project watersheds, ownership, and tributary watersheds in Jocko Lakes Salvage project area.

Hydrology Issues

An issue is "an effect (or a perceived effect, risk, or hazard) on a physical, biological, social, or economic resource" (The Shipley Group 1998, p.21). Furthermore, "[a]n issue is not an activity; instead, the predicted effects of the activity create the issue" (The Shipley Group 1998, p.21).

Based on this definition, and the issues raised by the public during the scoping process, the following two items summarize the hydrology-related issues that will be addressed:

- How would the proposed project activities and past, present and future actions affect water quality including sediment, temperature, channel stability and habitat? (Temperature is addressed in the fisheries report).
- How would the proposed project activities affect road density in the Project watersheds?
- How would the proposed project activities and past, present and future actions affect water yield/water quantity including magnitude, timing and duration of stream flows, and sediment transport?

Summary of Analysis

The effects of the Alternatives on water quality, road density and water quantity were evaluated. No streams or lakes in the project area are listed as water quality limited under section 303(d) of the Clean Water Act in the 2006 303(d) list, however, the 2006 303 d list in under litigation, so Montana DEQ is operating under court order to address the impairments identified on the 1996 303(d) list, which shows Buck Creek as an impaired stream. A TMDL is being developed in the Middle Blackfoot sub-basin, which includes the project area.

With the design requirements of Alternative 3 (Modified Proposed Action) and effective implementation of BMPs ("all reasonable land, soil, and water conservation practices") and INFISH RHCA buffers, the negative effects of this project on water quality would be short-term, and limited to 2-5 years and are associated with road construction, re-construction, BMP implementation, road grading, culvert removal and replacement, and road decommissioning, resulting in a short term increase. Positive effects would include water quality improvements from BMP upgrades on approximately 55 miles of roads used for the project, road decommissioning and storage of 10.7 miles and culvert removal and upgrades resulting in a longer term decrease of sediment annually. These positive effects would combine cumulatively with other positive effects from other recent watershed improvements. These positive benefits would outweigh the minor negative short-term impacts.

Effects to road density would also be primarily short-term increases (2-5 years) associated with temporary and short-term specified roads. Construction of approximately 4 miles of new short term specified road and temporary road would be constructed, although there would be no new permanent stream crossings. There would be slight decreases in watershed road density after the project.

Effects of salvage vegetation removal on water quality would be minimal due to design requirements of this project and effective implementation of BMPs.

Impacts to water quantity as a result of salvage vegetation removal would be minimal and not detectable. Salvage harvest of vegetation would not significantly reduce tree canopies enough to influence streamflows at detectable levels. Burning of over-stocked stands that existed before the fire may have led to an increase in water quantity, however flow increases are not a result of implementation of the project.

Effects of road work would have minor short-term negative and long-term positive effects on stream channels. Short term impacts are associated with the removal and/or replacement of 3 culverts for upgrades, 4 miles of short term specified and temporary road construction and 10.7 miles of road decommissioning or storage. Vegetation removal would not impact stream channel conditions because of BMPs and INFISH RHCA buffers.

Alternative 5 (no action) would not impact water quality, road density, water quantity or stream channels directly although there would be no upgrade and installation of BMPs under Alternative 5 which are designed to eliminate or minimize existing sediment sources. Therefore, there would be no reduction of sediment discharge associated with roads in the analysis area.

Proposed Action and Related Activities Summarized by HUC

The following series of tables provides a breakdown of the proposed activities by HUC 6 watershed. This information is provided here to show and summarize what project information was used as part of the hydrology analysis. Breakdowns of activities include the different types of salvage timber harvest, the types of logging systems to be used for treatments, and different road treatments. Activities are further delineated by those which would occur near streams, although these breakdowns do not take into account INFISH buffer restrictions. For example a unit as mapped may appear to be near a stream, however, INFISH buffer requirements would preclude activities in that unit from occurring within 300' of streams. Road activities, closure levels and road types are also defined. Construction of short term specified roads and temporary roads are proposed for this project. Road decommissioning and road BMP upgrades are also proposed.

The resource protection measures proposed for this project are listed later in this report and the effectiveness of those protection measures are discussed and considered in the effects analysis.

Table 1. Proposed timber salvage treatment types by HUC 6 watershed (for the entire Project watersheds). Units are acres.

Watershed (HUC 6)	Total Proposed Salvage Treatment Acres	Dry Season Tractor acres	Over-Snow Tractor acres	Skyline acres
Boles Cr	41		41	
Deer Cr	0			
Finley-Slippery	1428	21	1330	77
N Fk Placid Cr	0			
Placid-Vaughn	0			
Seeley-Archibald	181		181	

Table 2. Proposed road work within the project area boundary.

Watershed HUC 6	Proposed Units (acres)	Temp. Roads (miles)	Short Term Spec. Roads (miles)	New Perm. Roads (miles)		Road Decom. (miles)	
				Long Term Specified	Long Term Specified then Intermittent Stored Service	Reconstruct then Intermittent Stored Service- Storage	Closure and Decommision
Boles Creek	41	.1	0	NA	NA	.3	0
Deer Cr	0	0	0	NA	NA	0	0
Finley-Slippery	1428	1.2	2	NA	NA	3.6	3.5
N Fk Placid Cr	0	0	0	NA	NA	0	0
Placid-Vaughn	0	0	0	NA	NA	0	0
Seeley-Archibald	181	0	0	NA	NA	0	0
Alva Inez							

Table 3. Definitions of road terminology

Road Term or Phrase	Definition
Road	A motor vehicle travel way over 50 inches wide, unless designated and managed as a trail. A road may be classified, unclassified, or temporary.
Classified Road	Roads wholly or partially within or adjacent to National Forest system lands that are determined to be needed for long term motor vehicle access, including state roads, county roads, privately owned roads, National Forest System roads, and other roads authorized by the Forest Service.
Unclassified – Unauthorized Road or Trail	A road or trail that is not a forest road or trail or a temporary road or trail and that is not included in a forest transportation atlas. (36 CFR 212.1) Unauthorized roads are categorized into two types: • Undetermined. Roads where long term purpose and need has yet to be determined, and • Not Needed. Roads not needed for long-term management of national forest resources as determined through an appropriate planning document. (Travel Routes National Data Dictionary for Roads)
Roads on National Forest System lands that are not managed as part of the forest transportation system, such as unplanned roads, abandoned travel ways, and off-road vehicle tracks that have not been designated and managed as a trail, and those roads that were once under permit or other authorization and were not decommissioned upon the termination of the authorization.	
Temporary Road	Roads authorized by contract, permit, lease, other written authorization, or emergency operation, not intended to be a part of the forest transportation system and not necessary for long-term resource management.
Short Term Specified Road & Temporary Roads	Roads with short term use. Temporary Roads would be obliterated, recontoured, seeded and covered within one season following purchasers' use. Short Term Specified Roads would be decommissioned following sale and post sale activities.)
Long Term Specified Road	Roads with continuous or annual recurrent service.
Intermittent Stored Service	An intermittent service road, and closed to traffic
Construction	The erection, construction, installation, or assembly of a new fixed asset. (Financial Health – Common Definitions for Maintenance and Construction Terms, July 22, 1998)
Reconstruction	Activity that results in a Road improvement or Road Realignment of an existing classified road. (FSM 7705 – Transportation System)
Maintenance	The ongoing upkeep of a road necessary to retain or restore the road to the approved management objective. (FSM 7705 – Transportation System)
Realignment	Activity that results in the new location of an existing road or portions of an existing road and treatment of the old roadway. (FSM 7705 – Transportation System)
Decommissioning & Storage	Activities that result in the stabilization and restoration of an unneeded road to a more natural state. (36CFR 212.1, FSM 7705 – Transportation System)
BMPs	Best Management Practices related to road maintenance and operation which help minimize risk to resources such as water quality.
Closure	Refer to following table for closure level descriptions.

Table 4. Lolo National Forest road closure levels.

Level	Device	Mitigation	Status
1	Gate	Blade, seed, fertilize. Normal drainage. Treat noxious weeds.	Remains on NFSR system; Maintenance Level 1
2	Gate, guardrail, concrete or earth barrier, or Recontour at intersection	Type III dip, drivable waterbars, or outslope. Scarify 2-3 inches, seed & fertilize. May scatter slash on roadway. Treat noxious weeds.	Remains on NFSR system; Maintenance Level 1; if custodial care won't be performed, consider Closure Level 3 (self-maintaining).
3S Storage 3D Decommission	Recontour at intersection or Rock or earth barrier	Waterbar or intermittent outslope. Remove CMPs & restore all watercourses to natural channels & floodplains. Rip 6-12 inches, seed & fertilize. May scatter slash on road. Treat noxious weeds.	3S -- Retain on NFSR system in long term storage (self-maintaining); generally up to approx. 20 years. 3D – Decommission, remove from NFSR system, road not needed for 20+ years generally.
4	Recontour at intersection or Rock or earth barrier	Waterbar or intermittent outslope. Selective recontour along the road. Remove CMPs & restore all watercourses to natural channels & floodplains. Rip 12-18 inches, seed & fertilize. Scatter slash on recontoured slope. Treat noxious weeds.	Remove from NFSR system, road not needed for 30+ years generally.
5	Recontour	Recontour the entire road prism to almost pre-road conditions. Remove CMPs & restore all watercourses to natural channels & floodplains. Seed & fertilize. Scatter slash on recontoured slope. Treat noxious weeds.	Remove from NFSR system; road access not needed for 40+ years

- The mitigation and obliteration techniques which would be applied under the various closure levels would be used as needed on a site specific basis.

Examples:

- Ripping under a Level 3 closure would not be needed on a road which has revegetated since ripping is performed to promote revegetation;
- A Level 3 closure might be appropriate for a road not needed for 40+ years, depending on specific resource concerns.
- Type of weed treatment depends on the level of closure and extent of weed establishment.

- Only CMPs at drainages would generally be removed. CMPs which are used to drain ditches would generally not be removed unless they are located within an area to be recontoured under a Level 4 or 5 closure or the ditch carries a significant amount of water.

- Levels 3 through 5: Provide short-term sediment buffering (straw bales, coconut mats, etc.) at stream crossing-road recontour interfaces.

The following break-downs are based on attributes in the road treatment GIS layer.

Table 5. Summary of road activities within project area.

Closure Level	Project Road Type/Activity	Road Length (miles)
Open Haul	Road Maintenance/BMP maintenance and reconstruction	**55**
Short-Term Specified	Add to system, maintain BMPs	**2**
Road Storage	Closure after project, maintain BMPs, hydrologically stabilize	**3.9**
Temporary road	Decommission after project, hydrologically stabilize	**1.3**
Decommission	Rehabilitate, hydrologically stabilize	**3.5**

Forest Plan Direction and Regulatory Framework

Lolo National Forest Plan (USDA 1986) provides forest-wide management direction regarding water and hydrologic resources. Other direction is provided by federal and state laws, guidelines, executive orders and other agency direction described below.

Federal Regulations

A. The Federal Water Pollution Control Act of 1972 (Public Law 92-500) as amended in 1977 (Public Law 95-217) and 1987 (Public Law 100-4). Also known as the federal Clean Water Act.

This Act, was intended by Congress to provide a means to protect and improve the quality of water resources and maintain their beneficial uses. It provides the structure for regulating pollutant discharges to waters of the United States. As stated in Section 101 of the Act, the objective of the Act is "…to restore and maintain the chemical, physical, and biological integrity of the Nation's waters". Control of point and non-point sources of pollution are among the means to achieve the stated objective. The U.S. Environmental Protection Agency (EPA) is charged with administration of the Act, but there is provision for the delegation of many permitting, administrative, and enforcement functions to state governments. In Montana, the designated agency is the Montana Department of Environmental Quality (MDEQ).

Certain sections of the Act have special importance in management of non-point source pollution (e.g. sediment from forest management activities is considered non-point source whereas effluent from a sewage treatment plant is considered a point source). Sections 208 and 319 of the Act recognize the need for control strategies for non-point source pollution. Section 305(b) requires states to assess the condition of their waters and produce a biennial report summarizing the findings.

Waterbodies with impaired water quality (not fully meeting water quality standards) or threatened (likely to violate standards in the near future) are compiled by MDEQ in a separate list under Section 303(d) of the Act. This list must be submitted to EPA every two years. Waterbodies on the 303(d) list (known as Water Quality Limited—or WQL—waters) are to be targeted, and scheduled, for development of water quality improvement strategies on a priority basis. These strategies are in the form of Total Maximum Daily Loads, or TMDLs when a pollutant is involved, and technically consist of the quantity of pollutants that may be delivered to a waterbody without violating water quality standards. When water quality impairment is not related to a pollutant (habitat alteration) strategies are in the form of a Water Quality Restoration Plan (WQRP). Frequently, impairments are related to both pollutants and non-pollutants and TMDLs and WQRP are development in concert. In practice TMDLs and WQRP alone or in combination are plans to improve water quality in a listed waterbody until water quality standards are met (i.e., until designated uses are fully supported).

Section 404 of the Act outlines the permitting process for discharging dredged or fill material into waters of the United States, including wetlands. The U.S. Army Corps of Engineers administers the 404 program.

Under Section 401 of the Act, states and tribes may review and approve, set conditions on, or deny Federal permits (such as 404 permits) that may result in a discharge to State or Tribal waters, including wetlands. Applications for Section 404 permits are often joint 404/401 permits to ensure compliance at both the State and Federal levels.

Federal agency compliance with water pollution control mandates are addressed through Section 313 of the Clean Water Act and in Executive Order 12580 of January 23, 1987. Agency compliance is to be consistent with requirements that apply to "any nongovernmental entity" or private person. Compliance is to be in line with "all Federal, State, interstate, and local requirements, administrative authority, and process and sanctions respecting the control and abatement of water pollution". To comply with State Water Quality Standards, the Forest Service is required to apply water quality practices in State Forest Practices Regulations, where applicable - reasonable land, soil, and water conservation practices, or specialized best management practices. All these types of practices are designed with consideration of geology, land type, soil type, erosion hazard, climate, cumulative affects and other factors in order to fully protect and maintain soil, water, and water-related beneficial uses, and to prevent or reduce non-point source pollution.

To provide environmental protection and improvement emphasis for water and soil resources and water-related beneficial uses, the National Non-point Source Policy (December 12, 1984), the Forest Service Non-point Strategy (January 29, 1985), and the USDA Non-point Source Water Quality Policy (December 5, 1986) were developed. Soil and water conservation practices were recognized as the primary control mechanisms for non-point sources of pollution on National Forest System lands. This perspective is supported by the Environmental Protection Agency (EPA) in their guidance, "Nonpoint Source Controls and Water Quality Standards" (August 19, 1987).

B. Forest Service Manual Sections 2532.02, 2532.03

Sections 2532.02 and 2532.03 of the Manual describe the objectives and policies relevant to protection (and, where needed, improvement) of water quality on National Forest System Lands so that designated beneficial uses are protected. Guidelines for data collection activities (inventory and monitoring) are also described (USDA, 1990).

C. Executive Order 11988, Floodplain Management

This Executive Order requires that agencies avoid, to the extent possible, adverse impacts associated with occupancy and modification of floodplains. It applies to all floodplain locations, as a minimum to areas in the 100-year, or base, floodplain (Executive Order 1977).

D. Executive Order 11990, Protection of Wetlands

This Executive Order states that agencies shall minimize destruction, loss, or degradation of wetlands and shall preserve and enhance their natural and beneficial values. Agencies are to avoid construction in wetlands unless it is determined that there is no practicable alternative and that all practicable measures are taken to minimize harm to wetlands (Executive Order 1977).

State laws

A. Montana Water Quality Act (Title 75, Chapter 5, Montana Code) as revised October 1999

This Act describes water quality management requirements, water classifications, and water quality standards for the State of Montana. It is the document that describes the water quality permitting and enforcement powers delegated by EPA to states under the federal Clean Water Act. Montana DEQ is the agency responsible for administration of the Act. The following documents contain the specific water quality standards enforced by MDEQ:

- Montana Surface Water Quality Standards and Procedures for Waters in B-1 Use Classification [Administrative Rules of Montana (ARM) 17.30.623], as of June 2000).
- Montana Numeric Water Quality Standards (Circular WQB-7, September 1999). Applicable water quality standards are cited in the Water Quality section of this chapter.

B. State of Montana Best Management Practices for Forestry and Streamside Management Zone Law and Rules

The Montana Department of Natural Resources and Conservation (DNRC) is responsible for oversight of forestry and road management practices to protect resources in Montana. Best Management Practices (BMPs) for water quality in Montana (MSU 2001) are voluntary, preferred, measures to protect soil and water quality. They are developed for riparian and for upland management. The Forest Service uses the use of BMPs as mandatory minimum measures for protecting watershed resources, and generally exceed the minimum efforts required by State law. In addition, there is a Memorandum of Understanding between U.S. Forest Service, Montana Dept. of State Lands, Plum Creek Timber Company, Bureau of Land Management, Bureau of Indian Affairs, Flathead Agency, Dept. of Natural Resources and Conservation, and Dept. of Health and Environmental Sciences for the adopting and implementing of Best Management Practices for Forestry in Montana. This memorandum direction went into effect April 1987, and provides that the parties agree to incorporate Best Management Practices into their forest operations in order to minimize or prevent adverse water quality impacts. Lolo National Forest Best Management Practices, which are also mandatory, equal or exceed the protection afforded by Montana BMPs.

Streamside Management Zone (SMZ; 2005) rules are mandatory for timber sales, applying within the SMZ, which is "…a strip at least 50 feet wide on each side of a stream, lake, or other body of water, measured from the ordinary high water mark, and extending beyond the high water mark to include wetlands and areas that provide additional protection in zones with steep slopes or erosive soils". (Logan 1991) In the context of the SMZ rules, a stream is a natural watercourse with a defined channel, flowing either continuously or intermittently. Isolated wetlands, lying within a sale boundary but outside SMZ boundaries, are not regulated under the SMZ law. Under the law, specified activities associated with timber harvest—including broadcast burning, clearcutting, vehicle operation (except on established roads), road construction (except at crossings), and other activities—are prohibited in SMZs unless approved by DNRC. SMZs are not necessarily full-fledged buffers, but special measures are taken in the Zone to protect the special values found there.

On National Forest lands, streamside protection exceeds the SMZ law by meeting the Riparian Habitat Conservation Area (RHCA) guidelines described in INFISH (USDA 1995), which is an amendment to the Lolo National Forest Plan (see Fisheries section for more information).

C. Montana Stream Protection Act—SPA 124 Permits; Short-term Exemption from Montana's Surface Water Quality Standards (3A Authorization)

Activities that would physically alter the bed or immediate banks of a stream require permits under the Montana Stream Protection Act (1991). Such activities proposed by federal, state, county, and city government agencies require an SPA124 permit from Montana Fish, Wildlife & Parks; this is the counterpart of the 310 permit required from DNRC for projects proposed by private individuals. Land ownership does not necessarily determine which permit is needed; rather, the party in charge of the project determines permitting requirements. SPA 124 permits are required for new construction or for modification, operation, and maintenance of an existing facility, and may apply to intermittent drainages as well as perennial streams. Culvert removal and replacement, stream channel rehabilitation, and other such actions are examples of activities that would require these permits.

If construction would cause unavoidable short-term violations of state water quality standards (mainly sediment), a 3A Authorization needs to be obtained from MDEQ.

Lolo National Forest Plan

A. Goals and Objectives

Goal 8, p.II-1: Meet or exceed State water quality standards.

Objective 1, p.II-2: : "…improves the environmental quality of the Forest over current direction through strong Forest goals, Forest-wide standards, Management Area standards and direction, and an extensive, affordable Monitoring Program that emphasizes protection of water quality…."

B. Standards and Management Area Direction

Standard 15, p.II-12: "…application of best management practices will assure that water quality is maintained… that meets or exceeds State and Federal standards."

Standard 17, p.II-12: "A watershed cumulative effects analysis will be made of all projects involving significant vegetation removal prior to these projects being scheduled for implementation. These analyses will also identify existing opportunities to mitigate adverse effects on water-related beneficial uses, including capital investments for fish habitat or watershed improvement."

Standard 19, p.II-12: "Human-caused increases in water yields will be limited so that channel damage will not occur as a result of land management activities."

MA 13 Direction (pp. III-56-59) Too extensive to describe in detail, but provides goals and standards for protection and management of water and riparian resources. Some salient points of interest include:

> Standard 9: "Riparian vegetation, including overstory tree cover, will be left along water bodies as needed to provide shade, maintain streambank stability, desirable pool quality and quality for aquatic organisms, and promote filtering of overland flows." (p. III-57)
>
> Standard 13: "Roads will be managed…to avoid damage to drainage systems and resource values. Roads will be constructed and managed in a manner to keep sedimentation hazard low." (p. III-58)

Implementation, Project Planning, p.V-2: "As part of project planning, site specific water quality effects will be evaluated and control measures designed to insure that the project will meet Forest water quality goals; projects that will not meet State water quality standards will be redesigned, rescheduled, or dropped."

C. Inland Native Fish Strategy (INFISH)

The Lolo National Forest Plan was amended based upon recommendations made in INFISH (USDA, 1995). This amendment restricts certain types of management activities on forest riparian systems, with the objective of maintaining or improving habitat for inland native fish species. It designates priority watersheds for monitoring, restoration and watershed analysis; identifies default riparian management objectives (RMOs); and establishes riparian habitat conservation areas (RHCAs) around all streams, wetlands, waterbodies and landslide prone areas. See Fisheries section for a discussion of this amendment to the Forest Plan.

Affected Environment

Analysis Area Boundary

The analysis area boundary for water resources consists of the Clearwater River-Salmon and Placid Creek drainage areas, which are fifth level Hydrologic Unit Code watersheds (HUC 5) (Figure 1). The Jocko Lakes Salvage Project area is located in both HUC 5 watersheds. The project area also includes portions of tributary, sixth level HUC watersheds (HUC 6) to the Clearwater River. Those HUC 6 watersheds outside of the project area boundary are still considered as part of the cumulative effects analysis because conditions and resulting effects in those watersheds could potentially combine with the effects of the proposed activities. Similarly, the entirety of HUC 6 watersheds that overlap in part with the project area boundary are also included in this analysis because existing conditions and effects within the project area are due in part to activities and watershed conditions upstream of the project areas as well as activities and conditions within the project area.

Hydrologic field surveys were done in June, 2008 for each project harvest unit and to assess the project access roads, riparian areas, and stream channels.

General Watershed Characteristics

The project area is located west and south of Seeley Lake, Montana, west of the Swan Range and the Bob Marshall Wilderness Area, and east of the Mission Mountains. Elevations within the project area range from approximately 5,000 feet in upland areas to 4,000 feet near Seeley Lake. Proposed activity areas are located a few miles to the west of Seeley and Placid Lakes.

Table 6. Watershed, project area, and unit acres and land ownership.

	HUC 6			Project Area			Units	
Watershed HUC 6	Area (ac)	FS Own. (acres)	FS Own. (%)	Area (acres)	FS Own. (acres)	FS Own. (%)	Area (acres)	% HUC 6
Boles Cr	12,604	7,228	57	604	601	99	47	0.44
Deer Cr	12,893	2,166	17	0	0	0	0	0
Finley-Slippery	21,789	7,965	37	10,237	5,734	56	1476	7.7
N.Fk. Placid Cr	10,852	5,314	49	0	0	0	0	0
Placid-Vaughn	13,577	311	2	0	0	0	0	0
Seeley-Archibald	19,752	11,725	59	1047	1047	100	192	1.03

Climate

Average annual precipitation at Seeley Lake is 20 inches/year with 140 inches of annual snowfall. Most precipitation at Seeley Lake falls in the form of snow from November through March and as rain in May and June. July and August are warmest (mid-eighties), December and January are coldest (mid- to low-teens). Weather patterns are also strongly influenced by the surrounding mountains. NOAA climate data were obtained from the Western Regional Climate Center at http://www.wrcc.dri.edu/summary/climsmmt.html.

According to precipitation data mean annual precipitation in the project watersheds ranges from approximately 20 inches near the Town of Seeley Lake to over 70 inches at some of the highest elevations along the mountains to the east, and up to 40 inches along the Mission Mountains, with an overall mean of about 30” for the project area.

Geology, Groundwater, and Landforms

The Clearwater River drainage is bounded by the Mission Mountains on the west and the Swan Range on the east. Both mountain ranges are mainly sedimentary carbonate rocks. The entire valley and surrounding mountains were heavily glaciated during the Pleistocene epoch. Topography of the area is dominated by a prominent linear trend roughly paralleling the center of the valley. Glacial till deposits are found from valley floor level to the highest elevations within the area bounded by the Swan and Mission ridges. Alden (1953) shows that valley glacier ice, fed by tributary glaciers from the Swan and Mission Ranges, moved northwestward down the Swan Valley and southeastward down the Clearwater Valley. Apparently the present drainage divide separating the two river systems was the locale for accumulation of an ice mass nourished by tributary glaciers that spread laterally both northwestward and southeastward. Further, according to Alden (1953), the ice was at least 1,000 feet thick in the vicinity of present Salmon Lake and extended as far south as the Blackfoot Valley. Till deposits indicate that ice once covered Rice Ridge to its highest elevations. The surficial deposits underlying Rice Ridge to the south represent a medial moraine emplaced by ice and meltwater from both valley glaciers.

The bedrock basin underlying the project area contains a large volume of unconsolidated valley fill and forms an extensive groundwater reservoir. The valley fill, and consequently the groundwater reservoir, is deepest along the center of the valley. Topography and the distribution of rock outcrops indicate that the bedrock basin narrows gradually toward the north also abruptly about 2 miles down valley from Seeley Lake.

Recharge for this groundwater reservoir is accomplished by a combination of groundwater inflow from the Clearwater River, subsurface inflow from tributary drainages, subsurface flow through unconsolidated rock material overlying the main valley slopes and the main lake. The water level of the main lake, kettle hole lakes, drift-dammed ponds, and perennial streams are surface expressions of the water table that forms the upper boundary of the groundwater reservoir.

Geologic mapping further portrays the distribution of unconsolidated material units. Drilling indicates that valley fill materials may exceed 600 feet in thickness at several sites. This depth of fill suggests that surface and sub-surface hydrology are closely linked. The materials are dominantly interfingering accumulations of glacial till, outwash and alluvium from several glaciations. To a large extent, the fill materials were derived from local sources though ice transport from areas further north is indicated by the presence of erratics. Glacial tills because of their fine grain soil particles are generally very erosive and are easily transported in water. However, the topography in the project area is generally undulating with lower slopes that tend to keep sediment delivery risks low. Also, mainstream channels are described as "under-fit"; that is they evolved under conditions of much higher discharge. They are thus able to carry higher volumes of water without a high risk of eroding sediment from within the channels.

The vast majority of the Jocko Lakes Salvage Project proposed units are located on soils derived from glacial processes or from metasedimentary limestone, quartzite, and argillite (variously weathered). Exceptions include some of the units which are located on valley fill deposit or on alluvium.

Refer to the Soils Report for further discussion of soils within the project area and soils within each proposed unit. Design criteria, application of BMPs and mitigation measures would provide protection against erosion on all landtypes, but especially on sensitive landtypes.

Wetlands

Salvage activities would not take place in wetlands. Application of INFISH standards provide for protection of wetlands during salvage activities.

Hydrology

The hydrology of the 248,500-acre Clearwater River watershed (including private and state ownership) is primarily driven by the annual accumulation and melt of winter snowpack.

Numerous studies have assessed selected properties of the area's surface waters; among these studies are those of Juday and Keller (1974, 1976) and Streebin and others (1972, 1973). In 1973, the University of Oklahoma published a study of water quality in the Clearwater River drainage (Streebin, 1973). Two years of data collected prior to the 1973 Streebin report suggested the following:

1. Water quality generally is lower during the early spring runoff, and improves throughout the summer as the groundwater flow to runoff flow ratio increases.
2. There is a definite relationship between land use practices, particularly logging practices, and water quality.
3. Water quality may be more affected by the type of logging practice used than by the percentage of an area logged.
4. The streams in the basin with lowest quality water were outside the Jocko Lakes Project area (Richmond and Deer Creeks, and the West Fork of the Clearwater River).
5. At its source, the Clearwater River is of very high quality. With one notable exception, an area of badly eroding streambank upstream from Rainy Lake, the degradation encountered by the river as it flows downstream is caused principally by inflow from tributaries.
6. During the summer the following trends in the streams were observed:

   a. Increase in temperature.

   b. Decrease in dissolved oxygen (DO)

   c. Decrease in turbidity and suspended solids.

   d. Nitrates stayed at a fairly low level.

   e. Phosphates, both ortho and acid hydrolyzable remained fairly constant.

   f. Increase in alkalinity and conductivity.

Water Quality and Stream Channel Conditions

Water Quality

In the 1996 "Montana List of Waterbodies in Need of Total Maximum Daily Load (TMDL) Development" (Montana DEQ, http://www.deq.state.mt.us/ppa/mdm/303_d/303d_information.asp), 30 miles of stream in the Clearwater-Salmon HUC 5 were listed as Water Quality Limited Segments (WQLS). This includes Buck Creek located within the project area, and Deer Creek adjacent to the project area. Seeley Lake downstream of the project was listed as Water Quality Limited. The cold water fishery (trout) in Deer Creek, just outside of the project area, was considered threatened. Seeley Lake was partially supporting aquatic life and the cold water fishery (trout). For the 2006 303(d)/305(b) combined list, Seeley Lake fully support water quality beneficial uses, and Buck Creek within the project has insufficient information on support of beneficial uses. All other water bodies support beneficial uses.

Table 7. Excerpt of the 1996 303d listing of water quality limited stream segments and lakes in the Clearwater-Salmon fifth code HUC (Montana DEQ, 1996) in or adjacent to the project boundary.

Stream or Lake	Miles or acs	Probable Impaired Uses	Probable Use Support (Miles for streams, acres for lakes))				Trophic Level (Lakes only)	Probable Cause	Probable Source
			Fully	Threatened	Partial	Not Supporting			
Buck Creek	3	Cold water fishery-trout		3				Siltation	Silviculture
Seeley Lake	1048	Aquatic life support Cold water fishery-trout Swimmable	1048		1048 1048 1048		Moderate	Organic enrichment/ DO	Land development Silviculture

Waterbody Number = unique number assigned to the stream segment by MTDEQ
USGS Hydrologic Number = the fourth level Hydrologic Unit Code (HUC) assigned to the watershed to which the stream segment is tributary
Estimated Size = number of miles of stream segment length that is listed
Probable Impaired Uses = the beneficial uses of the stream segment which are impaired
Probable Use Support = miles of the stream segment whose beneficial uses are 1) fully supported, 2) threatened, 3) partially supported, or 4) not supported.
Fully = number of miles of the segment that are fully supporting the stream segment's beneficial uses
Threatened = number of miles of the segment whose beneficial uses are threatened
Partial = number of miles of the segment that are partially support the stream's beneficial uses
Not supporting = number of miles of the segment that are not supporting the stream's beneficial uses
Probable Cause = the most likely cause of the beneficial use impairments listed under "Probable Impaired Uses".
Probable Source = the most likely source of the beneficial use impairment cause

Threatened waterbodies "fully support their designated uses but there is reasonable expectation that a new activity in the watershed may result in partial or non-support of one or more uses unless proactive steps are taken". Water bodies that are partially supporting or not supporting their beneficial uses are considered to be impaired and failing to achieve compliance with water quality standards.

Water bodies were reassessed for beneficial use support and the 2006 303(d)/305(b) list was developed. However, Montana DEQ is operating under court order to address the impairments identified on the 1996 303(d) list. The 1996 303 (d) list is included here to display the water bodies for which Montana DEQ in partnership with the Forest Service must develop a TMDL Water Quality Restoration Plan, even though those bodies may not appear on more recent 303 (d) lists.

Table 8. Beneficial uses of water bodies in the project area.

Water body & Stream Description	Year	Aquatic Life	Coldwater Fishery	Drinking Water	Swimmable (Recreation)	Agriculture	Industry
Buck Creek	1996	P	T	F	F	F	F
	2006	I	I	I	I	I	I
Deer Creek	1996	F	T	F	F	F	F
	2006	F	P	F	F	F	F
N. Fork Placid Creek	F	F	F	F	F	F	F
	F	F	F	F	F	F	F
Seeley Lake	1996	P	P	P	F	F	F
	2006	F	F	F	F	F	F

F- Fully supporting, P- Partially supporting, T- Threatened, I- Insufficient information

Table 9. Probable causes and sources of the impaired beneficial use determinations for 1996 303(d) listed water bodies in the Jocko Lakes project watersheds.(MDEQ 2006). These water quality problems would be addressed in the Middle Blackfoot TMDL.

Water Body	Probable Causes	Probable Sources	Associated Beneficial Uses
Buck Creek)	Sedimentation/Siltation	-Channelization -Highways, Roads, Bridges, Infrastructure (New Construction) -Loss of Riparian Habitat -Streambank Modifications/destabilization	Aquatic Life and Cold Water Fishery
Deer Creek	Sedimentation/Siltation	-Forest Roads (Road Construction and Use) -Highway/Road/Bridge Runoff (Non-construction Related) -Highways, Roads, Bridges, Infrastructure (New Construction) -Loss of Riparian Habitat -Silviculture Activities	Aquatic Life and Cold Water Fishery
	Organic Enrichment	-Organic Residue Management - Past Silviculture Activities	Aquatic Life and Cold Water Fishery
Seeley Lake	Organic Enrichment	-Land development -Silviculture	Aquatic Life and Cold Water Fishery
	Dissolved Oxygen	-Land development -Silviculture	Aquatic Life and Cold Water Fishery

Water quality restoration planning and TMDL development for the Middle Blackfoot Basin River TMDL Planning Area has been ongoing since at least 2001 and is scheduled for completion in 2007-2009, although completion is expected in 2008.

Existing Road Surface Erosion

Sediment eroded from unpaved roads and delivered to stream channels at stream crossings or along road segments in close proximity to streams may impact water quality. A site-specific model was used to determine sediment production from road segments and delivery to streams at specific delivery points (stream crossings).

Recently DEQ measured and recorded WEPP road parameters at approximately 20 sites on Forest Service managed roads as part of hydrologic analysis of the Lolo National Forest 2007 DeBaugan Fuels Reduction Project to support St. Regis River watershed TMDL assessment efforts. These data are used for this analysis as the road characteristics for each project are similar. The mean annual sediment delivery contribution from surface erosion of roads per crossing was 0.53 tons based on the data collection and analysis conducted by DEQ. To estimate the existing conditions of sediment contribution from all roads on the Jocko Lakes project, this value was multiplied by the total estimated number of stream crossings (27) throughout the project watersheds (Table 10). Sediment can also be contributed where roads closely parallel streams, but these roads are not directly accounted for in this modeling effort.

Table 10. Estimated number of stream crossings and associated estimated annual sediment load and reduction due to BMP application treatments proposed in Alternative 3 for roads used for project activities. Some of these roads already have BMPs in place, so this estimate is high.

6th Code HUC Name	Estimated Number of Project Haul Road Stream Crossings	Existing Sediment Load (0.53 tons/year per crossing), No-Action Alt.	Sediment Reduction From Slash filter and BMP application Mod. Prop. Action Alt. (85% reduction)
Boles	0	0.0	**0.0**
Deer Cr (Clrwtr)	2	1.1	**.2**
Finley Slippery	22	11.7	**1.8**
N Fk Placid Cr		0.0	**0**
Seeley_Archibald	1	0.5	**.1**
Placid_Vaughn	3	1.6	**.2**
Totals	**28**	**14.9**	**2.2**

Stream Temperature

Stream temperature and other water quality and stream channel condition elements were analyzed in 2000 to address habitat concerns for bull trout and to establish a Watershed Baseline Condition for the Blackfoot River Section 7 Watershed (Prepared by Walch 2000). Usually stream temperature is highly dependent on canopy cover. Using this parameter the 2000 Watershed Baseline Condition Analysis found that eight HUCs are “Functioning at Risk” and the other six HUCs are “Functioning at an Unacceptable Risk”.

Data collected within the Clearwater River Watershed, in 1972, by the University of Oklahoma (Streebin et al. 1973) indicates that the Clearwater River increases in temperature as it progresses downstream. This data also records the lowest temperature in the Clearwater River at the inlet of Rainy Lake of 5.0º C during the month of May and the warmest at the outlet of Seeley Lake of 20º C during August. This study also collected temperature data in several tributaries to the Clearwater River. The stream temperature within these tributaries varies between 5.0º C and 18º C, with the exception of Owl Creek that varies between 8.0º C and 22.0º C.

In 1995 the Inland Native Fish Strategy (INFISH) amended the Lolo National Forest Plan and established a Riparian Management Objective for stream temperature of "Maximum water temperature below 15º C within adult holding habitat and below 9ºC within spawning and rearing habitats". The measurements taken during the Oklahoma study suggest that stream temperatures for the Clearwater River and some of tributaries do not meet this objective. Stream temperature data taken throughout the Lolo National Forest suggest that temperatures in this part of Montana may be naturally elevated, relative to the 15ºC INFISH temperature (Rosquist 1995).

Chemical Contamination/Nutrients

During the early 1970s the University of Oklahoma conducted studies that measured water quality throughout the Clearwater River Watershed (primarily upstream of the outlet of Seeley Lake). They used 14 chemical and physical parameters and 4 biological tests to assess water quality. In general their conclusions are as follows: Water quality generally is lowest during the early spring runoff, and improves throughout the summer as the groundwater flow to runoff flow ratio increases; there is a definite relationship between land use practices and water quality; water quality is more affected by logging practice than by the percentage of an area logged; the streams with the lowest water quality were Richmond and Deer Creeks and West Fork of the Clearwater River; the single important contribution to the pollution by the Clearwater itself is in the section of the river above Rainy Lake, which is badly eroding and depositing material into Rainy Lake; Seeley Cr. had about the same quality water as the other tributaries; no algal problems for the testing period existed for Rainy, Alva, Inez, or Seeley Lakes; Seeley Lake contained no fecal pollution in adjacent waters of the lake; Placid Lake has a serious algal problem with the presence of blue-green algae(*Aphanizomenon flos-aque*).

Streambank Condition

For streams in the project area streambank stability meets INFISH RMOs but is below that of its average reference condition. Most of the stream channel types within this EMA are classified as Rosgen "B" channel types, which have moderate entrenchment, width/depth ratios, and sinuosity (Rosgen 1996). These channel types generally have streambanks that are less susceptible to erosion. Pre-project stream surveys conducted in 2007 by the Lolo National Forest after the fire on Buck, Finley and Boles Creeks showed that stream banks were stable on these streams.

The 1995 INFISH Riparian Management Objective for streambank stability is to have greater than 80 percent of the stream with stable banks. Again using data from the Rice Ridge EMA analysis, bank stability varies from 96.1 to 100 percent. Qualitative data from field reviews completed in early 1970s and 1994 indicate sever bank erosion of the Clearwater River (above Rainy Lake). Reference data (for "B" channel types) indicates that streams of this size, type, and geology should have an average of 99.6 of their bank in a stable condition.

Watershed Improvement History

Road density, stream channel conditions and fish habitat on the Lolo National Forest have been improved in recent years through completion of numerous watershed improvement activities. Watershed improvement activities include road decommissioning, and culvert replacements.

Road Density

Roads and road density are often used as a coarse level descriptor of watershed characteristics and conditions. The roads network in the Project watersheds extends across all tributary watersheds. Roads in particular are identified as a source of sedimentation/siltation in Buck Creek and Deer Creek, a watershed adjacent to the project area, and have resulted in water quality impairment. Road density alone is not a good indicator of stream condition. Streams in the project area have very higher road densities, but fully support water quality beneficial uses (Montana DEQ 2006).

A multitude of research demonstrates that unpaved forest roads represent a source of sediment (USDA 2000, Burroughs and King, 1989). Sediment contributed from roads and delivered to streams can affect water quality, habitat, sediment transport regimes, and channel morphology.

Roads and road density may also impact water quantity. Research shows that roads interact with surface and subsurface flow of water over hillslopes. This interaction may affect the hydrologic response of a watershed, including the timing and magnitude of the hydrograph. Wemple and Jones (2003) found that depending on the nature of storm events, watershed characteristics, and road segment attributes, storm flow response may be more rapid and have greater peaks because of the interaction roads have on hillslope flow.

At least one commenter asked about the effects of the proposed project on roads and road density. Road density is defined as a ratio of the length of roads per unit area, usually reported in miles / mile^2. Road density is one measure used to assess the relative potential impacts of roads on water quality and water quantity. Road density is typically calculated using GIS layers of mapped roads and analysis areas. The analysis areas used for the hydrology assessment of the proposed Jocko Lakes project are sixth code HUC watersheds. The roads layer used represents roads as mapped and used for the TMDL assessment in 2008.

The 2000 Bull Trout baseline Section 7 Consultation study (USDA 2000) examined road-watershed and road-stream relationships by HUC 6 using spatial analysis of GIS data including road and stream layers. Among the parameters evaluated was road density (length of road per area of land). Road density provides a metric for the degree of “roadedness” or development in a watershed. Watersheds with a greater road density have decreased capability of supporting strong populations of key salmonids (USDA 1996). Road density for the Project watersheds and its tributary watersheds were evaluated.

Limitations-

There are several limitations of road density analysis and its implications. The accuracy of mapped roads is one limitation. Roads that are not mapped are not accounted for and result in lower road density numbers. Another limitation is that not all roads are equal. Roads that have grown in and have some level of natural recovery but are mapped may be represented as equal to open roads, when in fact partially recovered roads may have reduced impacts. Roads with higher slope positions, on ridgetops or away from streams are likely to have a much lesser impact on water quality than roads in valley bottoms, along streams and riparian areas, and roads that have stream crossings. Different road jurisdiction and management may correspond to different types and degrees of impacts also.

To address some of these limitations, other road measures may also be examined. Among the other parameters evaluated by USDA 2000 was the length of stream with roads within 300’ and 125’. Roads within these stream buffers impact sediment delivery potential and large woody debris recruitment potential, thus aquatic habitat.

The 300’ buffer was used based on a review of a large body of research on sediment delivery distances (Belt et al. 1992). The review concluded that sediment within 300’ of a water body has the potential to be delivered to the water body despite the presence of vegetation buffers. Roads are a source of sediment, and when constructed in riparian areas their proximity to a waterbody increases the likelihood of that sediment being delivered to the water body. Additionally, roads within 300’ of a stream generally hinder the attainment of the INFISH Riparian Management Objective, RMO, which partially delineates the Riparian Habitat Conservation Area (RHCA) with a 300’ buffer from perennial, fish-bearing streams (USDA 1995).

The 125’ buffer was used based on the average maximum height of the tree species most commonly found in riparian areas on the Lolo National Forest. Potential large woody debris recruitment is considered in terms of site potential tree height. In the region of the Lolo National Forest, mature trees within 125’ of a stream have the potential of falling into the stream, and thus being recruited as large woody debris. Roads within 125’ of streams preclude the growth of trees within the road template (often from top of cut slope to toe of the fill slope), decreasing the density of trees in the riparian area, and thus precluding the number of trees available for large woody debris recruitment and for stream shade.

The USDA Forest Service classified road density in examining the characteristics of aquatic/riparian ecosystems in the Columbia River Basin (CRB, 1996). Watersheds with greater than 4.7 mi/mi^2 have an “Extremely High” road density. “Very Low” road density is defined by 0.02 to 0.1 mi/mi^2.

The CRB study found that as road density in a watershed increases, the ability of the watershed to support strong populations of key salmonids is diminished. The effect is more pronounced when all land management types are considered, and less pronounced when only National Forest lands are considered. For all lands, about 8 percent of watersheds with “High” road density supported strong salmonids populations, whereas for National Forest lands, 22 percent of watersheds with “High” road density supported strong salmonids populations.

Table 11. Road density classification (USDA 1996).

Classification	Road Density (miles/mile^2)
Extremely High	> 4.7
High	1.7 - 4.7
Moderate	0.7 - 1.7
Low	0.1 - 0.7
Very Low	0.02 - 0.1

Road Density Existing Conditions-

Table 12. Jocko Lake s Salvage 6th Field HUC Characteristics, Clearwater River Basin

6th Field HUC Name	Total Square Miles	Total Stream Miles	Road Density (Mi/Mi$^{2)}$	% Stream with Road w/in 300’	% Stream with Road w/in 125’
Boles	19.7	37.3	3.9	15	7.1
Deer Cr (Clrwtr)	20.1	40.8	5.2	21.2	7.6
Finley Slippery	34	53.6	5	29.1	13.5
N Fk Placid Cr	16.9	40	5.4	20.9	8.6
Seeley_Archibald	30.9	57.6	5.1	23.8	9.5
Placid_Vaughn	21.2	33	5.3	21.1	9.7

GIS analysis of road density by HUC 6 reveals all of the Project watersheds have a “High” or “Extremely High” road density.

This indicates that watersheds like Finley Creek with relatively high percent of stream length encroached by roads are more likely to be affected by sediment and other road impacts whereas watersheds like Boles Creek are less likely to be affected by sediment and other road impacts.

Water Quantity / Yield

Change in Peak/Base Flow

The 2000 Watershed Baseline Condition Analysis used two parameters to measure this indicator. Road densities are used because roads can intercept shallow ground water and increase the rate of which it enters the stream, thereby, affecting the timing of peak flows. The second parameter used is percentage of the subwatershed that is in a regeneration harvest condition. Using these parameters through GIS, this study finds that all but one sixth field HUC is “Functioning at an Unacceptable Risk” for peak and baseflow changes. The other sixth field HUC is “Functioning at Risk”. Higher peak flows may be partially responsible for the increase in bank erosion. There is no INFISH RMO for this parameter. Please refer to the environmental effects section on water quantity and yield for additional details on the affected environment for water yield including baseline conditions.

Environmental Consequences

Road Density

Table 13. Changes in total road miles and road density between the no action and action alternatives. Numbers based on permanent road changes. Temporary and short-term specified roads for the action alternative would be decommissioned and slopes re-contoured after use.

	No Action Alternative (5)		Action Alternative (3)		
6th Code HUC Name	Existing Total Road Miles	Existing Road Density (miles/mile2)	Modified Proposed Action (Additional Road miles)	Resulting Road Density (miles/mile2)	Road Density Change (miles/mile2)
Boles	76.5	3.9	0	0	0
Deer Cr (Clrwtr)	105.7	5.2	0	0	0
Finley Slippery	171.3	5	-3.5	4.9	-0.1
N Fk Placid Cr	91.5	5.4	0	0	0
Seeley_Archibald	113.2	5.3	0	0	0
Placid_Vaughn	158.4	5.1	0	0	0

Alternative 5 – No Action Alternative

Direct, Indirect and Cumulative Effects

There would be no **direct, indirect, or cumulative** effects to road density associated with Alternative 5. Regulations and Forest Plan guides do not specifically restrict road lengths or road density.

Alternative 3 – Modified Proposed Action

Direct and Indirect Effects

Direct effects to road length and thus road density would occur as a result of the modified proposed action. A total of 10.7 miles of road would be decommissioned or stored (6.4 miles stored and 4.3 miles decommissioned). The effects of the action alternative to road density would include only slight changes. Other road changes are small and are not detectable in the road density calculation. Level 3 storage minimizes the impact of a road because runoff is decreased and infiltration is increased when the hardened road surface is ripped; this also reduces erosion of the road surface. Seeding and re-vegetation of the road surface under a Level 3 closure further slows runoff, increases infiltration and reduces erosion. Level 3 closures further reduce drainage problems because water-barring directs flow off the road, and pulling culverts and re-establishing streams and floodplains through crossings helps to restore hydrologic function of the watershed.

No new permanent long-term specified roads would be constructed. Four miles of temporary or short-term specified roads would be constructed but would have limited duration during the period of project implementation and would not affect **long term** road density because they would be recontoured to the original hillslope following use. Short term effects are anticipated to be 1-5 years depending on timing of construction and closure. Although a short-term spec road would be built within the Finley Creek RCHA, the 9974-2 road is between the stream and the proposed temp road and cuts off any source of sediment.

Regulations and Forest Plan guides do not specifically restrict road lengths or road density, therefore no mitigation applies strictly to changes in road length or density. However, regulations and Forest Plan guidance does apply to the effects of these changes, (**indirect** effects on water quality and water quantity), and are presented in separate sections below.

Cumulative Effects

Regardless of alternative, road density would remain relatively high throughout the project watersheds. Existing roads, particularly those located close to streams, would continue to impact water quality, stream condition, and watershed hydrology. The benefits of watershed improvements implemented in recent years would persist. Some examples of watershed improvement benefits include reduced erosion and sedimentation from roads, fewer road miles impacting watershed hydrology, fewer stream crossings impacting stream channels, improved fish passage and more available fish habitat. Road building related to development on private land and other ownerships may also continue to impact water quality, stream conditions, and watershed hydrology regardless of the alternative selected. Examples of impacts may include more stream crossings, more road miles, erosion and sediment from more roads, etc. No new system road construction is planned on Plum Creek lands or Montana DNRC Lands in conjunction with their salvaging of timber burned in the Jocko Lakes Fire.

Water Quality: Sediment

Temperature and habitat are also elements of water quality. These are discussed in the fisheries reports.

Methods and Rationale

For sediment to present a water quality concern it must be delivered to a stream. Those activities which would only disturb relatively small areas of soil, such as in hand piling or burning of hand piles, would not disturb sufficient areas of soil to produce significant volumes of sediment. The BAER post-fire analysis and Jocko Lakes Salvage soils report provide detailed information on burn severity and predicted affect on erosion based on land type associations for the burn area based on burn effects. Disturbed soil that does produce sediment which may be transported would not be delivered through the riparian habitat conservation areas (RHCAs; a.k.a. streamside buffer zones). Surveys of the fire area in fall 2007 have shown that grasses and herbaceous plants have begun to re-sprout and provide ground cover, mitigating erosion. For timber salvage operations, RHCAs would act as an effective buffer to eliminate sediment delivery to streams. Additional proper implementation of BMPs should “minimize or eliminate potential water quality effects" (Stednick Ch. 8 in Elliot and Audin 2006). Forest roads, landings, and skid trails pose the greatest risk of delivering sediment to streams, and are the focus of this sediment analysis.

Sediment eroded from the surface of forest roads, skid trails and other disturbed areas can be delivered to stream channels when roads and associated drainage structures carry flow and are interconnected with stream channels due to a lack of BMPs. It has been demonstrated that there is lower percentage of fine sediment in stream substrates in watersheds where roads have been decommissioned, where roads are not in use, and in roadless areas, when compared to roaded areas where roads are being used (McCaffery et al. 2007).

Sediment analysis included proposed harvest activity including landings, existing road surface erosion, proposed road construction, road maintenance work, increase in traffic levels from proposed activities and proposed road decommissioning and culvert replacements.

Harvest and road sediment was analyzed using modules of the WEPP (Water Erosion Prediction Project) model (Flanagan and Livingston 1995). Models simplify extremely complex physical systems and are developed from a limited database. Although specific quantitative values for sediment are generated from this model, it is important to note that the results are used as a tool in the interpretation of how real systems may respond. Therefore, the models' use is realistically limited to providing a means of comparison, not an absolute measure against verifiable standards.

Sediment production and delivery from roads was modeled for the Lolo National Forest using WEPP:Road. WEPP:Road (Elliot 1999) is a scientifically based model that predicts what sediment would enter stream courses, or drainages leading to stream courses, and is based on the WEPP (Water Erosion Prediction Project) model (Flanagan and Livingston 1995). The user enters site-specific inputs including climate; soil texture; percent rock content; road template design and condition; road surface gradient, length and width; road fill gradient and length; buffer gradient and length; road surface material; and traffic level. While the WEPP:Road model has not undergone direct validation, comparison of WEPP:Road-calculated outputs are within the range of local observed erosion rates and sediment distances.

The Wallace, Idaho climate file was the most proximal to and most closely resembles the climate of the Jocko Lakes Salvage Project area. Soil textures in the project area watersheds are generally various types of silt loams with high rock content. Input variables for the sample sites include road gradient, road width, fill gradient, fill length, buffer gradient, buffer length, spacing to the nearest cross-drain, road surface material type, traffic level, and road design templates. These variables were entered in to the WEPP:Road module interface and sediment erosion and delivery values were calculated.

Limitations-

WEPP predictions represent mean annual averages of sediment delivery produced by events based on the selected climate, road and site conditions. WEPP:Road predictions have been compared to and are generally within the range of actual field observations of sediment yields (USDA 2000). However, caution should be taken when applying model results, especially when selecting single values to apply to highly variable conditions.

Alternative 5 – No Action Alternative

Direct, Indirect and Cumulative Effects

The No Action alternative would have no **direct short-term or long-term** detrimental sediment effects to water quality. Roads would remain in their existing conditions. Project-related road maintenance work would not occur to existing roads and the proposed road decommissioning would not occur. There would be no sediment or water quality impacts from ground disturbing activities such as landings, tractor harvesting, new road construction and road reconstruction, increased haul traffic.

Indirectly, the existing road system would continue in the **short- and long-term** to risk sediment contribution to streams, currently modeled as 448.4 tons per year within the Project watersheds. Although old, infrequently used roads would continue to re-vegetate, reducing the amount of sediment produced and possibly contributed to streams, all of these old roads would continue to have varying degrees of impact to watershed hydrology and water quality. Stream channel and road fill scour, channel aggradation, and risk of sediment contribution from failure of undersized stream crossing would persist until otherwise addressed.

The No Action alternative would not likely contribute to **cumulative** sediment-related effects to water quality. Existing trends in water quality would likely be maintained.

No mitigation would be required under the no action alternative.

The No Action alternative is **consistent with Regulatory and Forest Plan** direction and would maintain existing watershed conditions.

Alternative 3 – Modified Proposed Action

Direct and Indirect Effects

Harvest

The primary source of sediment from harvesting is derived from ground disturbing activities, primarily summer dry season tractor harvest systems. Only one 21 acres unit would be harvested by summer tractor. Areas logged with tractor systems over snow would have much less disturbance. Ninety five percent of the acres salvaged would be with winter tractor yarding. In units logged with skyline logging systems, 77 acres, it is assumed there would be minimal to no ground disturbance. In these units, trees would be hand felled and activity timber salvage would be either lopped, scattered and burned, or would be hand piled and burned. Therefore, without ground disturbance from machinery it is assumed that sediment would not be generated from these units.

Harvest activity would not occur within INFISH buffers of 300’ of streams, therefore it is assumed that there would be no sediment delivery through these buffers. This assumption is based on an extensive review of research and monitoring and was the basis for establishment of the 300’ INFISH buffer requirement (USDA 1995). Recent monitoring in the Region gives further validation to this assumption (USDA 2006). Therefore the harvest proposed in Alternative 3 would have no measurable or detectable effect to sedimentation of streams.

Landings

Landings would not be constructed within the 300’ INFISH buffers; therefore it is assumed that there would be no sediment delivery through these buffers. This assumption is based on an extensive review of research and monitoring and was the basis for establishment of the 300' INFISH buffer requirement (USDA 1995). Recent monitoring in the Region gives further validation to this assumption (USDA 2006).

Short-term (2-5 years), sediment pulses generated from ground disturbance associated with construction or decommissioning of landings may occur. Because of the INFISH buffer requirements, any sediment generated during construction and decommissioning of landings would not be delivered to streams and therefore there would be no short-term sediment impact.

Table 14. Summary of modeled average annual sediment production from proposed landings. Landing acres based on 0.3 ac landings every 18 acres of treatment.

6th Code HUC Name	Number of Proposed Landings	Landing Acres	Sediment Delivery to Streams (tons/year)
Boles	3	1	0
Finley Slippery	82	25	0
N Fk Placid Cr	0	0	0
Seeley_Archibald	11	3	0
Placid_Vaughn	0	0	0

Road Construction and Maintenance

Proposed short term spec and temporary road construction would have minimal effects to water quality because it would occur primarily on mid- to upper slope and ridge top positions. A short-term specified road would be built through the RHCA along Finley Creek to access unit 28-1. An existing road (9974-2) currently bisects the RHCA and is located between the proposed short-term road and Finley Creek. With application of BMPs and additional mitigation measures, sediment contribution from stream crossings on temporary and maintained roads would be minimized.

For restoration activities, three undersized culverts would be restored by replacement with larger pipes suitable for fish passage and to accommodate larger streamflows and debris. Previous monitoring on the Lolo National Forest (Casselli et al. 1999) demonstrated that stream crossing removal/ replacement may generate 1-2 cubic yards of short-term sediment (1-2.5 tons) in runoff per 500 cubic yards of road fill volume involved. This contribution (up to 2.5 tons) would occur at installation and removal of this crossing providing no BMPs are installed during construction, however, with BMPs in place sediment would be reduced considerably. It is estimated that up to 5 tons of sediment could be contributed by these culvert removals/replacements over several years based on an estimate of 500 yards of fill material or less. Long term sediment production from the crossings would be reduced once the culvert is replaced, since it would be at much lower risk of failure. In addition, 1.2 miles of stream adjacent road near Buck Creek would be decommissioned in the Buck Creek drainage, considerably reducing risk of sediment delivery from that road segment. An additional 3.1 miles of road would be decommissioned and 6.4 miles would be stored for the project. Sediment reduction would result from closure and hydrologic stabilization of these roads, or from road decommissioning. Because these road segments would not be actively contributing sediment after treatment, it is estimated that the decommissioning and storage of 10.7 miles of road total would reduce sedimentation by over 5 tons annually. This is based on an estimate of 10 stream crossings on these road segments.

Road maintenance and reconstruction activities specified for roads 9974-2, 9975 and, 4367 would be conducted to bring roads up to standards prior to hauling. Road maintenance and reconstruction activities on all other haul roads will be completed as necessary and would be limited and intermittent. Activities would primarily include road blading/grading and cleaning out culverts as necessary before and after haul. Road maintenance improvements would be prioritized at stream crossings and along road segments paralleling streams. Road reconstruction would also include opening up and “grubbing” out vegetation from closed roads that would be used for the project and later placed into intermittent storage. A list of specific road BMPs and needed maintenance are provided in the Transportation Report. The highest priority needs, those with greatest impact to water quality would be addressed first.

Disturbance of the road bed material as a result of the blading normally results in a short-term increase in sediment (Luce and Black 1999). This increase typically subsides 60-80 percent within the first two years after blading (Luce and Black 2001, and Megahan 1974). In addition to road blading/grading, road maintenance work for the proposed action would also include cleaning out culverts, adding addition cross drains and adding slash filter windrows or other similar BMP practices at each stream crossing on haul routes. Effective implementation of such practices is expected to provide 85 percent or more sediment mitigation (Seyedbagheri 1996). As displayed in Table 10, this means by implementing Alternative 3, which includes slash filter windrows, sedimentation from existing stream crossings, estimated to be 14.9 tons/year, would be reduced by 12.7 tons/year down to 2.2 tons per year.

The proposed project would result in a total short-term increase in sediment to project streams as a result of road maintenance and haul traffic. This increase, while modeled to occur at the same time (for example, implementation of all project units and roads in the same year), would not likely occur all in the same year as the project would be implemented over several years in several phases. Likewise, the short-term sediment increase would occur in smaller increments over multiple years. The benefits of the road maintenance and BMP application would result in a decrease every year following implementation. Whereas the short-term increase would be a one-time occurrence, the long-term decrease from BMP upgrades would persist every year.

This analysis demonstrates that the proposed project would result in an average total short-term increase in sediment to project watersheds. This increase would not likely occur all in the same year as the project would be implemented over several years in several phases. Likewise, the short-term sediment increase would occur in smaller increments over multiple years. The benefits of BMP upgrades to roads, road decommissioning and culvert replacements would result in an overall decrease in sediment production every year following implementation. Whereas the short-term increase would be a one-time occurrence, the long-term increase would persist every year.

Cumulative Effects

For all alternatives, impacts from future ground disturbing activities are possible. Activities may include residential development, logging, roading, and fire. Other unforeseen events could combine with the past, present, proposed and foreseeable actions to create cumulative sediment-related effects that impact water quality. Past trends in water quality as identified in TMDL assessment work has identified that water quality in the Project watersheds such as Buck Creek has been impaired partly as result of sediment.

For the action alternative there may be indirect sediment effects from timber operations, although these effects may be more likely to occur with the No Action alternative than under the Proposed Action due to no additional culvert upgrades or BMP installation and upgrades. This effect may be exacerbated in watersheds with higher road density and water routing which would result in accelerated watershed responses.

Cumulatively, sediment produced from the proposed activities would combine with sediment produced from other activities such as roads, soil disturbing activities on private lands, etc. However, because the short-term increase associated with project implementation would last only a short time (2-5 years) and would be incremental, not occurring all at once, and because BMP practices and mitigation measures would be implemented effectively, the sediment impact would be limited as much as possible. The overall result would be beneficial, a long-term decrease in sediment in addition to long-term sediment decreases that have occurred watershed-wide as a result of watershed improvements including BMPs, road decommissioning, culvert removals and replacements and stream rehabilitation. The long-term benefit of increasing the amount and quality of available aquatic habitat would be greater than the short-term impact from achieving that benefit. Negatively the short-term increase would combine with other sediment impacts from private road and land development that are occurring but with no or less stringent land, soil and water conservation practice requirements (SMZ laws have much smaller buffers and apply only to commercial timber) than those required of the Forest Service (INFISH).

Mitigation and monitoring would be required as described in a later section.

The Proposed Action alternative, along with appropriate mitigation and monitoring, is **consistent with Regulatory and Forest Plan** direction and would maintain existing watershed conditions, and as modeled would result in an annual decrease in sediment effects to water quality compared to existing levels.

Water Quality: Channel Stability

Alternative 5 – No Action Alternative

There would be no **direct long term or short term** effects of the No Action alternative.

Indirectly, the presence of undersized culverts and their continued effects on stream channel stability at and near stream crossing would continue to be a resource concern.

Cumulatively, stream channel impacts may result from post-fire flow increases that may cause large pulses of sediment or water. There would be a greater likelihood of this occurring with the No Action alternative, since there would be no additional BMPs applied to the road system, and stream crossing culverts would not be upgraded.

There are **no conflicts with plans or policies** with this alternative and **no mitigation** would be necessary. Although the presence of undersized culverts and their continued effects on stream channel stability at and near stream crossing would continue to be a resource concern.

This alternative would meet Forest Plan and regulatory guidance related to stream channels.

Alternative 3

The salvage harvest portion of the Jocko Lakes Salvage project Action Alternative would not result in any negative, long-term **direct, indirect or cumulative** impacts to stream channels, since INFISH stream buffers would be applied. There would be **short-term** impacts related to actual removal and/or replacement of structures. However, the culvert replacements associated with BMP work and culvert removals associated with road decommissioning would have long-term benefits to stream channel stability by providing re-naturalized stream segments where culverts are removed and stream simulation where undersized crossings are replaced with structures that allow passage of water, material and aquatics organisms via natural stream processes and functions. **Standard mitigation measures, BMPs and**

aquatic organism passage (AOP) design criteria for Forest Service Region 1 stream crossings would ensure stream channel stability and function and AOP where structures are removed and/or replaced.

This alternative would meet **Forest Plan and regulatory guidance** related to stream channels. Stream channels would not be degraded, and where stream crossing culverts are removed or upgraded, stream channel stability would be improved.

Cumulative Effects

Stream channels in the Project watersheds have been affected by many different land uses and natural events. Currently, some stream channel segments are in need of restoration, some segments are recovering naturally, others have been resilient to both natural and human-caused disturbances. Regardless of the alternative selected, each of these scenarios would continue to exist in the Project watersheds.

Water Quantity/Water Yield

Methods and Rationale-

Methods for determining the effects of vegetation removal on water yield have been developed for the Lolo National Forest (Pfankuch 1973), and reviewed and refined for US Forest Service Region One (USDA 1978). The methods were developed for areas with snowmelt-dominated runoff. The equivalent clear-cut area (ECA) model is a key component of these methods. The basis of the ECA analysis is that water yield increases when vegetation is removed, whether by natural disturbance such as fire, or by human disturbance. The pre-fire ECA was used to determine the existing, baseline ECA and runoff values on Forest Service lands in the project area by watershed. The Timber Stand Management Recording System (RVAG) database for the Lolo National Forest was queried to obtain all records of documented timber harvest. USGS HUC 6 watersheds were used to delineate the tributary watersheds.

The model was then re-run to estimate canopy and run-off changes after the Jocko Lakes fire, and after timber salvage efforts are completed. Table 15 shows the results of this analysis.

Acres of vegetation removal from timber harvest, roads and fire are converted to ECAs to provide a common datum to compare activities based on the amount of cleared area. ECAs are calculated by summing the appropriate acreage, evaluating the percentage of crown removal then assigning a recovery value based on stand age. System roads are not recovered hydrologically and therefore are assigned a recovery value of zero. For timber harvest there is a continuum of recovery values as the stand ages.

Water yield increase is greatest immediately following vegetation removal. In years subsequent to vegetation removal, the ECA (and water yield increase) declines, or “recovers”, because of vegetation re-growth. The rate of re-growth and thus ECA recovery is based on evapotranspiration, snowfall accumulation related to patch dynamics, and the relationship between water yield and changes in vegetation interception. This re-growth relationship is expressed as a recovery curve.

Limitations-

There are limitations of ECA and water yield analysis. Removal of existing vegetation may demonstrate increases in water yield over existing conditions, however the ECA method does not account for the fact that fire suppression has resulted in overstocked forest conditions which may have actually been reducing water yield below “normal” levels. Therefore, the results as modeled for pre-fire conditions may actually over-estimate actual water yield increase. ECA analysis assumes that stands prior to harvest are fully stocked when in reality some stands at historic conditions were not fully stocked.

Also, this analysis does not account for effects of vegetation removal on other land ownerships, which is a known activity. And it does not weight estimates based on elevation and aspect which are known to influence water yield.

ECA analysis is a relative index of change that might occur, not an absolute result. It is used in combination with other information to determine the effects that the proposed activities may have.

Water yield increase values provided in this analysis are modeled approximations for the increase in runoff volume from vegetation removal. These values do not account for the effect the road system has on routing water and changes to the hydrograph. Although we did not model water yield impacts from roads, research has shown that such effects are real (Wemple and Jones 2003).

Alternative 5 – No Action Alternative

Direct and Indirect Effects

Under Alternative 5, timber salvage would not occur in the project area. Water yield increases caused by the Jocko Lakes fire, past timber harvest, roading, and other vegetation removal activities would continue to gradually diminish over time as vegetation continues to grow and mature. Water yield increases from existing roads would also remain the same, or diminish where closed roads continue to grow-in. Existing risk of forest fires and beetle infestations would remain or might increase as would the subsequent risk of future water yield increase from fire- and beetle-related vegetation loss. Post-fire modeled percent water yield increase from the project watersheds more than doubled while percent water yield increase in individual HUC 6 watersheds was up to 22 percent. Stream channels could experience minor instability due to increased water yield unrelated to salvage harvest effects. Where existing channel culverts are in-adequately sized such as the three culverts identified for replacement on Finley Creek, increased water yield from the Jocko Lakes fire could result in culvert failure.

Alternative 3 – Modified Proposed Action.

Direct and Indirect Effects

According to ECA analysis results, residual runoff for Forest Service lands on project watersheds before the fire was 5,441 acre-feet. Mean annual water yield for the Clearwater River based on USGS data collected at the gauging station is approximately 203,435 ac-ft/year. Flow data for the tributary watersheds is very limited. To obtain a water yield value for the tributary watersheds, mean annual water yield for the Clearwater River was distributed among the tributaries on an area-weighted basis. The area-weighted proportions of the Clearwater River mean annual runoff for each tributary watershed was used to calculate the percent water yield increase for each tributary.

Table 15. Predicted increase in water yield for baseline conditions before the fire and the year immediately after the fire for comparison of direct and indirect effects. ECAs generated by the fire were used to generate post-fire estimated flow increases.

Watershed	Watershed Area (ac)	Baseline Water Yield (ac-ft)	Pre-fire Harvest and Roads ECA, Forest Service only (ac, %)		Post-fire ECA as a result of the Fire only (ac)	Post-Fire Water Yield Increase as of 2008 (% total increase)	Post-Project Water Yield Increase from Mod. Proposed Action (% total increase)
Boles Ck	12,604	23,716	2,359	19%	1,293	3	0
Deer Ck	12,893	10,463	710	5%	724	4	0
Finley-Slippery Cks	21,789	26,354	1,740	8%	9,529	22	0
N Fk Placid Ck	10,852	2,817	748	7%	3,158	8	0
Placid-Vaughn Cks	13,577	10,301	526	4%	85	0	0
Seeley-Archibald Cks	19,752	12,633	3,826	19%	619	3	0

An increase in ECAs of 30 percent or more could potentially result in water yield increases that would exceed Forest Plan Standards. As reported below, both existing ECA and ECA with the addition of the proposed activities are well below 30 percent.

Percent canopy removal in the salvage units of the Modified Proposed Action is estimated to be close to zero percent on average. The focus of the Jocko Lakes salvage project is to salvage dead trees and leave live trees on site. The trees to be removed are dead, or have a low probability of surviving, so they would not influence water yield appreciably, and would not affect the total evapotranspiration, and change water yield. Because there is no measurable changes in evapotranspiration anticipate from the harvest of dead and dying trees, the high post-fire water yields are not predicted to change measurably from the proposed salvage harvest. The increased water yields generated from the fire would far exceed water yield effects from the proposed salvage harvest.

Table 15 displays the Equivalent Clearcut Acres calculated for the past activities combined with proposed activities and the fire. No additional ECAs would be generated by the proposed action.

ECA analysis suggests the proposed activities would have no detrimental direct or indirect effects on water yields. A recent comprehensive review of literature and research on the effects of vegetation removal on water yield concludes that >20 percent basal area must be removed before and significant change in flow can be detected, although insignificant increases may occur at levels less than 20 percent basal area removal (Troendle, MacDonald and Luce Ch. 7 in Elliot and Audin 2006).

Under Alternative 3, the proposed treatments would produce no additional ECAs in the Project watersheds. Using the “ECA greater than, or equal to 30 percent” criterion as an indicator of watersheds that have a high potential for hydrologic alteration due to existing conditions, none of the project area watersheds either individually or collectively would be at risk of impacts from increased water yield from the proposed activities. While the amount of runoff and water yield may increase as a result of the proposed activities, the effect would not likely be measurable. Effects to stream channels from increased water yield are not anticipated. Therefore the project would not affect the magnitude, timing, duration of flows or sediment transport beyond the existing conditions.

Cumulative Effects

Documented timber harvest on the National Forest in the Project watersheds began in the 1960s. Harvest activity increased in the 1970s, and peaked in the 1980s and early 1990s, and has diminished in the past decade. Harvest before the 1960s is not well documented or is undocumented. The impacts of vegetation loss from the Jocko Lakes fire in many of the project tributary drainages have the potential for large geomorphic effects compared to the water yield impacts from timber harvest history on the National Forest. Timber harvest on National Forest never has historically exceeded the 20-30 percent basal area removal or 30 percent crown removal on a HUC 6 watershed basis. All timber harvest on National Forest land has occurred on a much smaller scale compared to historical levels in recent years.

Results in Table 16 indicate that current ECA condition for each of the project area watersheds is well below 30 percent, with a range of 3 percent to 22 percent. Percent water yield increase from project activities is near 0 percent and un-measurable, well below the stated Forest Plan Standard of threshold value of 10 percent.

Table 16. Summary of existing and predicted water yield and ECA increase as a result of the fire and Jocko Lakes project for the Clearwater Basin for cumulative watershed effects.

Clearwater Basin Area (ac)	220,600
Baseline Pre-project Water Yield, Clearwater Basin (ac-ft)	203,435
Pre-fire ECA, Harvest and Roads, Forest Service lands only (ac)	9,909
Pre-fire Water Yield, Fire Watersheds (ac-ft)	5,441
Post-fire ECA as a result of the Fire (ac)	15,408
Post-fire Water Yield Increase as a result of the Fire (ac-ft)	8,730
Post-project Water Yield Increase as a result of Proposed Action (ac-ft)	0
Clearwater Basin Percent Water Yield Increase as a result of the Fire (%)	4

High severity fires in the project watersheds are not unusual or unnatural. Still, streams within heavily burned drainages recover over time; otherwise watershed effects due to a large fire at some period in history would permanently impact most streams. However, the effects of past fires on channel morphology may persist today, in part due to activities that have further reduced and in many cases continue to reduce the stability of vulnerable streams channels attempting to recover from fire-induced water yield impacts. These activities include stream encroachment, alteration by development of transportation corridors, and other activities such as timber harvest, particularly timber harvest or other clearing within riparian areas which has been observed on private ownerships.

For both alternatives, water yield increase from the Jocko Lakes fire would continue to gradually diminish over time as vegetation re-grows. The degree of these cumulative effects as modeled for most watersheds is above forest plan water yield increase thresholds. In the future, water yield will decrease as a result of vegetation re-growth. Unforeseen events (e.g. more large wildfires) could combine with the past, proposed and foreseeable actions to create cumulative effects that would exceed water yield thresholds. Water yield has been and will likely be impacted by other factors (decreased by increased forest density and increased by tree mortality).

Regulatory and Forest Plan Consistency

The Lolo Forest Plan, states "Timber harvest will not create runoff increases likely to result in channel degradation" and human-caused water yields will be limited so that channel damage will not occur as a result of land management activities" (Lolo National Forest Plan Pgs. II-71 & II-12,1986). Also, “The maximum increase over normal yield that considers soil and channel protection is estimated to be ten percent on streams with a good or better channel stability rating, and eight percent for streams with fair stability rating” (Lolo National Forest Plan, Pg. VI-30, 1986). Although the Forest Plan Standard is more restrictive, drawing on references from more recent and the best available science cited above, as a general rule, an increase in ECAs greater than 30 percent (Troendle et al. 2007) could potentially create water yields in excess of Forest Plan Standards. Because individual and cumulative ECAs are much less than 30 percent from the effects of the project and the proposed activities would not result in any measurable or significant water yield increase, the direct, indirect, and cumulative effects as modeled for all alternatives are consistent with the Forest Plan with regard to runoff and water yield.

Cumulative Effects Considered- Past, Present, and Reasonably Foreseeable Activities

Past, present and reasonably foreseeable activities in the project area , including timber harvest, are considered in the Cumulative Watershed Effects Worksheet analysis (Attached). This information was collected from the Forest’s activities layers and project planning documentation contained on the Seeley Lake Ranger District.

Management Requirements and Mitigation Measures

Streams in the project area are supporting or have insufficient information to establish support for beneficial uses rather than threatened or not supporting. Therefore, management requirements and mitigation measures are included, to at least maintain and in some elements such as sedimentation, improve current watershed conditions. Implementation of "all reasonable land, soil and water conservation practices" is a requirement of this project and would help mitigate projected effects.

To be in compliance with the State of Montana water quality and Lolo National Forest Plan standards, the Lolo National Forest must ensure all activities would result in full protection of water resources and designated beneficial uses. This would be accomplished through the application of Best Management Practices and other protective measures that would reduce the amount of erosion created from ground disturbing activities and would reduce the amount of sediment being transported to project area streams.

Specifically, Alternative 3 would meet all applicable standards because all of the following mitigation measures, BMP upgrades and other requirements would be implemented effectively. Measures on roads 9974-2, 9975, and 4367 would be applied prior to project activities.

Following is a summary list of management requirements and required mitigation measures to be implemented:

1. Montana Best Management Practices for Forestry would be met as a minimum, including provisions of the Streamside Management Zone Law. All activities would comply with Lolo NF Best Management Practices. MT DNRC approval would be requested if variances to Montana BMPs are needed.

2. Montana Streamside Protection Act (SPA) 124 Permits would be obtained for any activity that would disturb stream channels. U.S. Army Corps of Engineers 404/401 Permits would be obtained for any activities involving stream channels and/or wetlands.

3. Boundaries of wetlands and RHCAs would be designated prior to activities to exclude ground-based equipment and other activities.

4. Erosion control measures (straw bales, wattles, silt fences, hydro mulching, etc.) would be where necessary and remain in place before and during ground disturbing activities. To ensure effectiveness, erosion control measures would remain in place and functional until disturbed sites (roads, culverts, landings, etc.) are stabilized, typically for a minimum period of one growing season after ground disturbing activity occurs. This would require regular inspection and may require maintenance. Additional inspections and maintenance would occur following high rainfall events and prior to fall and spring runoff to ensure their effectiveness.

5. Prior to timber haul, all BMP and reasonable Soil and Water Conservation Practices designed to control surface drainage from roads would be in place on the following road segments and would be maintained to ensure functionality. All BMPs would be inspected by a hydrologist or fisheries biologist at the end of each operating season to assure their ability to protect water quality during spring snowmelt runoff season.

   Specific BMPs include:

   - 9974-2: Proposed BMP work includes slash filter windrows at stream crossings.
   - 9975: Proposed BMP work includes: riprap at culvert inlets/outlets, reconditioning 0.89 miles of road, cleaning of 1 CMP, 75 feet of berms and 50 feet of slash filter windrows.
   - 4367: Proposed BMP work includes replacing 2 culverts, 40 feet of ditch construction, 12 drain dips, riprap at culvert inlets/outlets, a rock buttress, reconditioning 2 miles of road, narrowing 195 feet of road, cleaning 5 CMPs, installing 154 feet of open-top drainage structures, and 260 feet of filter slash windrows.

   Additional maintenance – not included in BMP include:

   - 9975: Brushing 0.89 miles
   - 4367: Brushing 2 miles

   All other appropriate BMP measures will be implemented as needed.

6. Slash filter windrows would be applied to all stream crossings on haul routes BEFORE blading, haul and other project activities are to occur in order to mitigate 85 percent or more of the effects of road blading and increased sediment from haul traffic. Slash filter windrows will be maintained during and after haul to ensure effectiveness.

7. Slash filter windrows would be placed on relief culvert outlets that are within 300 feet of a waterway.

8. Fish biologist or hydrologist would be notified of all stream culvert removals during road decommissioning and of all stream crossing replacements to ensure appropriate alignment and reshaping of the stream channel, bankfull width, floodplain, step-pools and grade control structures, transplants, etc.

9. Special mitigation measures are required in units with localized wet areas and intermittent stream channels. For these areas, 150’ buffer around the wet areas and streams would be required. Other BMPs for operating around wet areas would also be necessary.

10. Stream crossings structures, if needed for the short-term specified road would be sized appropriately to meet or exceed natural bankfull channel widths and would be up to BMP

standards. Work would be conducted during dry conditions, either naturally or via a clear water diversion to further minimize sediment impacts, and other appropriate construction BMPs would also be applied.

11. If winter hauling is to occur, snow drainage holes (areas where drainage can flow through road-side snow berms and off the snow-packed road surface) will be designated prior to winter haul, and kept open throughout the duration of winter hauling

12. On temporary roads, sediment buffering devices such as slash filter windrows would be installed below all fill slopes within 300 feet of streams or drainage crossings.

13. All temporary roads would be ripped, recontoured, seeded, mulched and cover added within one season of completion of purchaser's use.

14. Coarse woody debris would be kept on site to meet objectives for long term soil productivity as specified within "Lolo National Forest Down Woody Material Guide", 2006 (USDA 2006).

15. Slash would be scattered on all disturbed, scarified and ripped surfaces: skid trails, landings, decommissioned roads, etc.

16. Ground based activities would be restricted to a dry operating season generally between June 15 and September 15. Ground based winter activities would follow identified BMP direction for activities during snow cover and/or frozen ground conditions. Operations outside of the specified conditions may occur only on a case-by-case basis following consultation with Forest Hydrologist and/or Soil Scientist.

17. Tractor and/or skidder yarding would be limited to those areas with slopes less than 35 percent with the exception of short pitches up to 50 percent in consultation with the soils scientist..

18. As soon as possible following the completion of harvest operation or slash disposal/burning (whichever occurs last), not to exceed one year, landing would be recontoured to the original surface contour, ripped, seeded with an approved Lolo native seed mix, mulched, and covered with woody debris.

19. Following burning, burn pile areas would be ripped (if necessary), seeded, mulched, and covered with woody debris, as with landing areas.

20. Skid trails would be water barred, slash would be scattered across their surfaces and where appropriate, ripped, seeded, and mulched.

21. Mitigation measures 11.1 through 11.10 listed in Appendix D of the Lolo National Forest Noxious Weed Management EIS (1991) would be followed to minimize potential effects of herbicides to water quality.

Recommended measures:

1. Dust abatement such as MgCl, while not required, is highly recommended for road segments adjacent to streams and at major stream crossings in order to reduce the impact of dust on water quality and to reduce wear and tear and road maintenance needs.

Effectiveness of Mitigation Measures and BMPs

Effectiveness of Best Management Practices and mitigations measures have been investigated in research studies and monitored by the Lolo National Forest as well as by the State of Montana. These studies and evaluations demonstrate that BMPs and mitigation measures can, in general, be effective at preventing erosion and sedimentation and have specifically been implemented effectively by the Lolo National Forest specifically as well as by the US Forest Service in Montana. Results of these studies and evaluations are summarized below.

General BMP Monitoring Results

Studies have proven that the specified erosion control measures are effective. Actual effectiveness depends on site conditions (steeper slopes and higher silt content lead to lower effectiveness) and on actual implementation methods. Both Burroughs (1990) and Burroughs and King (1989) stress the need to install protection measures as soon as possible after construction since most material is eroded in the first few years after construction: About half of the total fillslope sediment production measured over two years in one study took place in the first summer and fall after construction. Therefore, measures that are put in place immediately after construction have a greater chance of reducing sediment production when compared with measures that are installed later. Table 17 shows the effectiveness of selected BMPs in reducing erosion. Some of these measures would be used to reduce erosion on landings, skid trails, and/or roads in the Jocko Lakes Salvage Project.

Table 17. Effectiveness of erosion control measures (Seyedbagheri 1996)

Measure	Effectiveness
Straw mulch	32-47% reduction in erosion
Dense (grass) cover	99.5% reduction in erosion
Filter windrows	87-99% retention of eroded material
Hydromulch, seed, fertilize	71% effectiveness
Straw, crimp, netting	93% effectiveness
Excelsior mats	75% on 1:1 cutslopes, 60% on 0.75:1 cutslopes

Reducing the amount of displaced material that actually reaches stream channels is the second important aspect of reducing sediment delivery from roads, after reducing erosion. As cited in Seyedbagheri (1996), Haupt (1959) found that “slope obstruction index” (indicator of amount of logs, vegetation, etc. on slopes below roads that would slow surface runoff) was the variable most highly correlated with sediment transport distance. (Seyedbagheri 1996) Other authors also acknowledge the importance of slope obstructions in reducing sediment transport distances (Ketcheson and Megahan 1996).

Roads that are to remain open to use generally have the impacts described previously on water resources. Mitigation measures and best practices for roads, including proper culvert sizing and placement, relocating roads, and limiting road gradients, can reduce these impacts. Effects may also be offset by implementation of mitigation measures to reduce the amount of sediment produced by various road features (cutslopes, fillslopes, ditches, relief culverts, road beds) and by reducing the amount of material that actually reaches channels.

Further examples of erosion reduction from selected road treatments are shown below (from Burroughs 1990; Burroughs and King 1989):

Table 18. Examples of the effectiveness of erosion control measures on roads (Burroughs 1990, Burroughs and King 1989)

Measure	Effectiveness
Seasonal road closure when roads are wet	Reduces rutting; trials showed ruts increase sediment production by 2.1 times over an unrutted road.
Surfacing (trials used a 4-inch layer of 1.5-inch minus rock). Need at least 4 inches of gravel for notable decrease in sediment production.	Reduction in sediment production by 79% compared to unsurfaced condition. 6" of 1.5-inch minus gravel reduced sediment production by 70-92%, in several studies.
Erosion mats on cutslopes	Sediment reduction of 95% on 1:1 slopes (gneiss and schist parent material)

Lolo National Forest BMP Monitoring Results

The Lolo National Forest has evaluated the implementation and effectiveness of BMPs in a number of case studies. The evaluation results demonstrate that these measures are effective at reducing sediment impacts that might otherwise occur without the use of BMPs. (USDA 2002). Several of the case study evaluations were for the Northside timber sale and reflect the BMP effectiveness likely to be achieved for proposed activities of the Jocko Lakes Fire Salvage Project. Effective BMP implementation evaluated in the Northside timber sale include: Re-vegetation of Surface Disturbed Areas (13.04), Using Sale Area Maps to Designate Soil and Water Protection Needs (14.03), Protection of Unstable Areas (14.05), Log Landing Erosion Prevention and Control (14.11), Erosion Prevention and Control Measures during Timber Sale Operations (14.12). Results of other BMP evaluations across the Lolo National Forest further demonstrate the effectiveness of BMPs on protecting soil and water resources.

Montana DNRC 2006 BMP Audit Results

In addition, the Forest Service has cooperated with Montana DNRC and other land managers to monitor the implementation and effectiveness of Forestry BMPs on recent forest management activities. This effort is known as BMP auditing and results are provided in an annual report.

For implementation auditing in 2006, 93 percent out of 173 Federal practices evaluated application met or exceeded Montana Forestry BMP standards (DNRC 2006). Federal practices evaluated in 2006 consisted of four Forest Service sties, none of which occurred on the Lolo National Forest, and one BLM site. Of the 173 practices evaluated, 6 percent of the applications rated as minor departures, 1 percent was rated as a major departure, and 0 percent was rated as gross neglect. Across all ownerships (DNRC, Federal, Industrial and Non-industrial/Private), BMP applications were met or exceeded 96 percent out of 1,603 evaluated practices, 4 percent rated as minor departures, less than 1 percent rated as major departures, and 0 percent rated as gross neglect.

For effectiveness auditing in 2006, out of 175 Federal practices rated, 95 percent provided adequate protection, 2 percent had minor/temporary impacts, 2 percent had major/temporary/prolonged impacts and 0 percent had major/prolonged impacts. Across all ownerships, 97 percent of practices provided effective protections, 2 percent had minor/temporary impacts, <1 percent had major/temporary/prolonged impacts and <1 percent had major/prolonged impacts.

Jocko Lakes Salvage Project
Monitoring for Water and Fisheries Resources

Implementation and effectiveness monitoring for all timber work, road construction and reconstruction, decommissioning, BMP road work, and RHCA buffers is required (as agreed by District Ranger). The intent of such monitoring would be to ensure protection of water quality as intended by the effective implementation of BMP practices and RHCA buffers. The following activities will be monitored in accordance with the two tables below: road and timber BMPs, Riparian Habitat Conservation Area buffers, road decommissioning, and road-stream crossing improvements.

If monitoring finds that a practice(s) could adversely affect water quality and continued activity could lead to degraded beneficial uses then a modification to remedy the practice would be required. Monitoring would be conducted by hydrology and/or fisheries staff or seasonal crews as directed and supervised by hydrology, fisheries, engineering, and/or timber staff. If desired this monitoring could also be conducted by seasonal engineering or timber crews. Monitoring results, any necessary corrective measures, and results of corrective measures would be documented and reported in accordance with the Forest's Environmental Management System.

Road Implementation and Effectiveness Monitoring	
District:	Seeley Lake
Project Name:	Jock Lakes Salvage Project
Site Location:	Project road activities: BMPs, crossing replacements, and decommissioning
Monitoring Objective:	Determine if road maintenance and road BMP measures were implemented and to determine their effectiveness. Include culvert replacements.
Monitoring Type:	Implementation and effectiveness
Methodology:	BMPs: Evaluate several examples (4-5) of each type of BMP (several cross drains, several slash filter wind rows, several catch basins, etc). Crossing Replacements: Use Forest Xing Monitoring Protocol Decommissioning: review the most major stream crossing and assess one representative road section from each closure level. Observe if decommissioning was accomplished and if so, was it completed to the intended level standard. Assumes that if decommissioning was implemented to the appropriate level according to definitions/level standards then the decommissioning should meet the intent of and be effective at that designated level.
Frequency/Duration:	Monitor once post-project
Data Storage:	Photos, data sheets, reports will be stored in "aquatics" area.
Report:	Summary report including monitoring methods, data, maps, photos, summary and recommendations.
Funding Source:	Project funds (NFTM/WFHF)
Projected Costs:	$840 = $140/day for GS-5 tech. * 2 techs. * 3 days * 1 years
Personnel Needed:	2 GS-5 Hydrology technicians
Responsible Individual:	Forest Hydrologist
Prepared By:	Traci Sylte
Date Prepared:	9/5/08

Erosion Control – Buffers, Units, Landings Implementation &Effectiveness Monitoring	
District:	Seeley Lake
Project Name:	Jock Lakes Salvage Project
Site Location:	Project timber management activities: buffers, units, landings, temp. roads, skidding trails
Monitoring Objective:	Determine if timber BMP and InFish buffers were implemented and if determine effectiveness.
Monitoring Type:	Implementation and effectiveness
Methodology:	Units, landings, temporary roads, skid trails: determine if erosion control measures are effective and Montana timber BMPs have been addressed RHCAs: Visit units with streams and measure buffers with a tape and visually inspect for evidence of implementation and effectiveness.
Frequency/Duration:	Monitor once post-project
Data Storage:	Photos, data sheets, reports will be stored in "aquatics" area.
Report:	Summary report including monitoring methods, data, maps, photos, summary and recommendations.
Funding Source:	Project funds (NFTM/WFHF)
Projected Costs:	$280 = $140/day for GS-5 tech. * 2 techs. * 1 days * 1 years
Personnel Needed:	2 GS-5 Hydrology technicians
Responsible Individual:	Forest Hydrologist
Prepared By:	Traci Sylte
Date Prepared:	9/5/08

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Jocko Lakes Post-Fire Project
Hydrology
Cumulative Effects Worksheet

Cumulative impacts result when the effects of an action are added to or interact with other effects in a particular place and within a particular time. It is the combination of these effects, and any resulting environmental degradation, that should be the focus of cumulative impact analysis. While impacts can be differentiated by direct, indirect, and cumulative, the concept of cumulative impacts takes into account all disturbances since cumulative impacts result in the compounding of the effects of all actions over time.

1. **Description of the affected area for the cumulative effects analysis.**

a. Spatial bounds:

- A portion of the Clearwater River drainage Basin is the spatial bounds of the Jocko Lakes salvage. It includes the N. Fk. Placid Creek, Finely-Slippery, and Boles Creek 6th field watersheds.
- Why was this area selected? - Placid Creek and tributaries drain into Placid Lake, and Archibald Creek and tributaries drain into Seeley Lake. The Clearwater River flows through Seeley Lake, and Placid Creek drains into the Clearwater river downstream of the project. It is for these overwhelming reasons that the Cumulative effects of the action alternative for the modified proposed action that the Cumulative Effects analysis for the water resource is bounded by the drainage system of the Clearwater River basin.

As stated with the No Action alternative, all past, present and foreseeable activities within the project watersheds drainage were considered for the potential cumulative effects with and without the salvage harvest. The preponderance of evidence this analysis indicates that the Jocko Lakes fire itself has had the largest potential for effects to the water resource in the past 50 years of recorded history and in the reasonably foreseeable future. These potential effects have not been witnessed or recorded to date, but when compared to the environmentally sensitive implementation of the proposed salvage the cumulative effects will not be measurable.

b. Temporal bounds

The temporal bounds of the proposed activities will last, either singly or in combination with other anticipated effects is 10 to 20 years, depending on what component of the aquatic resource that is considered. See “Temporal Bounds” description above in the specialist report.

2. **The following is a list of all potential past, present, and reasonably foreseeable actions that may affect the water resource, and other resources analyzed for the Jocko Lakes proposal.**

Identification of Cumulative Actions

Cumulative Actions - Actions, which when view with past, present, and/or reasonably foreseeable actions, contribute to cumulative effects for WATER resources(s).

Refer to the Project File for additional information on the actions described below.

Table 19. Hydrology Cumulative Effects Summary by Ownership. Actions spanning each column are relevant to past, present and reasonably foreseeable actions.

Actions on All Ownerships	Past	Present (Spring 2008 – Spring 2009)	Reasonably Foreseeable
Wildland Fire	Wildland fires were historically a major disturbance factor throughout history on the Seeley Lake Ranger District. Within the Jocko Lakes Fire perimeter three relatively recent fires have occurred.	None	It is reasonable to assume wildland fire may occur in the area in the future.
Hydrologic Impacts	**Past fires have increased water yield, increased road impacts on sediment production and runoff.**	**Water yield has increased 3-22% in project watersheds.**	**Future fires will increase water yield, increase road impacts on sediment production and runoff.**
Wildland Fire Suppression	Beginning with the Fire Control Policy of 1935, the Forest Service procedure has been to suppress forest fires as quickly as possible. Suppression efforts for the Jocko Fire included 79 miles of dozer line.	Suppression of wildland fires, as appropriate will continue	Suppression of wildland fires, as appropriate will continue. Wildland fire use may expand, where resource objectives can be met, in the future.
Hydrologic Impacts	**Fire suppression has short term impacts on sediment production but ground disturbance from suppression such as fire lines were repaired as soon as possible after the fire, so cumulative effect is low. Earlier fires may not have had effective suppression rehab.**	**Suppression rehabilitation is complete, no on-going effects observed for Jocko Lakes fire.**	**Future fires in the Jocko Lakes watersheds will require suppression activities, but expect effects to be low. Light on the land suppression techniques observed.**
Hunting, Trapping, Predator and Beaver Control	Hunting has been a popular use of National Forest System land and other ownerships. Trapping of beavers and destruction of their dams occurred has occurred on all ownerships.	Hunting and trapping will continue. A limited amount of coyote and beaver population control may be occurring.	Hunting and trapping will continue. A limited amount of coyote and beaver population control may take place in the future, particularly on and near private property.
Hydrologic Impacts	**Reducing or eliminating beavers has changed valley hydrology by capturing/infiltrating less streamflow, not catching and storing stream sediments behind dams, and changing riparian shrub communities**	**Reducing or eliminating beavers is changing valley hydrology by capturing/infiltrating less streamflow, not catching and storing stream sediments behind dams, and changing riparian shrub communities**	**Present effects will continue.**

Actions on All Ownerships	Past	Present (Spring 2008 – Spring 2009)	Reasonably Foreseeable
Firewood and Other Miscellaneous Forest Product Gathering	Firewood gathering has occurred in the area. Other products gathered in small quantities include post and poles, berries, and Christmas trees.	Gathering will continue.	Will continue. Higher than historic energy costs may increase the public's desire to obtain firewood.
Hydrologic Impacts	**Minor impacts on hydrology, likely un-measurable, except for off-road vehicle use in sensitive areas.**		
Mushroom Harvest	Past personal use mushroom harvest likely occurred on all ownerships after past fires.	Fee commercial harvest permits will be issued by the USFS in a designated portion of NFS Land in the Jocko fire perimeter to harvest mushrooms.	
Hydrologic Impacts	**No hydrologic impact**		
Snowmobiling	This area has a number of popular snowmobile trails including groomed routes.	Use will continue.	Use will continue.
Hydrologic Impacts	**No hydrologic impact**		
Driving	Driving, sightseeing, and wildlife viewing on open Forest and private roads have occurred.	Use will continue.	Use will continue.
Hydrologic Impacts	**No hydrologic impact**		
Road Maintenance and BMPs	Roads on all ownerships have been maintained for use either by all users or for just the individual landowners. Roads used for the transport of forest products are generally maintained to meet Montana Best Management Practices (BMP). Road work to improve surface drainage, stabilize slopes, and reduce erosion and stream sedimentation has occurred.	Will continue.	Will continue.
Hydrologic Impacts	**Road maintenance can increase short term sediment, but improve conditions long-term- BMPs decrease likelihood of sedimentation from roads and other activities. BMPs have been employed since the 1980s- before that, impacts were higher from road-derived sediment.**	**Road maintenance can increase short term sediment, but improve conditions long-term- BMPs decrease likelihood of sedimentation from roads and other activities.**	**BMPs will continue to be employed, and will continue to reduce the production of sediment from Jocko Lakes watersheds.**
Hiking trails	Boles Creek trail was maintained in 1993. The trail is probably used mostly by hunters.	Use will continue.	Use will continue.
Hydrologic Impacts	**Little hydrologic impact with application of BMPs.**		

Actions on All Ownerships	Past	Present (Spring 2008 – Spring 2009)	Reasonably Foreseeable
Power line & Substation	Northwestern Energy has easements and maintains a 230 KV line 100 feet wide across multiple ownerships. There is a substation near the mouth of Finley Creek.	Will continue.	Will continue.
Hydrologic Impacts	**Little hydrologic impact with application of BMPs.**		
Grazing	There are no Forest Service grazing leases in this area; however, the area has traditionally received grazing use on state land (Section 16) and what were Champion (now Plum Creek) lands. Because of intermingled lands, grazing trespass on Forest Service land has occurred.	May continue.	May continue.
Hydrologic Impacts	**Very little impact since no allotments- trespass grazing will have little hydrologic impact.**		

Actions on National Forest System Land Only	Past	Present (Spring 2008 – Spring 2009)	Reasonably Foreseeable
Implementation of Burned Area Emergency Stabilization & Rehabilitation (BAER)	BAER activities in the Jocko Lakes post-fire environment were initiated immediately after the suppression efforts. Due to weather (snow) some of the BAER work could not be completed. Please refer to project file for a description of activities. Specific activities that either occurred last fall or will occur before spring 2009 include: 9 miles of handline restored to infiltrate precipitation; 60 miles of dozer line berms pulled back, logs, topsoil, and organic matter put on fireline to blend with adjacent ground to promote infiltration, erosion control implemented including waterbarring; 30 miles of rehabilitated roads seeded with approved seed mix; spot seeding of safety zones, helispots, drop points and staging areas; replaced 3 culverts (Culvert # 1397 on Placid Cr., Trib. #1289 on Slippery John Cr. # 1194 on Grouse Cr.); closed stabilized 2.1 miles of road; storm-proofed 3.25 miles of roads, armored 5 spillways.	Three repairs that will occur prior to any hauling for Jocko Salvage include: Rd. 9974 which was damaged by fire (Finley Creek). 4347 (Buck Creek) pipe (plastic pipe culvert burned). 17458 (plastic pipe culvert burned). Approximately 5.2 miles of road will be decommissioned including recontouring (Rd. 36210, 36212, 36213, 3614, 4342, 36023, and 36022 in Grouse Creek – outside the Jocko Salvage project area, and 46618 in Slippery John Creek)	
Hydrologic Impacts	**BAER treatments stabilize post-fire conditions and reduce risk of sedimentation from burned areas and roads in fire area. There is a short-term risk of sedimentation from ground-disturbing treatments, but hefty long-term benefit. Before the 1980s. BAER treatments typically were not done, post fire rehab was done sporadically.**	**Similar effect o past treatments: BAER treatments stabilize post-fire conditions and reduce risk of sedimentation from burned areas and roads in fire area. There is a short-term risk of sedimentation from ground-disturbing treatments, but hefty long-term benefit.**	**BAER treatments will continue to be applied on future fires.**
Removal of timber associated with fire suppression and hazard reduction	Approx. 0.5 mbf was removed from fire lines and roadside areas for fire suppression efforts that had commercial value and was sold.	Less then 1 mbf of timber removed for fire suppression or safety remains to be sold.	
Hydrologic Impacts	**Little hydrologic impact.**		

Actions on National Forest System Land Only	Past	Present (Spring 2008 – Spring 2009)	Reasonably Foreseeable
Fishing/Camping and Dispersed Sites.	Fishing and camping at Hidden Lake has a long history of use. In 2006 a new vault toilet (SST) was installed to create a healthier atmosphere for Forest visitors. This area does not receive as much dispersed recreation use as compared to the east side of the district, which is mostly wilderness and proposed wilderness.	Use will continue	Fishing and camping use at Hidden Lake is expected to continue to rise.
Hydrologic Impacts	**Little hydrologic impact, however, sensitive shoreline areas need to be protected from heavy use.**		
Special Use Permits	Outfitting and guest ranch near the project has utilized a FS special use permit to provide guided snowmobile tours within the project boundary for over 10 years.	Will continue	Will continue
Hydrologic Impacts	**Little hydrologic impact.**		
Fish Stocking & MDFW Non-native fish presence management	Montana Department of Fish, Wildlife and Parks have annually stocked approximately 1,000 westslope cutthroat per year in Hidden Lake. Stocking also occurs in Placid and Seeley lake. Non-native fish are present and are managed by MDFW	Will continue.	Will continue.
Hydrologic Impacts	**Little hydrologic impact.**		
Placid lake dam	Placid lake dam is a fish barrier to the Placid drainage.	Will continue.	Will continue.
Hydrologic Impacts	**Little hydrologic impact.**		
Stream Rehabilitation	Across the Forest approximately 0.21 miles of stream was rehabilitated in 2007; approx. 4.4 miles (direct channel reconstruction)	This type of work will continue.	This type of work will continue.
Hydrologic Impacts	**Positive hydrologic impact by reducing sediment sources**		
Road-Stream Crossing Replacements	Across the Forest approximately 6 stream crossing replacements occurred in 2007; approx. 55 (majority pipe arch & bridge replacements) On the Seeley Ranger District 6 crossings were removed in 2007 and a total of 66 have been removed since 1996.	This type of work will continue.	This type of work will continue.
Hydrologic Impacts	**Positive hydrologic benefit by reducing risk of culvert failure**		

Actions on National Forest System Land Only	Past	Present (Spring 2008 – Spring 2009)	Reasonably Foreseeable
Miles of Fish Habitat Made Available	Across the Forest in 2007: Culverts Removed: 6.65 miles and Culvert Replacements: 190 miles Across the Forest since 1996: Culverts Removed: 127.6 miles; Diversion Rehabilitation: 13 miles; Total: 330.6 miles On the Seeley Ranger District 2 miles was made available in 2007 and 18.22 miles have been made available since 1996 by culvert removals and .8 miles was made available in 2007 and 31.5 miles have been made available since 1996 by culvert replacements.	This type of work will continue.	This type of work will continue.
Hydrologic Impacts	**Little hydrologic effect.**		
Road Construction	Within the Jocko Lakes project area approximately 64 miles of road have been built on the national forest. The roads are in varying levels of use including roads that are closed and no longer drivable. The majority of roads built on federal lands were completed between 1950 to the mid- 1980s.	No new system roads are being constructed.	Unlikely any new system roads will be built in the reasonably foreseeable future on NFS land.
Hydrologic Impacts	**Past road construction before the 1980s had a larger effect on sedimentation rates due to lack of BMPs-**	**Road construction is big risk for increased sedimentation- no new permanent roads are proposed. BMPs will be applied to reduce risk.**	**BMPs will be applied to all new road construction, and will reduce the ris of sedimentation.**

Actions on National Forest System Land Only	Past	Present (Spring 2008 – Spring 2009)	Reasonably Foreseeable
Road Maintenance	Roads open for motorized use by the public are maintained with safety as a high priority. This primarily involves repairing drainage features and clearing live and down vegetation. Some roads have been closed (via closure orders) year-long or seasonally and are maintained at a lower level. There are approximately 49 miles of road under USFS jurisdiction; 13.4 miles of which are open year-long and receive a higher level of maintenance. Approximately 17 miles of USFS roads are closed year-long and 18.6 miles are closed seasonally. Culvert replaced with bridge at NFSR#2190 and Archibald crossing (completed with KV funds from Archloop Timber Sale).	Will continue.	Will continue.
Hydrologic Impacts	**Road maintenance has been on-going in Jocko Lakes watersheds- Application of BMPs started in the 1980s.**	**Road maintenance can increase short term sediment, but improve conditions long-term-BMPs decrease likelihood of sedimentation from roads and other activities.**	**Road maintenance will continue, and BMPs will continue to be employed.**
Road Storage and Decommissioning	Across the Forest approximately 788 miles of road under USFS jurisdiction have been closed or decommissioned since 1996. 51.6 miles in 2007.On the Seeley Ranger District approximately 15.2 miles of road were closed or decommissioned in 2007 and 125.2 miles since 1996.		
Hydrologic Impacts	**Road decommissioning did not begin until the mid-1990s; road storage has been on-going. Past road storage may not have hydrologically stabilized the road as is practiced at present.**	**The Jocko Lakes Roads Analysis recommends the storage or decommissioning of 9.6 miles of road within the roads analysis area that are not part of the salvage proposal and may be completed in the reasonable foreseeable future. This will reduce sediment sources and increased surface flow effects from roads.**	**Road decommissioning will continue as needed for resource protection with multiple benefits for resources. . Road storage will include hydrologic stabilization.**

Actions on National Forest System Land Only	Past	Present (Spring 2008 – Spring 2009)	Reasonably Foreseeable
Land Acquisition/Exchange	The District acquired a 20 acre lot around the Double Arrow Lookout in T16,R15,S5 just on the edge of the Jocko Fire perimeter, to facilitate management of the lookout and communications site. Forest Service acquired land from Champion Timber Company in 1992 in the Deep Creek Exchange near Hidden Lake.	Will continue.	Will continue.
Hydrologic Impacts	**Potential positive hydrologic impact where lands include wetlands, streams, or lakes.**		
Noxious Weed Control		Noxious weed control as outlined in the 2007 Integrated Weed Management on the Lolo National Forest Environmental Impact Statement and Decision will take place in the Jocko Fire perimeter.	Will continue.
Hydrologic Impacts	**Weeds have become an issue especially in the last decade- little hydrologic effect**	**Hydrologic effects to water quality will be minimized through application of BMPs recommended in Weed EIS.**	**Hydrologic effects to water quality will be minimized through application of BMPs recommended in Weed EIS.**
Irrigation	The BIA ditch takes water from the N. Fk. Placid and carries it over the divide into the Jocko drainage.	Will continue	Will continue
Hydrologic Impacts	**Some hydrologic impacts on channel dimensions**		

Actions on National Forest System Land Only	Past	Present (Spring 2008 – Spring 2009)	Reasonably Foreseeable
Timber Harvest	Approximately 34,092 acres of timber have been harvested on National Forest System land in the project area since the 1950s within the six, 6th order HUCs that encompass or are next to the project area. An acre of land may have had multiple harvest entries, so a straight percentage of the area that has been treated is not accurate. Within the Jocko Lakes Fire Salvage Project area approximately 4,894 acres of timber have been harvested on NFS land. An acre of land may have had multiple harvest entries, so a straight percentage of the area that has been treated is not necessarily accurate. The majority (67%) of the treatments in the HUC were accomplished in the 1970s and 1980s. Table D-2 details the acres of timber harvest by decade and treatment type. The most recent timber harvest projects are depicted in Table D-3.	Within the Jocko Salvage project area the Hidden Lake Timber Sale planned in 2007 to thin 388 ac. A portion of the area planned for thinning was burned by the Jocko Lakes fire and is included in this Salvage proposal (Unit 131).	
Hydrologic Impacts	**Past timber harvest effects have included sedimentation and increased runoff. Effects were particularly extensive before the 1980s and the introduction of BMPs. Extensive impacts have occurred from past harvest in riparian areas such as large wood removal, and operation of heavy equipment in drainages.**	**Current harvest practices effects are moderated by the required use of BMPs during and after harvest. In the Jocko Lakes project BMPs will be applied during harvest activities.**	**Future harvest will continue to use BMPs as a mitigation to reduce sedimentation as a result of forest practices.**

Actions on State and Private Ownership Only	Past	Present (Spring 2008 – Spring 2009)	Reasonably Foreseeable
State – School Trust Land: Timber Sales including Jocko Fire Salvage and activities	In 1990, the DNRC completed the Double Arrow Timber Sale shelterwood harvesting approximately 2.5 MMBF from 362 acres in **Section 6, and N1/2 Section 8,** Township 16 North, Range 15W – Winter harvest. In the early 1990s, DNRC harvested approximately 1.8 MMBF from approx. 220 acres in **Section 16,** T16N, R16W - In 1991 the Finley Creek Timber Sale harvested approx. 1.8 mmbf of seedtree and overstory removal from 220 acres in **Section 16**, T16N, R16W. Additional harvest entries occurred in the early 1960s. In 1996 Hidden Bugs Salvage Timber Sale and Hidden Bugs Timber Sale Supplemental EA – Under the original timber sale, the DNRC was harvesting approximately 800 thousand board feet of dead, dying, and susceptible lodgepole pine from approximately 125 acres in **Section 18**, Township 16 North, Range 15 West. In addition to timber harvesting, the original activities also included approximately 4 miles of road maintenance, 0.5 miles of new road construction, and 0.25 miles of road decommissioning. In August of 2007, the Jocko Lakes Fire burned approximately 140 acres of the original project area. Under the Hidden Bugs Supplemental EA, the DNRC harvested an additional 70 acres of partially and severely burned timber within **Section 18**. No additional road was constructed but some road maintenance was conducted to meet Montana Best Management Practices. Approximately 5,000 feet of fireline was used as a skid trail, and then it was obliterated. In **Section 6 and 8** of Township 16 North, Range 15 West and **Section 16** of Township 16 North Range 16 West, harvest approx. 8 to 11 MMBF of dead and dying timber from up to 1,503 acres. Approx. 2.75 miles of road constructed and decommissioned approx. 0.5 miles of existing road all within **Section 16.**	The DNRC is currently developing a proposed timber permit to salvage harvest approximately 34 acres of burned timber in Section 36 T16N R16W.	DNRC will plant, starting as early as the spring of 2009, appropriate tree species (western larch, ponderosa pine, and Douglas-fir) in high-severity burned areas to supplement natural regeneration. Approx. 0.5 miles of the new road construction, Section 16 of Township 16 North Range 16 West, would be removed post-harvest.
Hydrologic Impacts	**Practices have followed Montana BMPs and as a result have lower risk of producing sediment. Restoration improvements have significantly improved resource conditions.**	**Present harvest activities will have low risk of negative effects with the application of BMPs.**	**Future harvest activities will have low risk of negative effects with the application of BMPs**

Actions on State and Private Ownership Only	Past	Present (Spring 2008 – Spring 2009)	Reasonably Foreseeable
State – School Trust Land: Road construction, reconstruction (State)	Jocko Salvage Roadwork – In 2007 the DNRC constructed new roads, reconstructed existing roads, and replaced road features within Section 6 of Township 16 North Range 15 West and Section 16 of Township 16 North Range 16 West. Specifically, the DNRC constructed 1.5 miles of new road, reconstructed and maintained 3.6 miles of existing road, and replaced 10 culverts that were at risk of flooding or loss due to fire effects, with larger culverts. Activities are expected to be completed during the fall of 2007.		
Hydrologic Impacts	**Practices have followed Montana BMPs and as a result have lower risk of producing sediment. Restoration improvements have significantly improved resource conditions.**	**Present harvest activities will have low risk of negative effects with the application of BMPs.**	**Future harvest activities will have low risk of negative effects with the application of BMPs**
State – School Trust Land: Mineral Extraction	A flagstone/rock mineral lease removed approximately 60 tons of material from Sections 6 and 8, Township 16 North, Range 15 West in 2007 (less than 1 ac.).		
Private – Commercial Timber Lands	Since 1999 through 2007 Plum Creek has harvested, with associated actions, approx. 7,600 ac., removing approx. 26 mmbf of timber from their ownership in or near the Jocko Lakes fire perimeter (an area of roughly 18,000 ac.). Approx. 5,400 ac. of the harvest was some stage of regeneration harvest and 2,200 ac. was intermediate harvests.	Additional timber harvest can be anticipated on Plum Creek lands within the Jocko fire perimeter.	Additional timber harvest can be anticipated on Plum Creek lands within the Jocko fire perimeter.
Hydrologic Impacts	**Practices have followed Montana BMPs and as a result have lower risk of producing sediment.**	**Present harvest activities will have low risk of negative effects with the application of BMPs.**	**Future harvest activities will have low risk of negative effects with the application of BMPs**
Private Land Development	Within the Jocko Fire perimeter, T16,R16,S12,S ½, has been subdivided and sold to individuals.		
Hydrologic Impacts	**Impacts Unknown**		
Noxious Weed Control	The State of Montana applies herbicides on State lands near or adjacent to the Lolo NF. These programs treat adjacent areas and roads, State roads and highways within and around the Jocko Salvage area. Adjacent private landowners actively control weeds and some use herbicides. Methods include both aerial and ground application of herbicides.	Weed control is likely to continue.	Weed control is likely to continue.
Hydrologic Impacts	Impacts Unknown		